
Ansible Tower Installation and Reference Guide

Release Ansible Tower 3.7.3

Red Hat, Inc.

Jan 26, 2022

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Thank you for your interest in Ansible Tower. Ansible Tower is a commercial offering that helps teams manage complex multi-tier deployments by adding control, knowledge, and delegation to Ansible-powered environments.

The *Ansible Tower Installation and Reference Guide* helps you to understand the installation requirements and processes behind installing Ansible Tower. This document has been updated to include information for the latest release of Ansible Tower v3.7.3.

We Need Feedback!

If you spot a typo in this documentation, or if you have thought of a way to make this manual better, we would love to hear from you! Please send an email to: docs@ansible.com

If you have a suggestion, try to be as specific as possible when describing it. If you have found an error, please include the manual's title, chapter number/section number, and some of the surrounding text so we can find it easily. We may not be able to respond to every message sent to us, but you can be sure that we will be reading them all!

Ansible Tower Version 3.7.3; September 30, 2020; <https://access.redhat.com/>

TOWER LICENSING, UPDATES, AND SUPPORT

Ansible Tower (“**Ansible Tower**”) is a software product provided as part of an annual Red Hat Ansible Automation Platform subscription entered into between you and Red Hat, Inc. (“**Red Hat**”).

Ansible is an open source software project and is licensed under the GNU General Public License version 3, as detailed in the Ansible source code: <https://github.com/ansible/ansible/blob/devel/COPYING>

1.1 Support

Red Hat offers support to paid Red Hat Ansible Automation Platform customers.

If you or your company has purchased a subscription for Ansible Automation Platform, you can contact the support team at <https://access.redhat.com>. To better understand the levels of support which match your Ansible Automation Platform subscription, refer to *Subscription Types*. For details of what is covered under an Ansible Automation Platform subscription, please see the Scopes of Support at: <https://access.redhat.com/support/policy/updates/ansible-tower#scope-of-coverage-4> and <https://access.redhat.com/support/policy/updates/ansible-engine>.

1.2 Trial / Evaluation

While a license is required for Ansible Tower to run, there is no fee for a trial license.

- Trial licenses for Red Hat Ansible Automation are available at: <http://ansible.com/license>
- Support is not included in a trial license or during an evaluation of the Tower Software.

1.3 Subscription Types

Red Hat Ansible Automation Platform is provided at various levels of support and number of machines as an annual Subscription.

- **Standard**
 - Manage any size environment
 - Enterprise 8x5 support and SLA
 - Maintenance and upgrades included
 - Review the SLA at: <https://access.redhat.com/support/offerings/production/sla>
 - Review the Red Hat Support Severity Level Definitions at: <https://access.redhat.com/support/policy/severity>

- **Premium**

- Manage any size environment, including mission-critical environments
- Premium 24x7 support and SLA
- Maintenance and upgrades included
- Review the SLA at: <https://access.redhat.com/support/offerings/production/sla>
- Review the Red Hat Support Severity Level Definitions at: <https://access.redhat.com/support/policy/severity>

All Subscription levels include regular updates and releases of Ansible Tower, Ansible, and any other components of the Platform.

For more information, contact Ansible via the Red Hat Customer portal at <https://access.redhat.com/> or at <http://www.ansible.com/contact-us/>.

1.4 Node Counting in Licenses

The Tower license defines the number of Managed Nodes that can be managed as part of a Red Hat Ansible Automation Platform subscription. A typical license will say ‘License Count: 500’, which sets the maximum number of Managed Nodes at 500.

For more information on managed node requirements for licensing, please see <https://access.redhat.com/articles/3331481>.

1.5 Tower Component Licenses

To view the license information for the components included within Ansible Tower, refer to `/usr/share/doc/ansible-tower-<version>/README` where `<version>` refers to the version of Ansible Tower you have installed.

To view a specific license, refer to `/usr/share/doc/ansible-tower-<version>/*.txt`, where `*` is replaced by the license file name to which you are referring.

RELEASE NOTES

The following list summarizes the additions, changes, and modifications which were made to Ansible Tower v3.7.3.

2.1 Ansible Tower Version 3.7.3

- Updated to the latest version of the `git-python` library to no longer cause certain jobs to fail
- Updated to the latest version of the `ovirt.ovirt` collection to no longer cause connections to hang when syncing inventory from oVirt/RHV
- Added a number of optimizations to Ansible Tower's callback receiver to improve the speed of stdout processing for simultaneous playbooks runs
- Added an optional setting to disable the auto-creation of organizations and teams on successful SAML login
- Fixed an XSS vulnerability (CVE-2020-25626)
- Fixed a slow memory leak in the Daphne process
- Fixed Automation Analytics data gathering to no longer fail for customers with large datasets
- Fixed scheduled jobs that run every X minute(s) or hour(s) to no longer fail to run at the proper time
- Fixed delays in Ansible Tower's task manager when large numbers of simultaneous jobs are scheduled
- Fixed the performance for playbooks that store large amounts of data using the `set_stats` module
- Fixed the `awx-manage remove_from_queue` tool when used with isolated nodes
- Fixed an issue that prevented jobs from being properly marked as canceled when Tower is backed up and then restored to another environment

For older version of the release notes, as well as other reference materials, refer to the [Ansible Tower Release Notes](#).

GENERAL INSTALLATION NOTES

- Ansible Tower on RHEL 8 **requires** Ansible 2.8 or greater. Older versions of Ansible will not work on RHEL 8.
- If you need to access a HTTP proxy to install software from your OS vendor, ensure that the environment variable “HTTP_PROXY” is set accordingly before running `setup.sh`.
- The Tower installer creates a self-signed SSL certificate and keyfile at `/etc/tower/tower.cert` and `/etc/tower/tower.key` for HTTPS communication. These can be replaced after install with your own custom SSL certificates if you desire, but the filenames are required to be the same. See [Using custom certificates](#).
- Installing Ansible Tower 3.7 automatically installs the necessary versions of Node.js to run the Tower User Interface.
- Installing Ansible Tower v3.7.3 or later will install a newer version of rsyslog than what shipped with RHEL 7.7. See the [Tower Logging and Aggregation](#) section of the *Ansible Tower Administration Guide* guide for more detail.
- It is not recommended that you install Tower using service accounts (PostgreSQL, Redis, etc.) that get authenticated through Active Directory (AD) or LDAP.
- If using Ansible version 1.8 or later, ensure that fact caching using Redis is not enabled in `ansible.cfg` on the Tower machine.
- Note that the Tower installation must be run from an internet connected machine that can install software from trusted 3rd-party places such as Ansible’s software repository, and your OS vendor’s software repositories. In some cases, access to the Python Package Index (PyPI) is necessary as well. If you need to be able to install in a disconnected environment and the bundled installation program is not a solution for you (refer to [Using the Bundled Tower Installation Program](#)), please contact Ansible via the Red Hat Customer portal at <https://access.redhat.com/>.
- If installing Tower on OpenShift, refer to [OpenShift Deployment and Configuration](#).

3.1 Flags and extra vars passed with Tower

Flags and/or extra variables that you can use with the Ansible Tower installer include (but are not limited to) the following:

```
Usage: setup.sh [Options] [-- Ansible Options]

Options:
  -i INVENTORY_FILE      Path to ansible inventory file (default: inventory)
  -e EXTRA_VARS          Set additional ansible variables as key=value or YAML/JSON
```

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```

        i.e. -e bundle_install=false will force an online install

-b          Perform a database backup in lieu of installing
-r          Perform a database restore in lieu of installing
-k          Generate and distribute a new SECRET_KEY

-h          Show this help message and exit

Ansible Options:
  Additional options to be passed to ansible-playbook can be added following the --_
  ↪separator
    
```

Use the -- separator to add any Ansible arguments you wish to apply. For example: `./setup.sh -i my_awesome_inventory.yml -e matburt_is_country_gold=True -- -K`

The following table shows some extra variables that can be used during the installation of Tower.

Variable	Description	Default
upgrade_ansible	When installing Tower make sure Ansible is also up to date	False
create_preload	When installing Tower also create the Demo Org, project, credential, Job Template, etc.	True
bundle_install	When installing from a bundle where to put the bundled repos	/var/lib/tower-bundle
nginx_disable_https	Disable HTTPS traffic through nginx, this is useful if offloading HTTPS to a load balancer	False
nginx_http_port	Port to configure nginx to listen to for HTTP	80
nginx_https_port	Port to configure nginx to listen to for HTTPS	443
backup_dest	Where to place the backup from setup.sh -b	{{ playbook_dir }}
backup_dir	A temp location to use when backing up	/var/backups/tower/
restore_backup	Specify an alternative backup file to restore from	(None)
required_ram	The minimum RAM required to install Tower (should only be changed for test installation)	3750
min_open_fds	The minimum open file descriptions (should only be changed for test installations)	4096
ignore_preflight	Ignore preflight checks, useful when installing into a template or other non-system image (overrides required_ram and min_open_fds)	False

3.1.1 Examples

The following are examples of common scenarios - be sure to supply your own values appropriate to your specific case.

- **To upgrade core:**

```
./setup.sh -e upgrade_ansible_with_tower=1
```

- **To disable https handling at nginx:**

```
./setup.sh -e nginx_disable_https=true
```

- To specify a non-default path when restoring from a backup file:

```
./setup.sh -e 'restore_backup_file=/path/to/nondefault/location' -r
```

- To override an inventory file used by passing it as an argument to the setup script:

```
setup.sh -i <inventory file>
```

3.1.2 Using custom certificates

You may bring your own certificates as part of the default install and therefore, not rely on the self-signed one provided. The Ansible Tower installer provides three variables that allows you to configure the Tower deployment TLS-wise:

web_server_ssl_path	Path on the installer node to the custom certificate the Tower web server will serve. It will be copied as <code>/etc/tower/tower.cert</code> at install time.
web_server_ssl_key	Path on the installer node to the private key the certificate has been generated with. It will be copied as <code>/etc/tower/tower.key</code> at install time.
custom_ca_cert	Custom Certification Authority to add as trustworthy in the system bundle. It will be loaded into the Tower CA trusted store.

3.2 Additional Installation Tips

You may want to consider how to configure your proxies and websockets as part of the installation of Ansible Tower to align the websocket config with your nginx / load balancer configuration. See `ag_proxy_support` in the following section of this guide for further detail.

3.2.1 Platform-specific Installation Notes

Installing Tower on Systems with FIPS Mode Enabled

Tower can run on systems where FIPS mode is enabled, though there are a few limitations to keep in mind:

- Only Enterprise Linux 7+ is supported. The standard python that ships with RHEL must be used for Ansible Tower to work in FIPS mode. Using any non-standard, non-system python for Tower is therefore, unsupported.
- By default, Tower configures PostgreSQL using password-based authentication, and this process relies on the usage of md5 when `CREATE USER` is run at install time. To run the Tower installer from a FIPS-enabled system, specify `pg_password` in your inventory file. **DO NOT** use special characters in `pg_password` as it may cause the setup to fail:

```
pg_password='choose-a-password'
```

For further detail, see *Setting up the Inventory File*.

If you supply a password in the inventory file for the installer (`pg_password`), that password will be SCRAM-SHA-256 hashed by PostgreSQL as part of the installation process.

- The `ssh-keygen` command generates keys in a format (RFC4716) which uses the md5 digest algorithm at some point in the process (as part of a transformation performed on the input passphrase). On a FIPS-enforcing system, md5 is completely disabled, so these types of encrypted SSH keys (RFC4716 private keys protected by

a passphrase) will not be usable. When FIPS mode is enabled, any encrypted SSH key you import into Ansible Tower **must** be a PKCS8-formatted key. Existing AES128 keys can be converted to PKCS8 by running the following `openssl` command:

```
$ openssl pkcs8 -topk8 -v2 aes128 -in <INPUT_KEY> -out <NEW_OUTPUT_KEY>
```

For more details, see: <https://access.redhat.com/solutions/1519083>

- Use of Ansible features that use the `paramiko` library will not be FIPS compliant. This includes setting `ansible_connection=paramiko` as a transport and using network modules that utilize the `ncclient` `NETCONF` library.
- The TACACS+ protocol uses md5 to obfuscate the content of authorization packets; [TACACS+ Authentication](#) is not supported for systems where FIPS mode is enabled.
- The RADIUS protocol uses md5 to encrypt passwords in `Access-Request` queries; [RADIUS Authentication](#) is not supported for systems where FIPS mode is enabled.

Notes for Red Hat Enterprise Linux and CentOS setups

- In order for Ansible Tower to run on RHEL 8, Ansible 2.8 or greater must be installed. Ansible 2.8 and greater are supported versions for RHEL 8.
- Starting with Ansible Tower 3.5, Tower runs with Python 3, which is automatically installed on RHEL 8 when installing Tower.
- `PackageKit` can frequently interfere with the installation/update mechanism. Consider disabling or removing `PackageKit` if installed prior to running the setup process.
- Only the “targeted” SELinux policy is supported. The targeted policy can be set to disabled, permissive, or enforcing.
- When performing a bundled install, refer to [Using the Bundled Tower Installation Program](#) for more information.
- When installing Ansible Tower, you only need to run `setup.sh`, any repositories needed by Tower are installed automatically.
- The latest version of Ansible is installed automatically during the setup process. No additional installation or configuration is required.

Notes for Ubuntu setups

Ansible Tower no longer supports Ubuntu. Refer to previous versions of the *Ansible Tower Installation and Reference Guide* for details on Ubuntu.

Configuration and Installation on OpenShift

For OpenShift-based deployments, refer to [OpenShift Deployment and Configuration](#).

PROXY SUPPORT

Proxy servers act as an intermediary for requests from clients seeking resources from other servers. A client connects to the proxy server, requesting some service or available resource from a different server, and the proxy server evaluates the request as a way to simplify and control its complexity.

Note: Using SSL offloading or using a proxy that handles SSL for Tower is supported. The proxy/load balancer needs to be configured to pass the remote host information.

When offloading SSL to the load balancer or proxy, set `nginx_disable_https=true` as an extra variable passed to the setup playbook. Refer to *The Setup Playbook* for information on applying extra variables to the setup playbook.

Sessions in Tower associate an IP address upon creation. Tower policy requires that any use of the session match the original associated IP address.

To provide proxy server support, Tower handles proxied requests (such as ELB in front of Tower, HAProxy, Squid, and tinyproxy) via the `REMOTE_HOST_HEADERS` list variable in Tower settings (`/etc/tower/conf.d/remote_host_headers.py`). By default `REMOTE_HOST_HEADERS` is set to `['REMOTE_ADDR', 'REMOTE_HOST']`.

To enable proxy server support, setup `REMOTE_HOST_HEADERS` like the following: `REMOTE_HOST_HEADERS = ['HTTP_X_FORWARDED_FOR', 'REMOTE_ADDR', 'REMOTE_HOST']`

Note: A new installation of Ansible Tower will not contain the `remote_host_headers.py` file. However, you can still set those values in the System settings of the Configure Tower user interface.

SETTINGS / SYSTEM

SYSTEM

MISC. SYSTEM ACTIVITY STREAM LOGGING

* BASE URL OF THE TOWER HOST <small>?</small>	REVERT	* ENABLE ADMINISTRATOR ALERTS <small>?</small>	* ALL USERS VISIBLE TO ORGANIZATION ADMINS <small>?</small>
<input type="text" value="https://ec2-35.227.61.96.compute-1.amazonaws.com"/>	<input type="button" value="REVERT"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
* ORGANIZATION ADMINS CAN MANAGE USERS AND TEAMS <small>?</small>		* IDLE TIME FORCE LOG OUT <small>?</small>	* MAXIMUM NUMBER OF SIMULTANEOUS LOGGED IN SESSIONS <small>?</small>
<input checked="" type="checkbox"/>		<input type="text" value="1800"/>	<input type="text" value="-1"/>
* ENABLE HTTP BASIC AUTH <small>?</small>		ALLOW EXTERNAL USERS TO CREATE OAUTH2 TOKENS <small>?</small>	ACCESS TOKEN EXPIRATION <small>?</small>
<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	<input type="text" value="3153600000"/>
AUTHORIZATION CODE EXPIRATION <small>?</small>	REVERT	* REMOTE HOST HEADERS <small>?</small>	CUSTOM VIRTUAL ENVIRONMENT PATHS <small>?</small>
<input type="text" value="600"/>	<input type="button" value="REVERT"/>	<input type="text" value="REMOTE_ADDR, REMOTE_HOST"/>	<input type="text"/>
GATHER DATA FOR AUTOMATION INSIGHTS <small>?</small>			
<input checked="" type="checkbox"/>			
<input type="button" value="REVERT ALL TO DEFAULT"/>			<input type="button" value="CANCEL"/> <input type="button" value="SAVE"/>

Tower determines the remote host's IP address by searching through the list of headers in `REMOTE_HOST_HEADERS` until the `FIRST` IP address is located.

Note: Header names are constructed using the following logic:

With the exception of `CONTENT_LENGTH` and `CONTENT_TYPE`, any HTTP headers in the request are converted to `META` keys by converting all characters to uppercase, replacing any hyphens with underscores, and adding an `HTTP_` prefix to the name. For example, a header called `X-Barkley` would be mapped to the `META` key `HTTP_X_Barkley`.

For more information on HTTP request and response objects, refer to: <https://docs.djangoproject.com/en/1.8/ref/request-response/#django.http.HttpRequest.META>

Note: If using SSL termination at the load balancer and forwarding traffic to a different port on the tower node (443 -> 80), set the following values in the `/etc/tower/conf.d/custom.py` file accordingly:

```
USE_X_FORWARDED_PORT = True
USE_X_FORWARDED_HOST = True
```

4.1 Configure Known Proxies

When Tower is configured with `REMOTE_HOST_HEADERS = ['HTTP_X_FORWARDED_FOR', 'REMOTE_ADDR', 'REMOTE_HOST']`, it assumes that the value of `X-Forwarded-For` has originated from the proxy/load balancer sitting in front of Tower. In a scenario where Tower is still reachable without use of the proxy/load balancer or when the proxy does not validate the header, `X-Forwarded-For` can be spoofed fairly easily to fake the originating IP addresses. Using `HTTP_X_FORWARDED_FOR` in the `REMOTE_HOST_HEADERS` setting poses a vulnerability that essentially gives users access to certain resources that they should not have.

To avoid this, you can configure a list of “known proxies” that are allowed, which is the `PROXY_IP_WHITELIST` setting via the settings API. Load balancers and hosts that are not on the list will result in a rejected request.

`PROXY_IP_WHITELIST` only works if the proxies in the list are properly sanitizing header input and correctly setting an `X-Forwarded-For` value equal to the real source IP of the client; the crux of this setting is that Tower can rely on the IPs/hostnames in `PROXY_IP_WHITELIST` to provide non-spoofed values for the `X-Forwarded-For` field.

`HTTP_X_FORWARDED_FOR` should **never** be configured as an item in `REMOTE_HOST_HEADERS` unless all of the following are satisfied:

- You are using a proxied environment w/ ssl termination
- The proxy provides sanitization/validation of the `X-Forwarded-For` header to prevent client spoofing
- `/etc/tower/conf.d/remote_host_headers.py` defines `PROXY_IP_WHITELIST` that contains only the originating IP of trusted proxies/load balancers.

Note: If you do not need all of the traffic to be put through the proxy, then you can specify the IP scheme(s) that you want to exclude in the `no_proxy` field. The list can be IP ranges or individual IPs, separated by a comma. This example shows a specified range of IPs in JSON format:

```
"https_proxy": "example.proxy.com:8080",
"http_proxy": "example.proxy.com:8080",
"no_proxy": "10.0.0.0/8"
```

Also, an SCM update with a `no_proxy` configuration and a CIDR notation may not work for a particular SCM. The support for `http_proxy` and `no_proxy` depends on the the implementation in the application (gitlghsvn). For example, `git` does not support CIDR notation for `no_proxy` because `git` is limited by its C library: https://curl.haxx.se/libcurl/c/CURLOPT_NOPROXY.html.

4.2 Reverse Proxy

If you are behind a reverse proxy, you may want to setup a header field for `HTTP_X_FORWARDED_FOR`. The `X-Forwarded-For` (XFF) HTTP header field identifies the originating IP address of a client connecting to a web server through an HTTP proxy or load balancer.

```
REMOTE_HOST_HEADERS = ['HTTP_X_FORWARDED_FOR', 'REMOTE_ADDR', 'REMOTE_HOST']
```

4.3 Websocket Configuration

A key configuration that you should consider is websocket setup in order to align the websocket config with your `nginx` / load balancer configuration.

Tower nodes connect to all other Tower nodes via websockets. This interconnect is used to distribute all websocket emitted messages to all other Tower nodes. This is required because any browser client websocket can subscribe to any job that may be running on any Tower node. In other words, websocket clients are not routed to specific Tower nodes. Any Tower node can handle any websocket request. Therefore, each Tower node must know about all websocket messages destined for all clients.

Tower will automatically handle discovery of other Tower nodes via the Instance record in the database. Tower *must* be told the port, protocol, and whether or not to verify certificates when establishing the websocket connections. This is configured using the following three settings:

```
BROADCAST_WEBSOCKET_PROTOCOL = 'http'  
BROADCAST_WEBSOCKET_PORT = 80  
BROADCAST_WEBSOCKET_VERIFY_CERT = False
```

For example, topologies that do SSL termination in front of Tower, at the load balancer level would have the following settings:

```
BROADCAST_WEBSOCKET_PROTOCOL = 'http'  
BROADCAST_WEBSOCKET_PORT = 80
```

Topologies that perform SSL at each individual Tower node via `nginx` would have the following settings:

```
BROADCAST_WEBSOCKET_PROTOCOL = 'https'  
BROADCAST_WEBSOCKET_PORT = 443  
BROADCAST_WEBSOCKET_VERIFY_CERT = True
```

Note: It is intended that your nodes are broadcasting websocket traffic across a private, trusted subnet (and not the open Internet). Therefore, if you turn off HTTPS for websocket broadcasting, the websocket traffic (which is comprised mostly of Ansible playbook stdout), is sent between Tower nodes unencrypted.

REQUIREMENTS

Note: Tower is a full application and the installation process installs several dependencies such as PostgreSQL, Django, NGINX, and others. It is required that you install Tower on a standalone VM or cloud instance and do not co-locate any other applications on that machine (beyond possible monitoring or logging software). Although Tower and Ansible are written in Python, they are not just simple Python libraries. Therefore, Tower cannot be installed in a Python virtualenv or any similar subsystem; you must install it as described in the installation instructions in this guide. For OpenShift-based deployments, refer to [OpenShift Deployment and Configuration](#).

Ansible Tower has the following requirements:

- **Supported Operating Systems:**
 - Red Hat Enterprise Linux 8.2 or later 64-bit (x86)
 - Red Hat Enterprise Linux 7.7 or later 64-bit (x86)
 - CentOS 7.7 or later 64-bit (x86)

Note: Support for all versions of Ubuntu as a Tower platform has been discontinued as of Ansible Tower version 3.6.

- **A currently supported version of Mozilla Firefox or Google Chrome**
 - Other HTML5 compliant web browsers may work but are not fully tested or supported.
- **2 CPUs minimum** for Tower installations. Refer to the [capacity algorithm](#) section of the *Ansible Tower User Guide* for determining the CPU capacity required for the number of forks in your particular configuration.
- **4 GB RAM minimum** for Tower installations
 - 4 GB RAM (minimum and recommended for Vagrant trial installations)
 - 4 GB RAM (minimum for external standalone PostgreSQL databases)
 - For specific RAM needs, refer to the [capacity algorithm](#) section of the *Ansible Tower User Guide* for determining capacity required based on the number of forks in your particular configuration
- **20 GB of dedicated hard disk space** for Tower service nodes
 - 10 GB of the 20 GB requirement must be dedicated to `/var/`, where Tower stores its files and working directories
 - The storage volume should be rated for a minimum baseline of 750 IOPS.
- **20 GB of dedicated hard disk space** for nodes containing a database (*150 GB+ recommended*)
 - The storage volume should be rated for a high baseline IOPS (1000 or more.)

- All Tower data is stored in the database. Database storage increases with the number of hosts managed, number of jobs run, number of facts stored in the fact cache, and number of tasks in any individual job. For example, a playbook run every hour (24 times a day) across 250, hosts, with 20 tasks will store over 800000 events in the database every week.
- If not enough space is reserved in the database, old job runs and facts will need cleaned on a regular basis. Refer to [Management Jobs](#) in the *Ansible Tower Administration Guide* for more information
- **64-bit support required** (kernel and runtime)
- **PostgreSQL version 10** required to run Ansible Tower 3.7 and later. Backup and restore will *only* work on PostgreSQL versions supported by your current Ansible Tower version.
- **Ansible version 2.8 (at minimum) required** to run Ansible Tower versions 3.7 and later

Note: You cannot use versions of PostgreSQL and Ansible older than those stated above and be able to run Ansible Tower 3.7 and later. Both are installed by the install script if they aren't already present.

- **For Amazon EC2:**
 - Instance size of m4.large or larger
 - An instance size of m4.xlarge or larger if there are more than 100 hosts

5.1 Additional Notes on Tower Requirements

Actual RAM requirements vary based on how many hosts Tower will manage simultaneously (which is controlled by the `forks` parameter in the job template or the system `ansible.cfg` file). To avoid possible resource conflicts, Ansible recommends 1 GB of memory per 10 forks + 2GB reservation for Tower, see the [capacity algorithm](#) for further details. If `forks` is set to 400, 40 GB of memory is recommended.

For the hosts on which we install Ansible Tower, Tower checks whether or not `umask` is set to 0022. If not, the setup fails. Be sure to set `umask=0022` to avoid encountering this error.

A larger number of hosts can of course be addressed, though if the fork number is less than the total host count, more passes across the hosts are required. These RAM limitations are avoided when using rolling updates or when using the provisioning callback system built into Tower, where each system requesting configuration enters a queue and is processed as quickly as possible; or in cases where Tower is producing or deploying images such as AMIs. All of these are great approaches to managing larger environments. For further questions, please contact Ansible via the Red Hat Customer portal at <https://access.redhat.com/>.

The requirements for systems managed by Tower are the same as for Ansible at: http://docs.ansible.com/intro_getting_started.html

5.1.1 Notable PostgreSQL Changes

Ansible Tower uses PostgreSQL 10, which is an SCL package on RHEL 7 and an app stream on RHEL8. Some changes worth noting when upgrading to PostgreSQL 10 are:

- PostgreSQL user passwords will now be hashed with SCRAM-SHA-256 secure hashing algorithm before storing in the database.
- You will no longer need to provide a `pg_hashed_password` in your inventory file at the time of installation because PostgreSQL 10 can now store the user's password more securely. If users supply a password in the inventory file for the installer (`pg_password`), that password will be SCRAM-SHA-256 hashed by PostgreSQL

as part of the installation process. **DO NOT** use special characters in `pg_password` as it may cause the setup to fail.

- Since Tower is using a Software Collections version of PostgreSQL in Ansible Tower 3.7, the `rh-postgresql10` scl must be enabled in order to access the database. Administrators can use the `awx-manage dbshell` command, which will automatically enable the PostgreSQL SCL.
- If you just need to determine if your Tower instance has access to the database, you can do so with the command, `awx-manage check_db`.

5.1.2 PostgreSQL Configurations

Optionally, you can configure the PostgreSQL database as separate nodes that are not managed by the Tower installer. When the Tower installer manages the database server, it configures the server with defaults that are generally recommended for most workloads. However, you can adjust these PostgreSQL settings for standalone database server node where `ansible_memtotal_mb` is the total memory size of the database server:

```
max_connections == 1024
shared_buffers == ansible_memtotal_mb*0.3
work_mem == ansible_memtotal_mb*0.03
maintenance_work_mem == ansible_memtotal_mb*0.04
```

Refer to [PostgreSQL documentation](#) for more detail on tuning your PostgreSQL server.

5.2 Ansible Software Requirements

While Ansible Tower depends on Ansible Playbooks and requires the installation of the latest stable version of Ansible before installing Tower, manual installations of Ansible are no longer required.

Upon new installations, Tower installs the latest release package of Ansible 2.9.

If performing a bundled Tower installation, the installation program attempts to install Ansible (and its dependencies) from the bundle for you (refer to *Using the Bundled Tower Installation Program* for more information).

If you choose to install Ansible on your own, the Tower installation program will detect that Ansible has been installed and will not attempt to reinstall it. Note that you must install Ansible using a package manager like `yum` and that the latest stable version must be installed for Ansible Tower to work properly. At minimum, Ansible version 2.8 is required for Ansible Tower versions 3.7 and later.

OBTAINING THE TOWER INSTALLATION PROGRAM

Note: To obtain a trial version of Ansible Tower, visit: <http://www.ansible.com/tower-trial>

For pricing information, visit: <http://www.ansible.com/pricing>

To download the latest version of Tower directly (note, you must also obtain a license before using this), visit: <https://releases.ansible.com/ansible-tower/setup/ansible-tower-setup-latest.tar.gz>

For the OpenShift installer, go to http://releases.ansible.com/ansible-tower/setup_openshift

You may install standalone Tower or use the bundled installer:

- if you set up Tower on an environment with a direct Internet access, you can download the standalone Tower installer
- if you set up Tower on an environment without direct access to online repositories, or your environment enforces a proxy, you must use the bundled installer

Download and then extract the Ansible Tower installation/upgrade tool: <http://releases.ansible.com/ansible-tower/setup/>

```
root@localhost:~$ tar xvzf ansible-tower-setup-latest.tar.gz
root@localhost:~$ cd ansible-tower-setup-<tower_version>
```

To install or upgrade, start by editing the inventory file in the `ansible-tower-setup-<tower_version>` directory, replacing `<tower_version>` with the version number, such as `3.7.1` or `3.7.0` directory.

6.1 Using the Bundled Tower Installation Program

Beginning in Ansible Tower version 2.3.0, Tower installations can be performed using a bundled installation program. The bundled installation program is meant for customers who cannot, or would prefer not to, install Tower (and its dependencies) from online repositories. Access to Red Hat Enterprise Linux or CentOS repositories is still needed.

To download the latest version of the bundled Tower installation program directly (note, you must also obtain a license before using this), visit: <https://releases.ansible.com/ansible-tower/setup-bundle/>

Note: The bundled installer only supports Red Hat Enterprise Linux and CentOS.

Next, select the latest installation program. Note, a single `.tar.gz` is available that works with both RHEL 7 and RHEL 8 distributions:

```
ansible-tower-setup-bundle-latest.tar.gz
```

Note: On Red Hat Enterprise Linux 7, Ansible Tower requires the Python 3 Software Collection. If you are installing Tower offline, you need either CentOS-SCL or RH-SCL repositories enabled through a local mirror:

- Red Hat Subscription Manager: `rhel-server-rhscl-7-rpms`
- Red Hat UI: `rhui-rhel-server-rhui-rhscl-7-rpms`
- CentOS: `centos-release-scl`

A list of package dependencies from Red Hat Enterprise Linux repositories can be found in the `bundle/base_packages.txt` file inside the setup bundle. Depending on what minor version of Red Hat Enterprise Linux you are running, the version and release specified in that file may be slightly different than what is available in your configured repository.

INSTALLING ANSIBLE TOWER

Tower can be installed in various ways by choosing the best mode for your environment and making any necessary modifications to the inventory file. For OpenShift-based deployments, refer to [OpenShift Deployment and Configuration](#).

7.1 Tower Installation Scenarios

Tower can be installed using one of the following scenarios:

Single Machine:

- **As an integrated installation:**
 - This is a single machine install of Tower - the web frontend, REST API backend, and database are all on a single machine. This is the standard installation of Tower. It also installs PostgreSQL from your OS vendor repository, and configures the Tower service to use that as its database.
- **With an external database (2 options available):**
 - Tower with remote DB configuration: This installs the Tower server on a single machine and configures it to talk to a remote instance of PostgreSQL 10 as its database. This remote PostgreSQL can be a server you manage, or can be provided by a cloud service such as Amazon RDS.
 - Tower with a playbook install of a remote PostgreSQL system: This installs the Tower server on a single machine and installs a remote PostgreSQL database via the playbook installer (managed by Tower).

Note: 1). Tower will not configure replication or failover for the database that it uses, although Tower should work with any replication that you have. 2). The database server should be on the same network or in the same datacenter as the Tower server for performance reasons.

Settings available for a traditional Tower install:

- `pg_sslmode` controls the SSL functions of the PostgreSQL client, i.e., how the Tower server connects to the database. It defaults to `prefer`, which means if the database server offers SSL, the client will use it. You can also set it to `verify-full` to enforce SSL with full verification of certificate trust.
- `web_server_ssl_cert` and `web_server_ssl_key` allow the user to provide a certificate and key to be installed in the web server for the Tower UI and API. These must either both be provided or both be absent. If they are absent, a self-signed (untrusted) certificate will be generated at install time.
- `postgres_use_ssl` (`true/false`) - controls whether the PostgreSQL server will be configured to require SSL. This only has any effect with an internal/embedded database (i.e. when the Tower install script is doing the deployment of the database server). It has no effect on an external database.

- `postgres_ssl_cert` and `postgres_ssl_key` - must be supplied when `postgres_use_ssl` is true. These certificates should have a CN (or wildcard, subject alternate name, and so forth) that matches the hostname the Tower nodes will use to connect to the database server.

For OpenShift-based deployments, refer to [OpenShift Deployment and Configuration](#).

High Availability Multi-Machine Cluster:

Tower can be installed in a high availability cluster mode. In this mode, multiple Tower nodes are installed and active. Any node can receive HTTP requests and all nodes can execute jobs.

- **A Clustered Tower setup must be installed with an external database (2 options available):**
 - Tower with remote DB configuration: This installs the Tower server on a single machine and configures it to talk to a remote instance of PostgreSQL as its database. This remote PostgreSQL can be a server you manage, or can be provided by a cloud service such as Amazon RDS.
 - Tower with a playbook install of a remote PostgreSQL system: This installs the Tower server on a single machine and installs a remote PostgreSQL database via the playbook installer (managed by Tower).
- For more information on configuring a clustered setup, refer to [Clustering](#).

Note: Running in a cluster setup requires any database that Tower uses to be external—PostgreSQL must be installed on a machine that is not one of the primary or secondary tower nodes. When in a redundant setup, the remote PostgreSQL version requirements is *PostgreSQL 10*.

7.2 Setting up the Inventory File

As you edit your inventory file, there are a few things you must keep in mind:

- The contents of the inventory file should be defined in `./inventory`, next to the `./setup.sh` installer playbook.
- For **installations and upgrades**: If you need to make use of external databases, you must ensure the database sections of your inventory file are properly setup. Edit this file and add your external database information before running the setup script.
- For **upgrading an existing cluster**: When upgrading a cluster, you may decide that you want to also reconfigure your cluster to omit existing instances or instance groups. Omitting the instance or the instance group from the inventory file will not be enough to remove them from the cluster. In addition to omitting instances or instance groups from the inventory file, you must also [deprovision instances](#) or [instance groups](#) before starting the upgrade. Otherwise, omitted instances or instance groups will continue to communicate with the cluster, which can cause issues with tower services during the upgrade.
- For **clustered installations**: If you are creating a clustered setup, you must replace `localhost` with the hostname or IP address of all instances. All nodes/instances must be able to reach any others using this hostname or address. In other words, you cannot use the `localhost ansible_connection=local` on one of the nodes *AND* all of the nodes should use the same format for the host names.

Therefore, this will *not* work:

```
[tower]
localhost ansible_connection=local
hostA
hostB.example.com
172.27.0.4
```

Instead, use these formats:

```
[tower]
hostA
hostB
hostC
```

OR

```
hostA.example.com
hostB.example.com
hostC.example.com
```

OR

```
[tower]
172.27.0.2
172.27.0.3
172.27.0.4
```

- For **all standard installations**: When performing an installation, you must supply any necessary passwords in the inventory file.

Note: Changes made to the installation process now require that you fill out all of the password fields in the inventory file. If you need to know where to find the values for these they should be:

```
admin_password='' ← Tower local admin password
pg_password='' ← Found in /etc/tower/conf.d/postgres.py
```

Warning: Do not use special characters in `pg_password` as it may cause the setup to fail.

Example Inventory file

- For **provisioning new nodes**: When provisioning new nodes add the nodes to the inventory file with all current nodes, make sure all passwords are included in the inventory file.
- For **upgrading a single node**: When upgrading, be sure to compare your inventory file to the current release version. It is recommended that you keep the passwords in here even when performing an upgrade.

Example Single Node Inventory File

```
[tower]
localhost ansible_connection=local

[database]

[all:vars]
admin_password='password'

pg_host=''
pg_port=''

pg_database='awx'
pg_username='awx'
pg_password='password'
```

Warning: Do not use special characters in `pg_password` as it may cause the setup to fail.

Example Multi Node Cluster Inventory File

```
[tower]
clusternode1.example.com
clusternode2.example.com
clusternode3.example.com

[database]
dbnode.example.com

[all:vars]
ansible_become=true

admin_password='password'

pg_host='dbnode.example.com'
pg_port='5432'

pg_database='tower'
pg_username='tower'
pg_password='password'
```

Warning: Do not use special characters in `pg_password` as it may cause the setup to fail.

Example Inventory file for an external existing database

```
[tower]
node.example.com ansible_connection=local

[database]

[all:vars]
admin_password='password'
pg_password='password'

pg_host='database.example.com'
pg_port='5432'

pg_database='awx'
pg_username='awx'
```

Warning: Do not use special characters in `pg_password` as it may cause the setup to fail.

Example Inventory file for external database which needs installation

```
[tower]
node.example.com ansible_connection=local
```

(continues on next page)

(continued from previous page)

```
[database]
database.example.com

[all:vars]
admin_password='password'
pg_password='password'

pg_host='database.example.com'
pg_port='5432'

pg_database='awx'
pg_username='awx'
```

Warning: Do not use special characters in `pg_password` as it may cause the setup to fail.

Once any necessary changes have been made, you are ready to run `./setup.sh`.

Note: Root access to the remote machines is required. With Ansible, this can be achieved in different ways:

- `ansible_user=root ansible_ssh_pass="your_password_here"` inventory host or group variables
- `ansible_user=root ansible_ssh_private_key_file="path_to_your_keyfile.pem"` inventory host or group variables
- `ANSIBLE_BECOME_METHOD='sudo' ANSIBLE_BECOME=True ./setup.sh`
- `ANSIBLE_SUDO=True ./setup.sh` (Only applies to Ansible 2.7)

The `DEFAULT_SUDO` Ansible configuration parameter was removed in Ansible 2.8, which causes the `ANSIBLE_SUDO=True ./setup.sh` method of privilege escalation to no longer work. For more information on become plugins, refer to [Understanding Privilege Escalation](#) and the [list of become plugins](#).

7.3 The Setup Playbook

Note: Ansible Tower 3.0 simplifies installation and removes the need to run `./configure/` as part of the installation setup. Users of older versions should follow the instructions available in the v.2.4.5 (or earlier) releases of the Tower Documentation available at: <http://docs.ansible.com/>

The Tower setup playbook script uses the `inventory` file and is invoked as `./setup.sh` from the path where you unpacked the Tower installer tarball.

```
root@localhost:~$ ./setup.sh
```

The setup script takes the following arguments:

- `-h` – Show this help message and exit
- `-i INVENTORY_FILE` – Path to Ansible inventory file (default: `inventory`)
- `-e EXTRA_VARS` – Set additional Ansible variables as `key=value` or `YAML/JSON` (i.e. `-e bundle_install=false` forces an online installation)

- `-b` – Perform a database backup in lieu of installing
- `-r` – Perform a database restore in lieu of installing (a default restore path is used unless `EXTRA_VARS` are provided with a non-default path, as shown in the code example below)

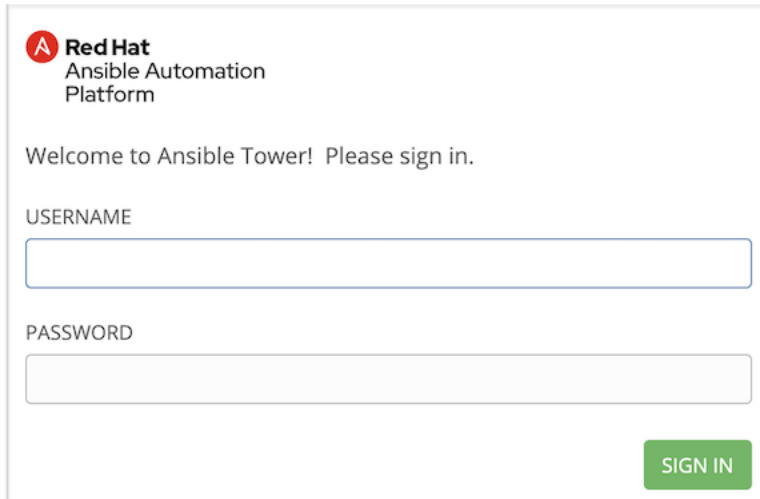
```
./setup.sh -e 'restore_backup_file=/path/to/nondefault/location' -r
```

Note: Please note that a issue was discovered in Tower 3.0.0 and 3.0.1 that prevented proper system backups and restorations.

If you need to back up or restore your Tower v3.0.0 or v3.0.1 installation, use the v3.0.2 installer to do so.

After calling `./setup.sh` with the appropriate parameters, Tower is installed on the appropriate machines as has been configured. Setup installs Tower from RPM packages using repositories hosted on **ansible.com**.

Once setup is complete, use your web browser to access the Tower server and view the Tower login screen. Your Tower server is accessible from port 80 (`https://<TOWER_SERVER_NAME>/`) but will redirect to port 443 so 443 needs to be available also.



If the installation of Tower fails and you are a customer who has purchased a valid license for Ansible Tower, please contact Ansible via the Red Hat Customer portal at <https://access.redhat.com/>.

7.4 Changing the Password

Once installed, if you log into the Tower instance via SSH, the default admin password is provided in the prompt. You can then change it with the following command (as root or as AWX user):

```
awx-manage changepassword admin
```

After that, the password you have entered will work as the admin password in the web UI.

UPGRADING AN EXISTING TOWER INSTALLATION

You can upgrade your existing Tower installation to the latest version easily. Tower looks for existing configuration files and recognizes when an upgrade should be performed instead of an installation.

As with installation, the upgrade process requires that the Tower server be able to access the Internet. The upgrade process takes roughly the same amount of time as a Tower installation, plus any time needed for data migration.

This upgrade procedure assumes that you have a working installation of Ansible and Tower.

Note: You can not convert an embedded-database Tower to a Clustered installation as part of an upgrade. Users who want to deploy Tower in a Clustered configuration should back up their Tower database, install a new Clustered configuration on a different VM or physical host, and then restore the database. It is possible to add additional instances later on to Tower if it is already operating on an external database. Refer to the [Clustering](#) chapter of the *Ansible Tower Administration Guide*.

If Tower is on a version of RHEL older than RHEL 8 and you want to upgrade to Ansible Tower on RHEL 8, follow the sequence outlined below:

1. [Get the Tower Installer](#) and upgrade to Ansible Tower 3.7 on RHEL 7
2. Run Tower Backup included in the Tower setup playbook. See [Backing Up and Restoring Tower](#) in the *Ansible Tower Administration Guide* for details.
3. [Get the Tower Installer](#) and install a fresh version of Ansible Tower 3.7 on RHEL 8
4. Run Tower Restore included in the Tower setup playbook. See [Backing Up and Restoring Tower](#) in the *Ansible Tower Administration Guide* for details.

This process ensures that the PostgreSQL database is also properly migrated to the latest version if you are upgrading an embedded-database Tower. Note that if you upgrade a Tower with an external database, the client libraries will be upgraded as well, but you will need to upgrade your external PostgreSQL server manually. Be sure to check the release notes to see if this applies to you before upgrading.

8.1 Requirements

Before upgrading your Tower installation, refer to [Requirements](#) to ensure you have enough disk space and RAM as well as to review any software needs. For example, you should have the latest stable release of Ansible installed before performing an upgrade.

Note: All upgrades should be no more than two major versions behind what you are currently upgrading to. For example, in order to upgrade to Ansible Tower 3.6.x, you must first be on version 3.4.x; i.e., there is no direct upgrade path from version 3.3.x. Refer to the [recommended upgrade path article](#) off your customer portal.

In order to run Ansible Tower 3.5 on RHEL 8, you must also have Ansible 2.8 or later installed.

8.2 Back Up Your Tower Installation

It is advised that you create a backup before upgrading the system. After the backup process has been accomplished, proceed with OS/Ansible/Tower upgrades.

Refer to [Backing Up and Restoring Tower](#) in the *Ansible Tower Administration Guide*.

8.3 Get the Tower Installer

You may install standalone Tower or use the bundled installer:

- if you set up Tower on an environment with a direct Internet access, you can download the standalone Tower installer
- if you set up Tower on an environment without direct access to online repositories, or your environment enforces a proxy, you must use the bundled installer

Download and then extract the Ansible Tower installation/upgrade tool: <http://releases.ansible.com/ansible-tower/setup/>

```
root@localhost:~$ tar xvzf ansible-tower-setup-latest.tar.gz
root@localhost:~$ cd ansible-tower-setup-<tower_version>
```

To install or upgrade, start by editing the inventory file in the `ansible-tower-setup-<tower_version>` directory, replacing `<tower_version>` with the version number, such as `3.7.1` or `3.7.0` directory.

Note: As part of the upgrade process, database schema migration may be done. Depending on the size of your Tower installation, this may take some time.

If the upgrade of Tower fails or if you need assistance, please contact Ansible via the Red Hat Customer portal at <https://access.redhat.com/>.

8.4 The Setup Playbook

Note: Ansible Tower 3.0 simplifies installation and removes the need to run `./configure/` as part of the installation setup. Users of older versions should follow the instructions available in the v.2.4.5 (or earlier) releases of the Tower Documentation available at: <http://docs.ansible.com/>

The Tower setup playbook script uses the `inventory` file and is invoked as `./setup.sh` from the path where you unpacked the Tower installer tarball.

```
root@localhost:~$ ./setup.sh
```

The setup script takes the following arguments:

- `-h` – Show this help message and exit

- `-i INVENTORY_FILE` – Path to Ansible inventory file (default: `inventory`)
- `-e EXTRA_VARS` – Set additional Ansible variables as `key=value` or YAML/JSON (i.e. `-e bundle_install=false` forces an online installation)
- `-b` – Perform a database backup in lieu of installing
- `-r` – Perform a database restore in lieu of installing (a default restore path is used unless `EXTRA_VARS` are provided with a non-default path, as shown in the code example below)

```
./setup.sh -e 'restore_backup_file=/path/to/nondefault/location' -r
```

Note: Please note that a issue was discovered in Tower 3.0.0 and 3.0.1 that prevented proper system backups and restorations.

If you need to back up or restore your Tower v3.0.0 or v3.0.1 installation, use the v3.0.2 installer to do so.

USABILITY ANALYTICS AND DATA COLLECTION

Usability data collection is included with Tower to collect data to better understand how Tower users specifically interact with Tower, to help enhance future releases, and to continue streamlining your user experience.

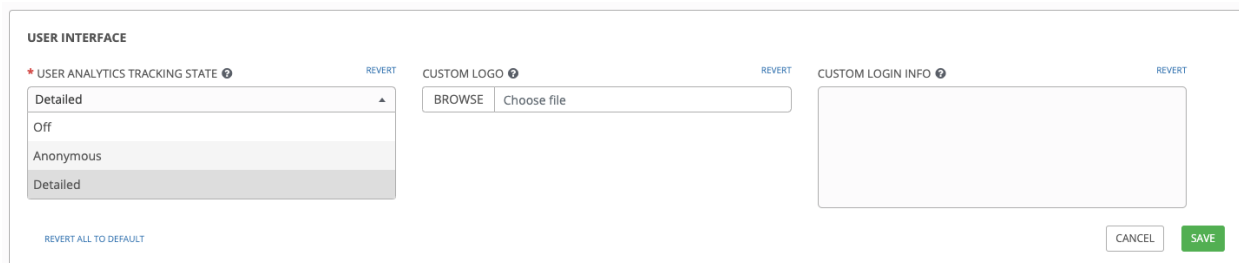
Only users installing a trial of Tower or a fresh installation of Tower are opted-in for this data collection.

If you want to change how you participate in this analytics collection, you can opt out or change your settings using



the Configure Tower user interface, accessible from the Settings () icon from the left navigation bar.

Ansible Tower collects user data automatically to help improve the Tower product. You can control the way Tower collects data by setting your participation level in the **User Interface** tab in the settings menu.



1. Select the desired level of data collection from the User Analytics Tracking State drop-down list:

- **Off:** Prevents any data collection.
- **Anonymous:** Enables data collection without your specific user data.
- **Detailed:** Enables data collection including your specific user data.

2. Click **Save** to apply the settings or **Cancel** to abandon the changes.

For more information, see the Red Hat privacy policy at <https://www.redhat.com/en/about/privacy-policy>.

SUPPORTED ATTRIBUTES FOR CUSTOM NOTIFICATIONS

This section describes the list of supported job attributes and the proper syntax for constructing the message text for notifications. The supported job attributes are:

- `allow_simultaneous` - (boolean) indicates if multiple jobs can run simultaneously from the JT associated with this job
- `controller_node` - (string) the instance that managed the isolated execution environment
- `created` - (datetime) timestamp when this job was created
- `custom_virtualenv` - (string) custom virtual environment used to execute job
- `description` - (string) optional description of the job
- `diff_mode` - (boolean) if enabled, textual changes made to any templated files on the host are shown in the standard output
- `elapsed` - (decimal) elapsed time in seconds that the job ran
- `execution_node` - (string) node the job executed on
- `failed` - (boolean) true if job failed
- `finished` - (datetime) date and time the job finished execution
- `force_handlers` - (boolean) when handlers are forced, they will run when notified even if a task fails on that host (note that some conditions - e.g. unreachable hosts - can still prevent handlers from running)
- `forks` - (int) number of forks requested for job
- `id` - (int) database id for this job
- `job_explanation` - (string) status field to indicate the state of the job if it wasn't able to run and capture stdout
- `job_slice_count` - (integer) if run as part of a sliced job, the total number of slices (if 1, job is not part of a sliced job)
- `job_slice_number` - (integer) if run as part of a sliced job, the ID of the inventory slice operated on (if not part of a sliced job, attribute is not used)
- `job_tags` - (string) only tasks with specified tags will execute
- `job_type` - (choice) run, check, or scan
- `launch_type` - (choice) manual, relaunch, callback, scheduled, dependency, workflow, sync, or scm
- `limit` - (string) playbook execution limited to this set of hosts, if specified
- `modified` - (datetime) timestamp when this job was last modified
- `name` - (string) name of this job

- `playbook` - (string) playbook executed
- `scm_revision` - (string) scm revision from the project used for this job, if available
- `skip_tags` - (string) playbook execution skips over this set of tag(s), if specified
- `start_at_task` - (string) playbook execution begins at the task matching this name, if specified
- `started` - (datetime) date and time the job was queued for starting
- `status` - (choice) new, pending, waiting, running, successful, failed, error, canceled
- `timeout` - (int) amount of time (in seconds) to run before the task is canceled
- `type` - (choice) data type for this job
- `url` - (string) URL for this job
- `use_fact_cache` - (boolean) if enabled for job, Tower acts as an Ansible Fact Cache Plugin, persisting facts at the end of a playbook run to the database and caching facts for use by Ansible
- `verbosity` - (choice) 0 through 5 (corresponding to Normal through WinRM Debug)
- **host_status_counts (count of hosts uniquely assigned to each status)**
 - `skipped` (integer)
 - `ok` (integer)
 - `changed` (integer)
 - `failures` (integer)
 - `dark` (integer)
 - `processed` (integer)
 - `rescued` (integer)
 - `ignored` (integer)
 - `failed` (boolean)
- **summary_fields:**
 - **inventory**
 - * `id` - (integer) database ID for inventory
 - * `name` - (string) name of the inventory
 - * `description` - (string) optional description of the inventory
 - * `has_active_failures` - (boolean) (deprecated) flag indicating whether any hosts in this inventory have failed
 - * `total_hosts` - (deprecated) (int) total number of hosts in this inventory.
 - * `hosts_with_active_failures` - (deprecated) (int) number of hosts in this inventory with active failures
 - * `total_groups` - (deprecated) (int) total number of groups in this inventory
 - * `groups_with_active_failures` - (deprecated) (int) number of hosts in this inventory with active failures
 - * `has_inventory_sources` - (deprecated) (boolean) flag indicating whether this inventory has external inventory sources

- * `total_inventory_sources` - (int) total number of external inventory sources configured within this inventory
 - * `inventory_sources_with_failures` - (int) number of external inventory sources in this inventory with failures
 - * `organization_id` - (id) organization containing this inventory
 - * `kind` - (choice) (empty string) (indicating hosts have direct link with inventory) or 'smart'
- project**
- * `id` - (int) database ID for project
 - * `name` - (string) name of the project
 - * `description` - (string) optional description of the project
 - * `status` - (choices) one of new, pending, waiting, running, successful, failed, error, canceled, never updated, ok, or missing
 - * `scm_type` (choice) - one of (empty string), git, hg, svn, insights
- job_template**
- * `id` - (int) database ID for job template
 - * `name` - (string) name of job template
 - * `description` - (string) optional description for the job template
- unified_job_template**
- * `id` - (int) database ID for unified job template
 - * `name` - (string) name of unified job template
 - * `description` - (string) optional description for the unified job template
 - * `unified_job_type` - (choice) unified job type (job, workflow_job, project_update, etc.)
- instance_group**
- * `id` - (int) database ID for instance group
 - * `name` - (string) name of instance group
- created_by**
- * `id` - (int) database ID of user
 - * `username` - (string) username
 - * `first_name` - (string) first name
 - * `last_name` - (string) last name
- labels**
- * `count` - (int) number of labels
 - * `results` - list of dictionaries representing labels (e.g. {"id": 5, "name": "database jobs"})

Information about a job can be referenced in a custom notification message using grouped curly braces `{{ }}`. Specific job attributes are accessed using dotted notation, for example `{{ job.summary_fields.inventory.name }}`. Any characters used in front or around the braces, or plain text, can be added for clarification, such as '#' for job ID and single-quotes to denote some descriptor. Custom messages can include a number of variables throughout the message:


```
{{ job_friendly_name }} {{ job.id }} ran on {{ job.execution_node }} in {{ job.
↳elapsed }} seconds.
```

In addition to the job attributes, there are some other variables that can be added to the template:

- `approval_node_name` - (string) the approval node name
- `approval_status` - (choice) one of `approved`, `denied`, and `timed_out`
- `url` - (string) URL of the job for which the notification is emitted (this applies to start, success, fail, and approval notifications)
- `workflow_url` - (string) URL to the relevant approval node. This allows the notification recipient to go to the relevant workflow job page to see what's going on (i.e., This node can be viewed at: `{{ workflow_url }}`). In cases of approval-related notifications, both `url` and `workflow_url` are the same.
- `job_friendly_name` - (string) the friendly name of the job
- `job_metadata` - (string) job metadata as a JSON string, for example:

```
{'url': 'https://towerhost/$/jobs/playbook/13',
'traceback': '',
'status': 'running',
'started': '2019-08-07T21:46:38.362630+00:00',
'project': 'Stub project',
'playbook': 'ping.yml',
'name': 'Stub Job Template',
'limit': '',
'inventory': 'Stub Inventory',
'id': 42,
'hosts': {},
'friendly_name': 'Job',
'finished': False,
'credential': 'Stub credential',
'created_by': 'admin'}
```

GLOSSARY

Ad Hoc Refers to running Ansible to perform some quick command, using `/usr/bin/ansible`, rather than the orchestration language, which is `/usr/bin/ansible-playbook`. An example of an ad hoc command might be rebooting 50 machines in your infrastructure. Anything you can do ad hoc can be accomplished by writing a Playbook, and Playbooks can also glue lots of other operations together.

Callback Plugin Refers to some user-written code that can intercept results from Ansible and do something with them. Some supplied examples in the GitHub project perform custom logging, send email, or even play sound effects.

Control Groups Also known as *cgroups*, a control group is a feature in the Linux kernel that allows resources to be grouped and allocated to run certain processes. In addition to assigning resources to processes, cgroups can also report actual resource usage by all processes running inside of the cgroup.

Check Mode Refers to running Ansible with the `--check` option, which does not make any changes on the remote systems, but only outputs the changes that might occur if the command ran without this flag. This is analogous to so-called “dry run” modes in other systems, though the user should be warned that this does not take into account unexpected command failures or cascade effects (which is true of similar modes in other systems). Use this to get an idea of what might happen, but it is not a substitute for a good staging environment.

Container Groups Container Groups are a type of Instance Group that specify a configuration for provisioning a pod in a Kubernetes or OpenShift cluster where a job is run. These pods are provisioned on-demand and exist only for the duration of the playbook run.

Credentials Authentication details that may be utilized by Tower to launch jobs against machines, to synchronize with inventory sources, and to import project content from a version control system.

Credential Plugin Python code that contains definitions for an external credential type, its metadata fields, and the code needed for interacting with a secret management system.

Distributed Job A job that consists of a job template, an inventory, and slice size. When executed, a distributed job slices each inventory into a number of “slice size” chunks, which are then used to run smaller job slices.

External Credential Type A managed credential type for Tower used for authenticating with a secret management system.

Facts Facts are simply things that are discovered about remote nodes. While they can be used in playbooks and templates just like variables, facts are things that are inferred, rather than set. Facts are automatically discovered when running plays by executing the internal setup module on the remote nodes. You never have to call the setup module explicitly, it just runs, but it can be disabled to save time if it is not needed. For the convenience of users who are switching from other configuration management systems, the fact module also pulls in facts from the ‘ohai’ and ‘facter’ tools if they are installed, which are fact libraries from Chef and Puppet, respectively.

Forks Ansible and Tower talk to remote nodes in parallel and the level of parallelism can be set several ways—during the creation or editing of a Job Template, by passing `--forks`, or by editing the default in a configuration file. The default is a very conservative 5 forks, though if you have a lot of RAM, you can easily set this to a value like 50 for increased parallelism.

Group A set of hosts in Ansible that can be addressed as a set, of which many may exist within a single Inventory.

Group Vars The `group_vars/` files are files that live in a directory alongside an inventory file, with an optional filename named after each group. This is a convenient place to put variables that will be provided to a given group, especially complex data structures, so that these variables do not have to be embedded in the inventory file or playbook.

Handlers Handlers are just like regular tasks in an Ansible playbook (see Tasks), but are only run if the Task contains a “notify” directive and also indicates that it changed something. For example, if a config file is changed then the task referencing the config file templating operation may notify a service restart handler. This means services can be bounced only if they need to be restarted. Handlers can be used for things other than service restarts, but service restarts are the most common usage.

Host A system managed by Tower, which may include a physical, virtual, cloud-based server, or other device. Typically an operating system instance. Hosts are contained in Inventory. Sometimes referred to as a “node”.

Host Specifier Each Play in Ansible maps a series of tasks (which define the role, purpose, or orders of a system) to a set of systems. This “hosts:” directive in each play is often called the hosts specifier. It may select one system, many systems, one or more groups, or even some hosts that are in one group and explicitly not in another.

Instance Group A group that contains instances for use in a clustered environment. An instance group provides the ability to group instances based on policy.

Inventory A collection of hosts against which Jobs may be launched.

Inventory Script A very simple program (or a complicated one) that looks up hosts, group membership for hosts, and variable information from an external resource—whether that be a SQL database, a CMDB solution, or something like LDAP. This concept was adapted from Puppet (where it is called an “External Nodes Classifier”) and works more or less exactly the same way.

Inventory Source Information about a cloud or other script that should be merged into the current inventory group, resulting in the automatic population of Groups, Hosts, and variables about those groups and hosts.

Job One of many background tasks launched by Tower, this is usually the instantiation of a Job Template; the launch of an Ansible playbook. Other types of jobs include inventory imports, project synchronizations from source control, or administrative cleanup actions.

Job Detail The history of running a particular job, including its output and success/failure status.

Job Slice See *Distributed Job*.

Job Template The combination of an Ansible playbook and the set of parameters required to launch it.

JSON Ansible and Tower use JSON for return data from remote modules. This allows modules to be written in any language, not just Python.

Metadata Information for locating a secret in the external system once authenticated. The uses provides this information when linking an external credential to a target credential field.

Notification Template An instance of a notification type (Email, Slack, Webhook, etc.) with a name, description, and a defined configuration.

Notification A manifestation of the notification template; for example, when a job fails a notification is sent using the configuration defined by the notification template.

Notify The act of a task registering a change event and informing a handler task that another action needs to be run at the end of the play. If a handler is notified by multiple tasks, it will still be run only once. Handlers are run in the order they are listed, not in the order that they are notified.

Organization A logical collection of Users, Teams, Projects, and Inventories. The highest level in the Tower object hierarchy is the Organization.

Organization Administrator An Tower user with the rights to modify the Organization's membership and settings, including making new users and projects within that organization. An organization admin can also grant permissions to other users within the organization.

Permissions The set of privileges assigned to Users and Teams that provide the ability to read, modify, and administer Projects, Inventories, and other Tower objects.

Plays A playbook is a list of plays. A play is minimally a mapping between a set of hosts selected by a host specifier (usually chosen by groups, but sometimes by hostname globs) and the tasks which run on those hosts to define the role that those systems will perform. There can be one or many plays in a playbook.

Playbook An Ansible playbook. Refer to <http://docs.ansible.com/> for more information.

Policy Policies dictate how instance groups behave and how jobs are executed.

Project A logical collection of Ansible playbooks, represented in Tower.

Roles Roles are units of organization in Ansible and Tower. Assigning a role to a group of hosts (or a set of groups, or host patterns, etc.) implies that they should implement a specific behavior. A role may include applying certain variable values, certain tasks, and certain handlers—or just one or more of these things. Because of the file structure associated with a role, roles become redistributable units that allow you to share behavior among playbooks—or even with other users.

Secret Management System A server or service for securely storing and controlling access to tokens, passwords, certificates, encryption keys, and other sensitive data.

Schedule The calendar of dates and times for which a job should run automatically.

Sliced Job See *Distributed Job*.

Source Credential An external credential that is linked to the field of a target credential.

Sudo Ansible does not require root logins and, since it is daemonless, does not require root level daemons (which can be a security concern in sensitive environments). Ansible can log in and perform many operations wrapped in a `sudo` command, and can work with both password-less and password-based sudo. Some operations that do not normally work with `sudo` (like `scp` file transfer) can be achieved with Ansible's *copy*, *template*, and *fetch* modules while running in `sudo` mode.

Superuser An admin of the Tower server who has permission to edit any object in the system, whether associated to any organization. Superusers can create organizations and other superusers.

Survey Questions asked by a job template at job launch time, configurable on the job template.

Target Credential A non-external credential with an input field that is linked to an external credential.

Team A sub-division of an Organization with associated Users, Projects, Credentials, and Permissions. Teams provide a means to implement role-based access control schemes and delegate responsibilities across Organizations.

User An Tower operator with associated permissions and credentials.

Webhook Webhooks allow communication and information sharing between apps. They are used to respond to commits pushed to SCMs and launch job templates or workflow templates.

Workflow Job Template A set consisting of any combination of job templates, project syncs, and inventory syncs, linked together in order to execute them as a single unit.

YAML Ansible and Tower use YAML to define playbook configuration languages and also variable files. YAML has a minimum of syntax, is very clean, and is easy for people to skim. It is a good data format for configuration files and humans, but is also machine readable. YAML is fairly popular in the dynamic language community and the format has libraries available for serialization in many languages (Python, Perl, Ruby, etc.).

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