Chapter 2: Setting Up of the Lab Environment and Course Resource

1. Installing Docker

1-1. Docker Overview

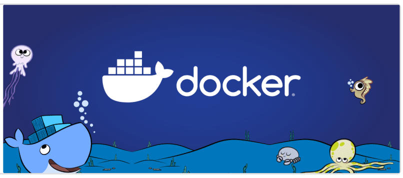
- Container offering that provides OS-level virtualization
- Containers are a convenient means of bundling software, libraries and configuration data, into a consumable format
- Available as a convenient “Docker Desktop” on both Mac OS X and Windows
- Also, easily installed on Linux
- Lab, makes use of Docker and Docker Compose

1-2. Installing Docker

Docker Desktop - Docker

Our Docker Subscription Service Agreement includes a change to the terms for Docker Desktop It remains free for small businesses (fewer than 250 employees AND less than $10 million in annual revenue), personal use, education, and non-commercial open source projects.

https://www.docker.com/products/docker-desktop/



1-2-1. Docker Test

```
$ docker run -it --rm ubuntu bash
Unable to find image 'ubuntu:latest' locally
latest: Pulling from library/ubuntu
405f018f9d1d: Pull complete
Digest: sha256:b6b83d3c331794420340093eb706a6f152d9c1fa51b262d9bf34594887c2c7ac
Status: Downloaded newer image for ubuntu:latest
root@62534192cdac:/# uname -a
Linux 62534192cdac 5.10.104-linuxkit #1 SMP Thu Mar 17 17:08:06 UTC 2022 x86_64 x86_64 x86_64 GNU/Linux
root@62534192cdac:/# cat /etc/os-release
PRETTY_NAME="Ubuntu 22.04 LTS"
NAME="Ubuntu"
VERSION_ID="22.04"
VERSION="22.04 LTS (Jammy Jellyfish)"
VERSION_CODENAME=jammy
ID=ubuntu
ID_LIKE=debian
HOME_URL="https://www.ubuntu.com/"
SUPPORT_URL="https://help.ubuntu.com/"
BUG_REPORT_URL="https://bugs.launchpad.net/ubuntu/"
PRIVACY_POLICY_URL="https://www.ubuntu.com/legal/terms-and-policies/privacy-policy"
UBUNTU_CODENAME=jammy
root@62534192cdac:/# exit
```

1-2-2. Course Lab Repository

https://github.com/spurin/diveintoansible-lab

2. Installing the Ansible Lab

```
$ git clone https://github.com/spurin/diveintoansible-lab.git
$ cd diveintoansible-lab
$ docker-compose up
```

ttypd

- http://localhost:1000
- Ansible Terminal : id/pwd ⇒ ansible/password

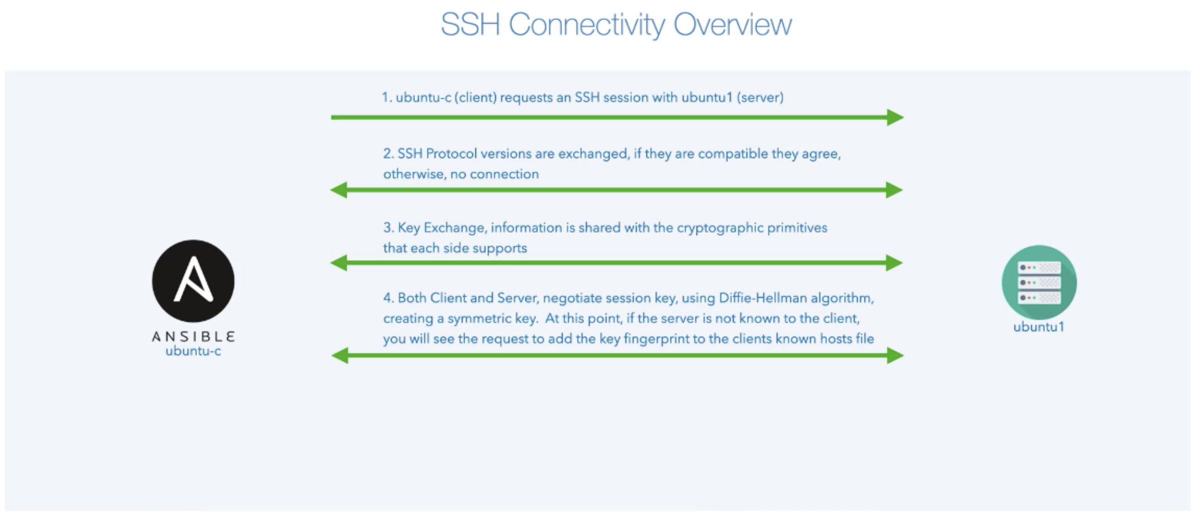
```
# docker-compose kill
$ ctrl + C
# docker remove
$ docker-compose rm
```

Google Cloud Shell

- https://diveinto.com/p/playground

3. Configuring Secure Shell (SSH) Connectivity between Hosts

3-1. SSH fingerprint



1. ubuntu-c (client) requests an SSH session with ubuntu1 (server)

2. SSH Protocol versions are exchanged, if they are compatible they agree, otherwise, no connection

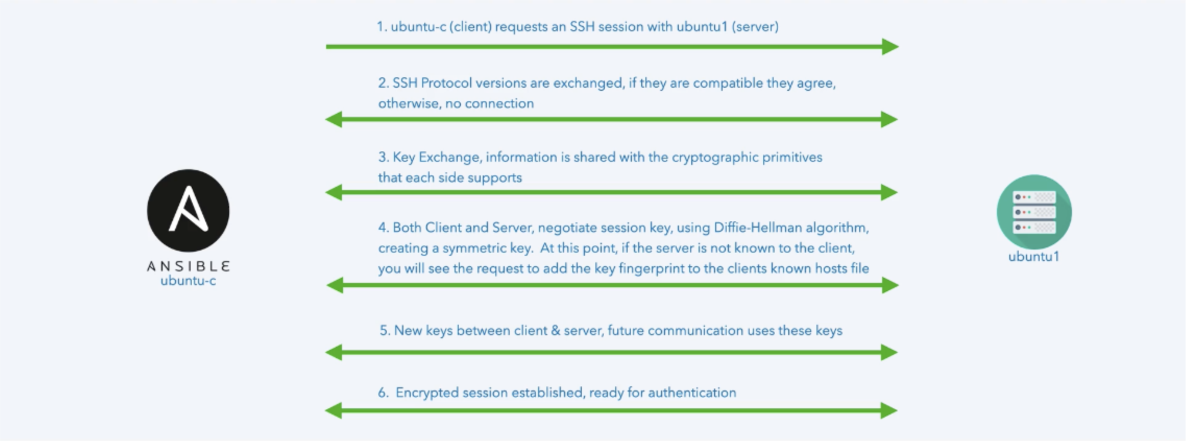
3. Key Exchange, information is shared with the cryptographic primitives that each side supports

4. Both Client and Server, negotiate session key, using Diffie-Hellman algorithm, creating a symmetric key. At this point, if the server is not known to the client, you will see the request to add the key fingerprint to the clients known hosts file

```
ubuntu-c login: ansible
Password:
Welcome to Ubuntu 20.04.3 LTS (GNU/Linux 5.10.104-linuxkit x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/advantage
Last login: Fri Jun 24 08:01:30 UTC 2022 on pts/0
To run a command as administrator (user "root"), use "sudo <command>".
See "man sudo_root" for details.

ansible@ubuntu-c:~$ ssh ubuntu1
The authenticity of host 'ubuntu1 (172.19.0.3)' can't be established.
ECDSA key fingerprint is SHA256:cLX1ONxhgqvVI4kGIBw04MZ6hZx2BCrn4/VWMD4TmNs.
```

```
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added 'ubuntu1,172.19.0.3' (ECDSA) to the list of known hosts.
ansible@ubuntu1's password:
To run a command as administrator (user "root"), use "sudo <command>".
See "man sudo_root" for details.

ansible@ubuntu1:~$
```

SSH Connectivity Overview



1. ubuntu-c (client) requests an SSH session with ubuntu1 (server)

2. SSH Protocol versions are exchanged, if they are compatible they agree, otherwise, no connection

3. Key Exchange, information is shared with the cryptographic primitives that each side supports

4. Both Client and Server, negotiate session key, using Diffie-Hellman algorithm, creating a symmetric key. At this point, if the server is not known to the client, you will see the request to add the key fingerprint to the clients known hosts file

5. New keys between client & server, future communication uses these keys

6. Encrypted session established, ready for authentication

```
ansible@ubuntu-c:~$ ls -a
.  ..  .bash_logout  .bashrc  .cache  .profile  .ssh  .vimrc
ansible@ubuntu-c:~$ cd .ssh/
ansible@ubuntu-c:~/.ssh$ ls
known_hosts
ansible@ubuntu-c:~/.ssh$ cat known_hosts
|1|/wvptH2eEnkcX0kG3VcBLIOQza0=|lkEh2RwnRojcVdXzX7cZ2mRQWx8= ecdsa-sha2-nistp256 AAAAE2VjZHNhLXNoYTItbmlzdHAyNTYAAAAIbmlzdHAyNTYAAABBB
|1|M9N+4etrWXxkES5dMOaYwL31ovI=|MEb5WP6H5Mhjn3Heo9YuuCAvf90= ecdsa-sha2-nistp256 AAAAE2VjZHNhLXNoYTItbmlzdHAyNTYAAAAIbmlzdHAyNTYAAABBB
ansible@ubuntu-c:~/.ssh$ ssh-keygen -H -F ubuntu1
# Host ubuntu1 found: line 1
|1|/wvptH2eEnkcX0kG3VcBLIOQza0=|lkEh2RwnRojcVdXzX7cZ2mRQWx8= ecdsa-sha2-nistp256 AAAAE2VjZHNhLXNoYTItbmlzdHAyNTYAAAAIbmlzdHAyNTYAAABBB
```

known_hosts 첫번째 라인과 ubuntu1 호스트의 fingerprint 가 일치함을 알 수 있다.

```
ansible@ubuntu-c:~/.ssh$ ping ubuntu1
PING ubuntu1 (172.19.0.3) 56(84) bytes of data.
64 bytes from ubuntu1.diveinto.io (172.19.0.3): icmp_seq=1 ttl=64 time=0.076 ms
64 bytes from ubuntu1.diveinto.io (172.19.0.3): icmp_seq=2 ttl=64 time=0.157 ms
64 bytes from ubuntu1.diveinto.io (172.19.0.3): icmp_seq=3 ttl=64 time=0.099 ms
^C
--- ubuntu1 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2045ms
rtt min/avg/max/mdev = 0.076/0.110/0.157/0.034 ms
```

ubuntu1 호스트의 IP를 알아내기 위해 ping 을 이용한다.

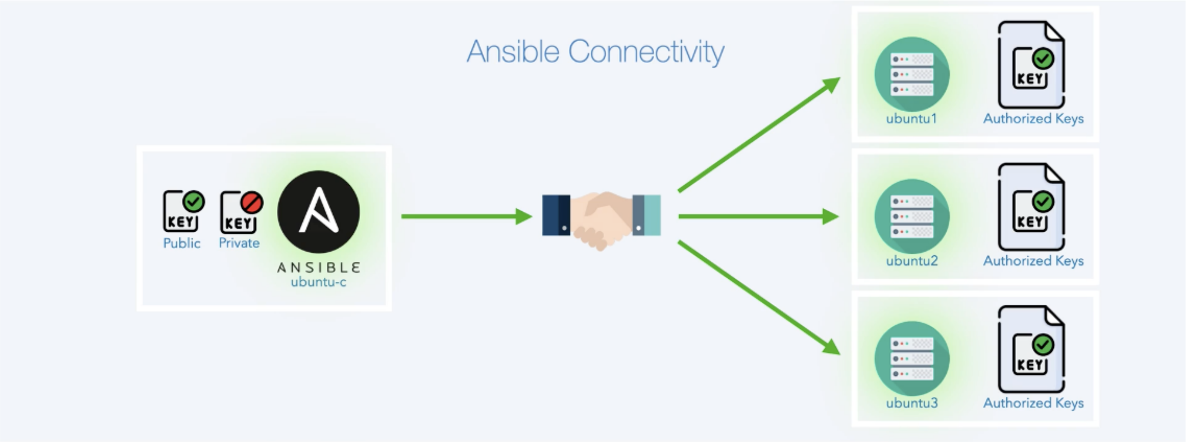
```
ansible@ubuntu-c:~/.ssh$ cat known_hosts
|1|/wvptH2eEnkcX0kG3VcBLIOQza0=|lkEh2RwnRojcVdXzX7cZ2mRQWx8= ecdsa-sha2-nistp256 AAAAE2VjZHNhLXNoYTItbmlzdHAyNTYAAAAIbmlzdHAyNTYAAABBB
|1|M9N+4etrWXxkES5dMOaYwL31ovI=|MEb5WP6H5Mhjn3Heo9YuuCAvf90= ecdsa-sha2-nistp256 AAAAE2VjZHNhLXNoYTItbmlzdHAyNTYAAAAIbmlzdHAyNTYAAABBB
ansible@ubuntu-c:~/.ssh$ ssh-keygen -H -F ubuntu1
# Host ubuntu1 found: line 1
|1|/wvptH2eEnkcX0kG3VcBLIOQza0=|lkEh2RwnRojcVdXzX7cZ2mRQWx8= ecdsa-sha2-nistp256 AAAAE2VjZHNhLXNoYTItbmlzdHAyNTYAAAAIbmlzdHAyNTYAAABBB
ansible@ubuntu-c:~/.ssh$ ping ubunt1
ping: ubunt1: Name or service not known
ansible@ubuntu-c:~/.ssh$ ping ubuntu1
PING ubuntu1 (172.19.0.3) 56(84) bytes of data.
64 bytes from ubuntu1.diveinto.io (172.19.0.3): icmp_seq=1 ttl=64 time=0.076 ms
64 bytes from ubuntu1.diveinto.io (172.19.0.3): icmp_seq=2 ttl=64 time=0.157 ms
64 bytes from ubuntu1.diveinto.io (172.19.0.3): icmp_seq=3 ttl=64 time=0.099 ms
^C
--- ubuntu1 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2045ms
rtt min/avg/max/mdev = 0.076/0.110/0.157/0.034 ms
```

```
ansible@ubuntu-c:~/.ssh$ ^C
ansible@ubuntu-c:~/.ssh$ ssh-keygen -H -F 172.19.0.3
# Host 172.19.0.3 found: line 2
|1|M9N+4etrWXxkES5dMOaYwL31ovI=|MEb5WP6H5Mhjn3Heo9YuuCAvf90= ecdsa-sha2-nistp256 AAAAE2VjZHNhLXNoYTItbmlzdHAyNTYAAAAIbmlzdHAyNTYAAABBB
ansible@ubuntu-c:~/.ssh$
```

호스트이름이 아닌 IP로 fingerprint를 확인하면 known_hosts의 두 번째 라인과 일치함을 알 수 있다.

known_host 파일을 삭제하면 fingerprint를 재 생성한다.

3-2. 패스워드 없이 ssh 접속



- 녹색키 : public key
- 적색키 : private key
- public key는 모든 호스트가 공유
- private key는 클라이언트만 가지고 있음

```
ubuntu-c login: ansible
Password:
Welcome to Ubuntu 20.04.3 LTS (GNU/Linux 5.10.104-linuxkit x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/advantage
Last login: Fri Jun 24 08:02:20 UTC 2022 on pts/0
To run a command as administrator (user "root"), use "sudo <command>".
See "man sudo_root" for details.

ansible@ubuntu-c:~$ ssh-keygen
Generating public/private rsa key pair.
Enter file in which to save the key (/home/ansible/.ssh/id_rsa): <엔터>
Enter passphrase (empty for no passphrase): <엔터>
Enter same passphrase again: <엔터>
Your identification has been saved in /home/ansible/.ssh/id_rsa
Your public key has been saved in /home/ansible/.ssh/id_rsa.pub
The key fingerprint is:
SHA256:WiWlM7HktWGU4i/rVwjK1/XkrTFG/timByEforpF2Q4 ansible@ubuntu-c
The key's randomart image is:
+---[RSA 3072]----+
|        o.*.     |
|       o.B.o     |
|       .B.o      |
|        o= o+ =  |
|     . .S+E+.X + |
|      ooo.=o. X .|
|      .. +.... O |
|        o..   o =|
|       .oo    .+ |
+----[SHA256]-----+
ansible@ubuntu-c:~$
```

public key와 private key 확인

- public key : id_rsa.pub
- private key : id_rsa

```
ansible@ubuntu-c:~$ cat .ssh/id_rsa.pub
ssh-rsa AAAAB3NzaC1yc2EAAAADAQABAAABgQDiVxSFb3KyKZ7koWKcupeTmeredUtvZrLwf0Y9OCRk6Ka7sSkMunWgwhZuQZj0QziDSVkip8V1CNDU49+ia5bDUWLnhmPiGU
ansible@ubuntu-c:~$ cat .ssh/id_rsa
-----BEGIN OPENSSH PRIVATE KEY-----
b3BlbnNzaC1rZXktdjEAAAAABG5vbmUAAAAEbm9uZQAAAAAAAAABAAABlwAAAAdzc2gtcn
NhAAAAAwEAAQAAAYEA4lcUhW9ysime5KFinLqXk5nq3nVLb2ay8H9GPTgkZOimu7EpDLp1
oMIWbkGY9EM4g0lZIqfFdQjQ1OPfomuWw1Fi54Zj4hlAkRgq/pBZcU01IrEdKvkbV2nT7M
hmExCAJ9Lnr0mR0FrgmNb1c49BgA/EeuCJxeDx4CFA0QlMyCqCxrErkofZaRXNgtYj7MX9
/7+u2XXLlyOqnQtMts1rqRTk9KwrGxpPDrBgY3OT5C/TgyEY1DWIDG5h18AB7seh3jen4s
sMq2/NWvGPTxeTvBWv01X7SC0kNxyx4Ll7/bjmn1JjYlSFRDS3T2fek90QcfyDLbfAghqV
vMy4gT78qvEYFiOnlK1IyTE4lMCZG4teBaRAzfFyYdDr5VD9chfp+POkt+wb4//X1kdQeC
fr7Fq/gfT99c6VzRp2EcZlDLrFyLFGSZmKkXft18LktuycC4xSHrYc+UTKJfp9WhgKNrLv
T3oEoW1UW5J1stlwEjRrk0pokJcegqaqs+P5Q9ibAAAFiJK3JKOStySjAAAAB3NzaC1yc2
EAAAGBAOJXFIVvcrIpnuShYpy6l5OZ6t51S29msvB/Rj04JGToprUxKQy6daDCFm5BmPRD
OINJWSKnxXUI0NTj36JrlsNRYueGY+IZQJEYKv6QWXFNNSKxHSr5G1dp0+zIZhMQgCfS56
9JkdBa4JjW9XOPQYAPxHrgicXg8eAhQNEJTMgqgsaxK5KH2WkVzYLWI+zF/f+/rtl1y5cj
qp0LTLbNa6kU5PSsKxsaTw6wYGNzk+Qv04MhGNQ1iAxuYdfAAe7Hod43p+LLDKtvzVrxj0
8Xk7wVr9NV+0gtJDccseC5e/245p9SY2JUhUQ0t09n3pPdEHH8gy23wIIalbzMuIE+/Krx
GBYjp5StSMkxOJTAmRuLXgWkQM3xcmHQ6+VQ/XIX6fjzpLfsG+P/19ZHUHgn6+xav4H0/f
XOlc0adhHGZQy6xcixRkmZipF37dfC5LbsnAuMUh62HPlEyiX6fVoYCjay7096BKFtVFuS
dbLZcBI0a5NKaJCXHoKmqrPj+UPYmwAAAAMBAAEAAAGAS1uq3XJpwZ/R41VIO950MRSB+m
cbIpAS67e0bxWOKHq9aKhnfnFmUIvOZA87Gbh3zF5TaxJoz7qLrRXhk3Y2z/j88RDxmInH
0Yc2aWMuJGcMVeyaRYCC9euqP5/JPHe184xozxezkKdxN/H57uu3ZyfYxwCTXmqynWj056
QtCEf/GqBKXZMVc8NqlTEu7NpO4yOy13w8uKmLWJY2iHaEbdsjD8Ny5qcvwzg+H16P0t2J
kpMmbSEVlu35bZfkDNgyEC0dr8+fv4XXSOD+Z0aEHvCUt2x5vjL95n6vpXFlLqXJlmG102
Q5wiwiQtkZIMJbAPjc+I8BQK8ohNHCy3LZGuJMlhR5Dhj8AXhEBCSDDIEg7jPFw2lQpQ36
tosDAvDjrxAKAalKBZdg1/iapSjY1g0c60MUJ43VZ0N8iFJWgwNUMcRnt5ad8+gAeIpd4N
w9s/X92G5q/lSeGEJeCSYQ8CdKLR94bcb5qoCNZ3cYBGCK6SJWeVbmDvX/UBZM5CZBAAAA
wB++GkYxu7xGhCEfSHzmSIp0ocomC5tIsICzBYn5Jh17tLMphayGHUNktHh299VEMr1PwN
s8sp0T+vJkaOqM5lNXlHhyV3JIydo3odqHxRi0r61o3ofsnb3eZLJGfq1Sbnv5NNx3WmIG
yXRcRmGk07/5YLoAWxysc+95rEOn9G/1qZDTX+AF+8FBxajZ3qMQgyYnV7Y/ND21+a8H++
f1aNzpDF452mmZ4kRoYGnHAWxuFJdV7CXK4hM+yGLWJSlYDQAAAMEA91wkiqKuwAa0J7b9
hYWUd/XrgW0mDBUFdMR71iThDUL151b/NGwa1YTNp9HM1lEJG4LR9zkCq90KAhPzF0sFMH
GBL03DKTLPSIODwlF1lSX4jSKYPeRekPzdMjhwhwdoUv82aq6pEQnjwl0FLHtfdHOf48dm
rjta7ZecIQrBZ8Jyj9MjFKjaZp1ygNUN6RLbDf/U7t+dukItkpwASoXQ61ZL36MsvWVS3m
j2BqMS9ULvs6Er6kvb+2Rbyr23TMezAAAAwQDqPvtI++4Mwjs9LK/RraVJCx844dOnmdT3
+l/ClBrqUzWz9E1z2wcB+fZWZ+QabSbh23hpXeqoerpInA4L4xzQYt/3Y6EXx4IP22Xtya
zUG+9bcuxKmznZAp031si69oYPaJGSnCfkEtVYvmJpPtnqMzVLfQyegxM0cWVes6zHoRez
6N3wZVYskSBuUETE0Lad3P+rTlyOd132Jm2IacsH9/KOFuI/XOhdRWA60zU6sKLCLLzdU3
rGYOEqUMOmN3kAAAAQYW5zaWJsZUB1YnVudHUtYwECAw==
-----END OPENSSH PRIVATE KEY-----
ansible@ubuntu-c:~$
```

public key 를 원격서버에 복사 후 패스워드 없이 로그인 시도

```
ansible@ubuntu-c:~$ ssh-copy-id ansible@ubuntu1
/usr/bin/ssh-copy-id: INFO: Source of key(s) to be installed: "/home/ansible/.ssh/id_rsa.pub"
/usr/bin/ssh-copy-id: INFO: attempting to log in with the new key(s), to filter out any that are already installed
/usr/bin/ssh-copy-id: INFO: 1 key(s) remain to be installed -- if you are prompted now it is to install the new keys
ansible@ubuntu1's password:

Number of key(s) added: 1

Now try logging into the machine, with:   "ssh 'ansible@ubuntu1'"
and check to make sure that only the key(s) you wanted were added.

ansible@ubuntu-c:~$ ssh ubuntu1
Last login: Fri Jun 24 08:02:32 2022 from 172.19.0.5
To run a command as administrator (user "root"), use "sudo <command>".
See "man sudo_root" for details.

ansible@ubuntu1:~$
```

3-3. ssh-copy-id 패스워드 입력 자동화 하기

- apt update
- sshpass 설치

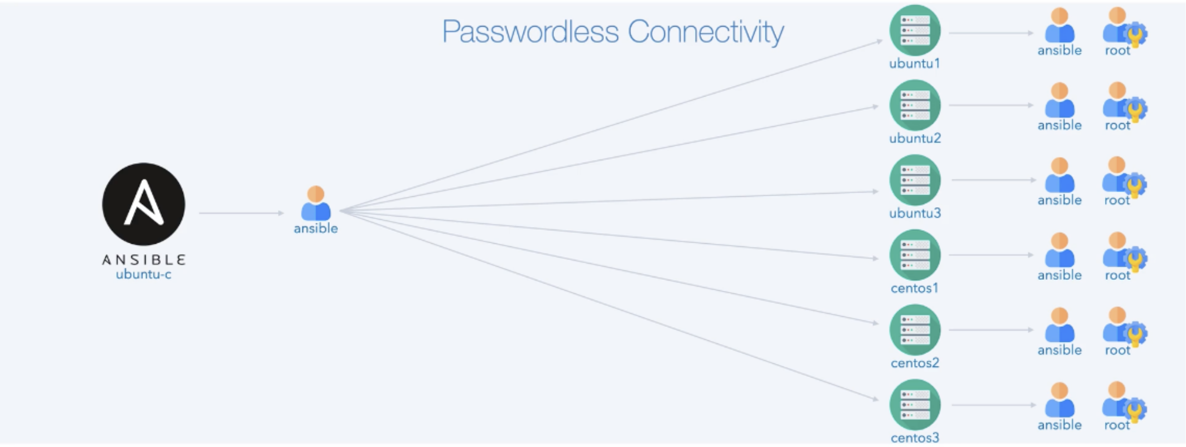
```
ansible@ubuntu-c:~$ sudo apt-get update
ansible@ubuntu-c:~$ sudo apt-get install sshpass
Reading package lists... Done
```

```
Building dependency tree
Reading state information... Done
The following NEW packages will be installed:
  sshpass
0 upgraded, 1 newly installed, 0 to remove and 81 not upgraded.
Need to get 10.5 kB of archives.
After this operation, 30.7 kB of additional disk space will be used.
Get:1 http://archive.ubuntu.com/ubuntu focal/universe amd64 sshpass amd64 1.06-1 [10.5 kB]
Fetched 10.5 kB in 1s (18.9 kB/s)
debconf: delaying package configuration, since apt-utils is not installed
Selecting previously unselected package sshpass.
(Reading database ... 25849 files and directories currently installed.)
Preparing to unpack .../sshpass_1.06-1_amd64.deb ...
Unpacking sshpass (1.06-1) ...
Setting up sshpass (1.06-1) ...
```

ubuntu1, ubuntu2, ubuntu3, centos1, centos2, centos3 에 ssh-copy-id 자동화

```
ansible@ubuntu-c:~$ echo password > password.txt
ansible@ubuntu-c:~$ for user in ansible root
> do
>   for os in ubuntu centos
>   do
>     for instance in 1 2 3
>     do
>       sshpass -f password.txt ssh-copy-id -o StrictHostKeyChecking=no ${user}@${os}${instance}
>     done
>   done
> done
ansible@ubuntu-c:~$ rm password.txt
```

⚠️ StrictHostKeyChecking=no
fingerprint 입력 생략



3-4. ansible 호스트 연결 확인

```
ansible@ubuntu-c:~$ ansible -i ubuntu1,ubuntu2,ubuntu3,centos1,centos2,centos3 all -m ping
ubuntu2 | SUCCESS => {
    "ansible_facts": {
        "discovered_interpreter_python": "/usr/bin/python3"
    },
    "changed": false,
    "ping": "pong"
}
ubuntu1 | SUCCESS => {
    "ansible_facts": {
        "discovered_interpreter_python": "/usr/bin/python3"
    },
    "changed": false,
    "ping": "pong"
}
ubuntu3 | SUCCESS => {
    "ansible_facts": {
        "discovered_interpreter_python": "/usr/bin/python3"
    },
    "changed": false,
    "ping": "pong"
}
centos2 | SUCCESS => {
    "ansible_facts": {
        "discovered_interpreter_python": "/usr/libexec/platform-python"
    },
    "changed": false,
    "ping": "pong"
}
centos1 | SUCCESS => {
    "ansible_facts": {
        "discovered_interpreter_python": "/usr/libexec/platform-python"
    },
    "changed": false,
    "ping": "pong"
}
centos3 | SUCCESS => {
    "ansible_facts": {
        "discovered_interpreter_python": "/usr/libexec/platform-python"
    },
    "changed": false,
    "ping": "pong"
}
ansible@ubuntu-c:~$
```

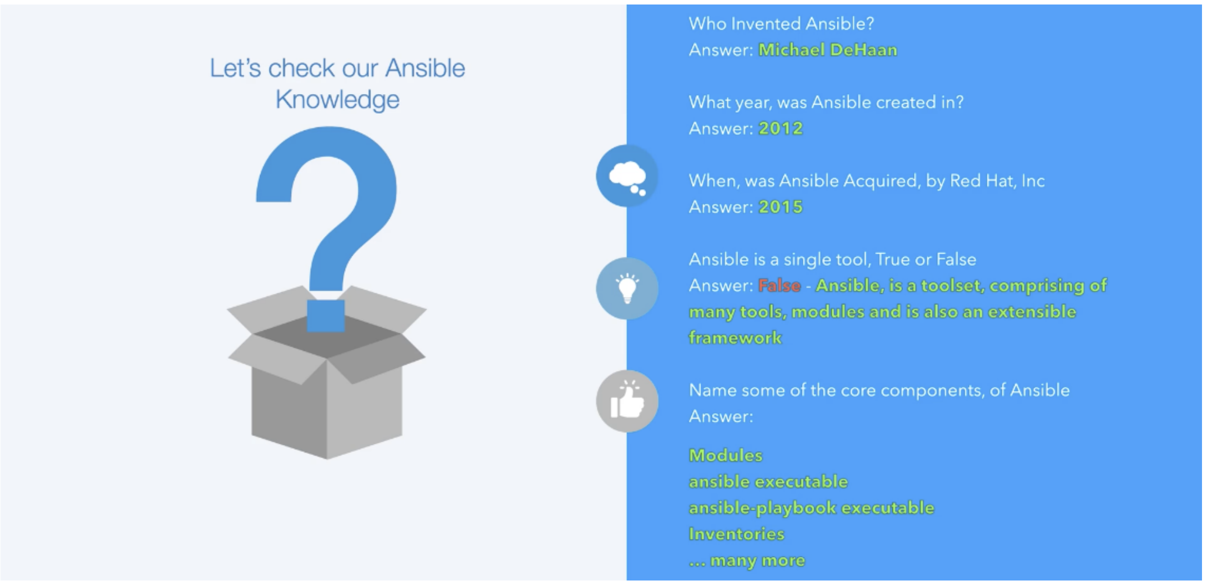
- -i : inventory
- ubuntu1~centos3 : host
- all : host의 그룹명
- -m : module
- ping : module 명

4. Setting Up the Course Repository

https://github.com/spurin/diveintoansible

```
ansible@ubuntu-c:~$ git clone https://github.com/spurin/diveintoansible.git
Cloning into 'diveintoansible'...
remote: Enumerating objects: 644, done.
remote: Counting objects: 100% (195/195), done.
remote: Compressing objects: 100% (80/80), done.
remote: Total 644 (delta 171), reused 115 (delta 115), pack-reused 449
Receiving objects: 100% (644/644), 1.95 MiB | 1.76 MiB/s, done.
Resolving deltas: 100% (330/330), done.
Updating files: 100% (1465/1465), done.
ansible@ubuntu-c:~$ cd diveintoansible/
ansible@ubuntu-c:~/diveintoansible$ ls
'Ansible Architecture and Design'  'Ansible Playbooks, Introduction'   DiveIntoAnsible_Cover.png  'Structuring Ansible Playbooks'
'Ansible Playbooks, Deep Dive'     'Creating Modules and Plugins'      README.md                  'Using Ansible with Cloud Services a
ansible@ubuntu-c:~/diveintoansible$
```

5. Section 1 and 2 Quiz



Let's check our Ansible Knowledge

Who Invented Ansible?
Answer: Michael DeHaan

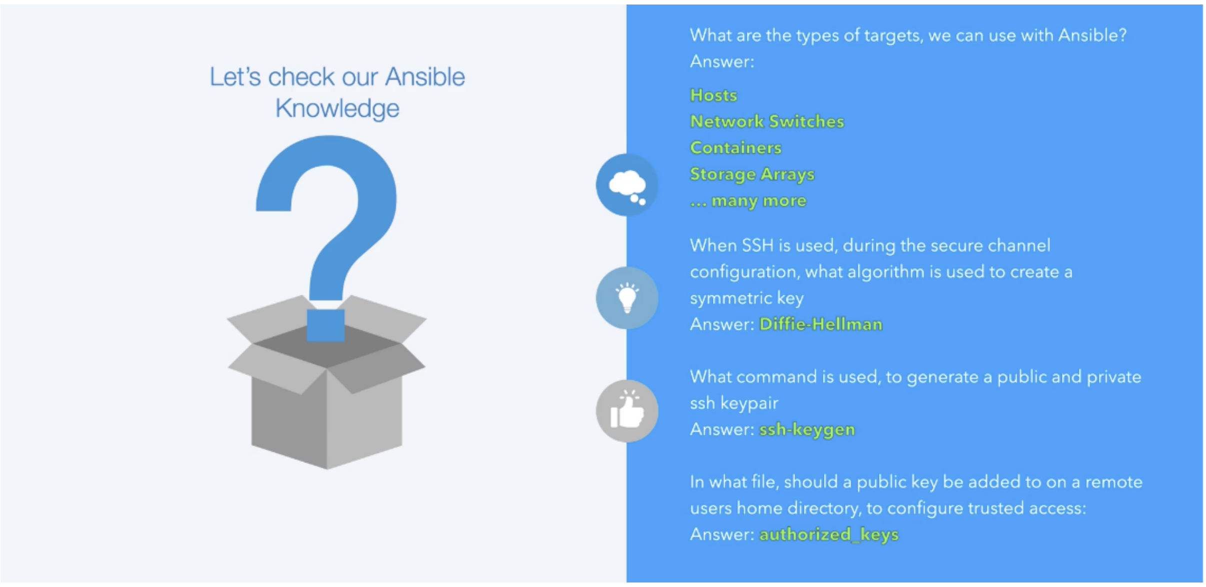
What year, was Ansible created in?
Answer: 2012

When, was Ansible Acquired, by Red Hat, Inc
Answer: 2015

Ansible is a single tool, True or False
Answer: False - Ansible, is a toolset, comprising of many tools, modules and is also an extensible framework

Name some of the core components, of Ansible
Answer:

Modules
ansible executable
ansible-playbook executable
Inventories
... many more



Let's check our Ansible Knowledge

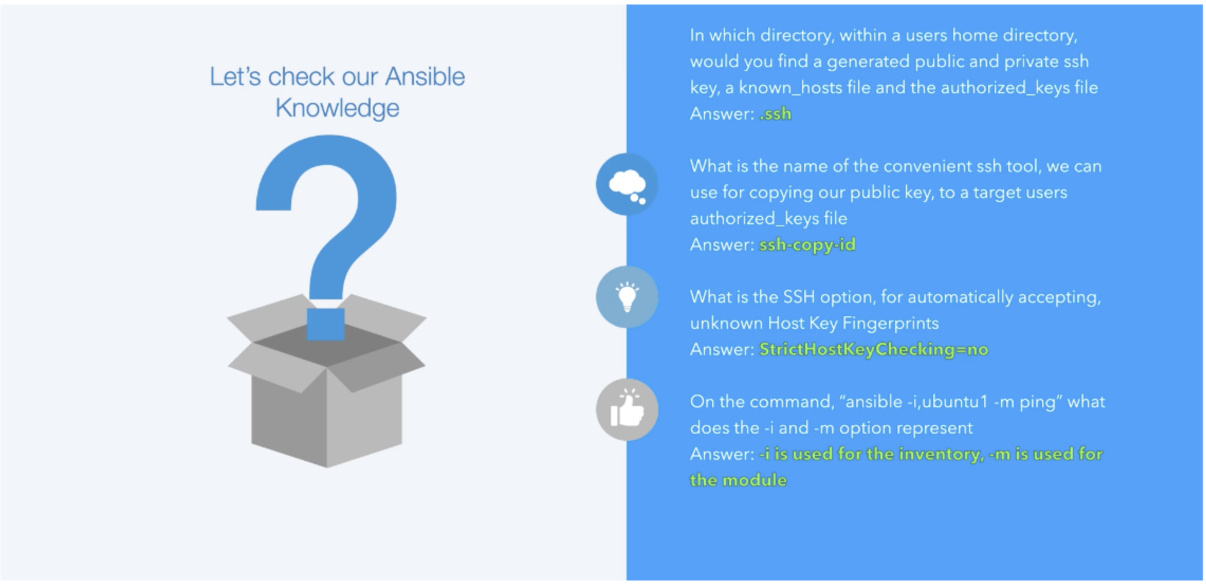
What are the types of targets, we can use with Ansible?
Answer:

Hosts
Network Switches
Containers
Storage Arrays
... many more

When SSH is used, during the secure channel configuration, what algorithm is used to create a symmetric key
Answer: Diffie-Hellman

What command is used, to generate a public and private ssh keypair
Answer: ssh-keygen

In what file, should a public key be added to on a remote users home directory, to configure trusted access:
Answer: authorized_keys



Let's check our Ansible Knowledge

In which directory, within a users home directory, would you find a generated public and private ssh key, a known_hosts file and the authorized_keys file
Answer: .ssh

What is the name of the convenient ssh tool, we can use for copying our public key, to a target users authorized_keys file
Answer: ssh-copy-id

What is the SSH option, for automatically accepting, unknown Host Key Fingerprints
Answer: StrictHostKeyChecking=no

On the command, "ansible -i,ubuntu1 -m ping" what does the -i and -m option represent
Answer: -i is used for the inventory, -m is used for the module