Ansible & Docker

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# **Introduction**

In this article, we will discuss about installing Docker on node using Ansible. We will install Docker on Ubuntu 14.04 OS through Ansible playbook. We will use a role in the playbook to install it. Then we will discuss about, how to build and deploy Docker images through Ansible.

# **Install Docker through Ansible**

To install Docker on a node first you need to establish ssh connectivity to that node from your machine as Ansible is ssh based. Your node can be anything a virtual machine, a cloud instance, bare metal machine etc. Here, we will use AWS EC2 instance running on Ubuntu 14.04 OS. We need to follow below steps:

## Setup node:

You can refer “Using AWS EC2 instance as node” in previous article to add an EC2 instance as node.

|  |
| --- |
| BANL141cc14d1:playbooks ngupta9$ ansible ubuntu1404 -i hosts -m ping  ubuntu1404 | SUCCESS => {  "changed": false,  "ping": "pong"  }  BANL141cc14d1:playbooks ngupta9$ |

## Create playbook:

Now, connection is fine so we will create a playbook to install docker on the node.

|  |
| --- |
| BANL141cc14d1:playbooks ngupta9$ cat install\_docker.yml  ---  - name: Install docker on Ubuntu  hosts: ubuntu1404  tags: ubuntu  become: yes  become\_method: sudo  roles:  - install\_docker\_on\_ubuntu  BANL141cc14d1:playbooks ngupta9$ |

Here, I am using a role “install\_docker\_on\_ubuntu”, so we need t create this role and this role will perform the tasks.

## Create role:

To create role “install\_docker\_on\_ubuntu”, create a roles directory and create role inside that

|  |
| --- |
| BANL141cc14d1:playbooks ngupta9$ mkdir -p roles/install\_docker\_on\_ubuntu/tasks/  BANL141cc14d1:playbooks ngupta9$  BANL141cc14d1:playbooks ngupta9$ cd roles/install\_docker\_on\_ubuntu/tasks/  BANL141cc14d1:tasks ngupta9$ cat main.yml  ---  - name: Add docker apt keys  apt\_key: keyserver=keyserver.ubuntu.com id=36A1D7869245C8950F966E92D8576A8BA88D21E9  - name: update apt  apt\_repository: repo='deb https://get.docker.com/ubuntu docker main' state=present  - name: Install docker  apt: pkg=lxc-docker update\_cache=yes  - name: add user ubuntu in docker group  user: name=ubuntu  groups=docker  append=yes  - name: start docker service  service: "name=docker state=restarted"  BANL141cc14d1:tasks ngupta9$ |

Then create a main.yml inside like above, this will perform the required task to install Docker. These tasks include add Docker apt key & repo, install docker, add user in docker group, restart docker service

## Run playbook

Now, setup is done. You can run the playbook.

|  |
| --- |
| BANL141cc14d1:tasks ngupta9$ ansible-playbook -i hosts install\_docker.yml  PLAY [Install docker on Ubuntu] \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*  TASK [setup] \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*  ok: [ubuntu1404]  TASK [install\_docker\_on\_ubuntu : Add docker apt keys] \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*  changed: [ubuntu1404]  TASK [install\_docker\_on\_ubuntu : update apt] \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*  changed: [ubuntu1404]  TASK [install\_docker\_on\_ubuntu : Install docker] \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*  changed: [ubuntu1404]  TASK [install\_docker\_on\_ubuntu : add user ubuntu in docker group] \*\*\*\*\*\*\*\*\*\*\*\*\*\*  ok: [ubuntu1404]  TASK [install\_docker\_on\_ubuntu : start docker service] \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*  changed: [ubuntu1404]  ---  PLAY RECAP \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*  ubuntu1404 : ok=6 changed=5 unreachable=0 failed=0  BANL141cc14d1:tasks ngupta9$ |

# **Create Docker Images:**

Docker images are created with the help of DockerFile on local machine and these images are pushed to a registry known as docker hub. In this way other machines/nodes can pull these images and use these images. This is the docker way.

For simpler images, Dockerfiles work just fine. However, when you want to create complex images then you should use Ansible. To create an image, we will need a base image so we will be using an official image which is having Ansible installed on it because we will need Ansible on the image to run the playbook. Below are the steps which we need to follow to create an docker image:

* Use an official Ansible base image that has Ansible installed in it.
* In the Dockerfile, copy the playbooks into the image.
* Invoke Ansible from the Dockerfile, to run the playbook copied in previous step.
* Push Docker images up from your local/remote machine to the registry.

There are 2 most commonly used official Ansible base image, which are hosted on the Docker registry (Docker Hub):

• ansible/centos7-ansible (CentOS 7)

• ansible/ubuntu14.04-ansible (Ubuntu 14.04).

We’ll be using the Ubuntu 14.04 image to create a new image. I have created a Dockerfile, Ansible playbook and other required file.

Files and directory structure:

|  |
| --- |
| BANL141cc14d1:create\_docker\_image ngupta9$ find .  .  ./ansible  ./ansible/docker-container.yml  ./ansible/files  ./ansible/files/nginx.conf  ./ansible/templates  ./ansible/templates/index.html.j2  ./Dockerfile |

Contents of the Dockerfile:

|  |
| --- |
| BANL141cc14d1:create\_docker\_image ngupta9$ cat Dockerfile  FROM ansible/ubuntu14.04-ansible:stable  MAINTAINER Nikhil Gupta <coolnicks.nikhil@gmail.com>  ADD ansible /srv/ansible  WORKDIR /srv/ansible  RUN ansible-playbook docker-container.yml -c local  EXPOSE 80  BANL141cc14d1:create\_docker\_image ngupta9$ |

Here,

FROM: It will download stable version of base image ubuntu14.04-ansible.

ADD: Will add Ansible directory to docker image under /srv/Ansible

WORKDIR: Working directory of the image will be /srv/Ansible

RUN: Run the command inside image. In this case it will run Ansible playbook

EXPOSE: It will expose port 80 of the image

Contents of the Ansible playbook “docker-container.yml”:

|  |
| --- |
| BANL141cc14d1:ansible ngupta9$ cat docker-container.yml  ---  - name: Configure webserver with nginx  hosts: local  tasks:  - name: install nginx  apt: pkg=nginx update\_cache=yes cache\_valid\_time=3600  - name: copy nginx config file  copy: src=files/nginx.conf dest=/etc/nginx/sites-available/default  - name: enable configuration  file: >  dest=/etc/nginx/sites-enabled/default  src=/etc/nginx/sites-available/default  state=link  - name: copy index.html  template: src=templates/index.html.j2 dest=/usr/share/nginx/html/index.html  mode=0644  - name: restart nginx  service: name=nginx state=restarted  BANL141cc14d1:ansible ngupta9$ |

It will install nginx package on the docker image, copy the file, create symlink and restart nginx service.

Now, run docker build command (from the directory which is having Dockerfile) to create an image and run playbook.

|  |
| --- |
| BANL141cc14d1:create\_docker\_image ngupta9$ docker build -t coolnicks/ansible:ubuntu1404-nginx .  Sending build context to Docker daemon 7.168 kB  Step 1 : FROM ansible/ubuntu14.04-ansible:stable  stable: Pulling from ansible/ubuntu14.04-ansible  012a7829fd3f: Pull complete  41158247dd50: Pull complete  916b974d99af: Pull complete  a3ed95caeb02: Pull complete  58482305ed21: Pull complete  bbe6d6c9d4eb: Pull complete  Digest: sha256:89bd35c622c295b81c58f365abb36c88703ab1c08266603f8c37f85b48cd9d28  Status: Downloaded newer image for ansible/ubuntu14.04-ansible:stable  ---> 1526eaefd882  Step 2 : MAINTAINER Nikhil Gupta <coolnicks.nikhil@gmail.com>  ---> Running in c2adc186034c  ---> 7360a86eeb3e  Removing intermediate container c2adc186034c  Step 3 : ADD ansible /srv/ansible  ---> 0e0a8f03503d  Removing intermediate container c4bea88b9d26  Step 4 : WORKDIR /srv/ansible  ---> Running in d7fff0a3373e  ---> 0aff84252db5  Removing intermediate container d7fff0a3373e  Step 5 : RUN ansible-playbook docker-container.yml -c local  ---> Running in f45a120f9972  PLAY [Configure webserver with nginx] \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*  GATHERING FACTS \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*  ok: [localhost]  TASK: [install nginx] \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*  changed: [localhost]  TASK: [copy nginx config file] \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*  changed: [localhost]  TASK: [enable configuration] \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*  ok: [localhost]  TASK: [copy index.html] \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*  changed: [localhost]  TASK: [restart nginx] \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*  changed: [localhost]  PLAY RECAP \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*  localhost : ok=6 changed=4 unreachable=0 failed=0  ---> e6a5292053d2  Removing intermediate container f45a120f9972  Step 6 : EXPOSE 80  ---> Running in 36fe68d3eeb8  ---> b4dcce787cd4  Removing intermediate container 36fe68d3eeb8  Successfully built b4dcce787cd4  BANL141cc14d1:create\_docker\_image ngupta9$ |

Here, coolnicks/ansible:ubuntu1404-nginx is repository and tag name.

Now, you can see that docker image has been created.

|  |
| --- |
| BANL141cc14d1:create\_docker\_image ngupta9$ docker images  REPOSITORY TAG IMAGE ID CREATED SIZE  coolnicks/ansible ubuntu1404-nginx b4dcce787cd4 32 seconds ago 329 MB  ansible/ubuntu14.04-ansible stable 1526eaefd882 16 months ago 287.4 MB  BANL141cc14d1:create\_docker\_image ngupta9$ |

You can create a container on local machine using image coolnicks/ansible:ubuntu1404-nginx. Run below command to create container.

|  |
| --- |
| BANL141cc14d1:create\_docker\_image ngupta9$ docker run -it --name=my\_ubuntu\_nginx\_container -p 8182:80 coolnicks/ansible:ubuntu1404-nginx  root@83c353dafc07:/srv/ansible# pwd  /srv/ansible  root@83c353dafc07:/srv/ansible# ls -ltr  total 12  drwxr-xr-x 2 root root 4096 Feb 16 15:52 files  drwxr-xr-x 2 root root 4096 Feb 16 15:56 templates  -rw-r--r-- 1 root root 616 Feb 16 15:59 docker-container.yml  root@83c353dafc07:/srv/ansible# exit  exit  BANL141cc14d1:create\_docker\_image ngupta9$ |

You can see that we are logged into docker container as root user.

Now, we will push the image to docker hub:

|  |
| --- |
| BANL141cc14d1:create\_docker\_image ngupta9$ docker login  Login with your Docker ID to push and pull images from Docker Hub. If you don't have a Docker ID, head over to https://hub.docker.com to create one.  Username: coolnicks  Password:  Login Succeeded  BANL141cc14d1:create\_docker\_image ngupta9$ docker push coolnicks/ansible:ubuntu1404-nginx  The push refers to a repository [docker.io/coolnicks/ansible]  e249affdfba9: Pushed  eb215defd7fc: Pushed  aa3113f45762: Mounted from ansible/ubuntu14.04-ansible  aa7aa9635b36: Mounted from ansible/ubuntu14.04-ansible  5f70bf18a086: Mounted from ansible/ubuntu14.04-ansible  ac3aa667d51c: Mounted from ansible/ubuntu14.04-ansible  d28ebd7b34b8: Mounted from ansible/ubuntu14.04-ansible  7ccf5baddc67: Mounted from ansible/ubuntu14.04-ansible  ubuntu1404-nginx: digest: sha256:12a8bddaae10bc18974a2251dcd48b293a530d9f761f4830bd30f0d8db7673a6 size: 2195  BANL141cc14d1:create\_docker\_image ngupta9$ |

# **Deploy Docker images:**

To deploy a docker image on a node through Ansible, we will have to right a playbook.

Steps, we need to follow:

* Write Ansible playbooks to pull Docker images down to remote hosts
* Start up Docker containers on remote hosts
* Passing in configuration information.

Below are the contents of the playbook. We will use 2 modules docker\_image and docker\_container. docker\_image to pull the image from docker hub and docker\_container to create container on the node from the image pulled from docker hub.

|  |
| --- |
| BANL141cc14d1:create\_docker\_image ngupta9$ cat docker\_image\_deploy.yml  ---  - name: Deploy docker image  hosts: ubuntu1404  become: yes  become\_method: sudo  tasks:  - name: pull docker image  docker\_image:  name: "coolnicks/ansible:ubuntu1404-nginx"  - name: Create a docker container  docker\_container:  name: nginx-ansible  image: "coolnicks/ansible:ubuntu1404-nginx"  published\_ports:  - 8090:80  BANL141cc14d1:create\_docker\_image ngupta9$ |

Issue below command to run the playbook. It will pull image and create container on ubuntu1404 host.

|  |
| --- |
| $ ansible-playbook -i hosts docker\_image\_deploy.yml |

You might phase issues while running the playbook and get this error:

|  |
| --- |
| BANL141cc14d1:create\_docker\_image ngupta9$ ansible-playbook -i hosts docker\_image\_deploy.yml  PLAY [Deploy docker image] \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*  TASK [setup] \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*  ok: [ubuntu1404]  TASK [pull docker image] \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*  fatal: [ubuntu1404]: FAILED! => {"changed": false, "failed": true, "msg": "Failed to import docker-py - No module named docker. Try `pip install docker-py`"}  to retry, use: --limit @/Users/ngupta9/install\_docker\_using\_ansible/create\_docker\_image/docker\_image\_deploy.retry  PLAY RECAP \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*  ubuntu1404 : ok=1 changed=0 unreachable=0 failed=1  BANL141cc14d1:create\_docker\_image ngupta9$ |

To resolve this error you need to install docker and docker-py modules on the node (in this case ubutu1404). I have created a playbook to do this:

|  |
| --- |
| BANL141cc14d1:create\_docker\_image ngupta9$ cat install\_docker\_modules.yml  ---  - name: install certain python modules for docker  hosts: ubuntu1404  become: yes  become\_method: sudo  tasks:  - name: Install modules  pip:  name: "{{ item.name }}"  version: "{{ item.version }}"  state: present  with\_items:  - { name: docker, version: 2.0.0 }  - { name: docker-py, version: 1.10.6 }  BANL141cc14d1:create\_docker\_image ngupta9$ |

You need to run this playbook and it will install the modules.

|  |
| --- |
| BANL141cc14d1:create\_docker\_image ngupta9$ ansible-playbook -i hosts install\_docker\_modules.yml  PLAY [install certain python modules for docker] \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*  TASK [setup] \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*  ok: [ubuntu1404]  TASK [Install modules] \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*  changed: [ubuntu1404] => (item={u'version': u'2.0.0', u'name': u'docker'})  changed: [ubuntu1404] => (item={u'version': u'1.10.6', u'name': u'docker-py'})  PLAY RECAP \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*  ubuntu1404 : ok=2 changed=1 unreachable=0 failed=0  BANL141cc14d1:create\_docker\_image ngupta9$ |

Then, you can run the playbook again to deploy the docker image.

|  |
| --- |
| BANL141cc14d1:create\_docker\_image ngupta9$ ansible-playbook -i hosts docker\_image\_deploy.yml  PLAY [Deploy docker image] \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*  TASK [setup] \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*  ok: [ubuntu1404]  TASK [pull docker image] \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*  changed: [ubuntu1404]  TASK [Create a docker container] \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*  changed: [ubuntu1404]  PLAY RECAP \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*  ubuntu1404 : ok=3 changed=2 unreachable=0 failed=0  BANL141cc14d1:create\_docker\_image ngupta9$ |

Now you can go to the node (in this case ubuntu1404) and check if image is deployed and container got created.

|  |
| --- |
| BANL141cc14d1:create\_docker\_image ngupta9$ ssh ubuntu1404  Welcome to Ubuntu 14.04.5 LTS (GNU/Linux 3.13.0-105-generic x86\_64)  \* Documentation: https://help.ubuntu.com/  System information as of Thu Feb 16 19:15:28 UTC 2017  System load: 0.01 Processes: 113  Usage of /: 37.5% of 7.74GB Users logged in: 0  Memory usage: 12% IP address for eth0: 10.0.1.51  Swap usage: 0% IP address for docker0: 172.17.0.1  Graph this data and manage this system at:  https://landscape.canonical.com/  Get cloud support with Ubuntu Advantage Cloud Guest:  http://www.ubuntu.com/business/services/cloud  New release '16.04.1 LTS' available.  Run 'do-release-upgrade' to upgrade to it.  Last login: Thu Feb 16 19:16:05 2017 from 202.62.91.201  ubuntu@ip-10-0-1-51:~$ docker ps -a  CONTAINER ID IMAGE COMMAND CREATED STATUS PORTS NAMES  662476401c21 coolnicks/ansible:ubuntu1404-nginx "/bin/bash" 3 minutes ago Exited (0) 3 minutes ago nginx-ansible  ubuntu@ip-10-0-1-51:~$  ubuntu@ip-10-0-1-51:~$  ubuntu@ip-10-0-1-51:~$ docker images  REPOSITORY TAG IMAGE ID CREATED VIRTUAL SIZE  coolnicks/ansible ubuntu1404-nginx 0ff1cd7c9735 2 hours ago 328.9 MB  ubuntu@ip-10-0-1-51:~$  ubuntu@ip-10-0-1-51:~$ |