How to Install Docker on the Linux Server?

written by sysadmin | 10 February 2025

A Docker is a platform for developing, shipping, and running container applications. Docker is like installing a virtual machine application on your laptop or server, whether it's VirtualBox, VMWare, or Xen, so you can test various operating systems or applications on it without putting your laptop or server in danger.

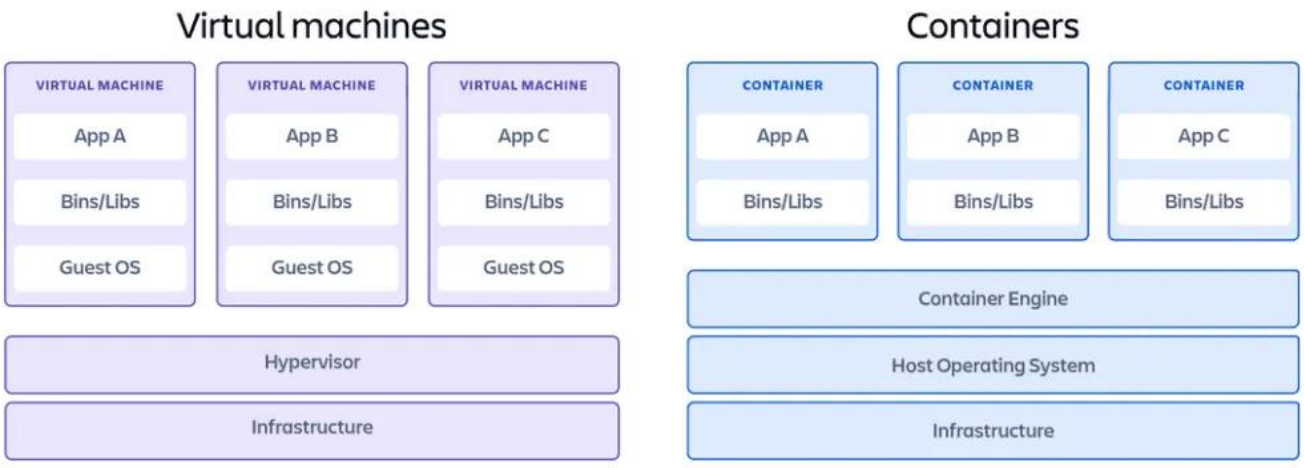
Problem

How to install Docker on the Linux server?

Solution

A. Docker summary

The key differentiator between containers and virtual machines is that virtual machines virtualize an entire machine down to the hardware layers, and containers only virtualize software layers above the operating system level. Take a look at the image below to make the difference between virtual machines and Docker clearer:



Comparison of Docker and Virtual Machine Architecture (image credit from atlassian.com)

The table below shows the comparison between virtual machines and Docker:

Comparison Item	Docker Container	VM
Isolation level	Low	High
Time required for startup	Seconds	Minutes
Image size	Several megabytes	Hundreds of megabytes to several gigabytes
Running performance (compared with bare metal servers)	Performance loss: < 2%	Performance loss: about 15%
Image portability	Not related to the platform	Related to the platform
Density	100 to 1000 on a single machine	10 to 100 on a single machine
Security	1. When the privilege of a user in a container is escalated from a common user to the **root** user, the user gains root permissions of the host machine. 2. Hardware isolation is not implemented, so containers are vulnerable to attacks.	1. The root permissions of a VM tenant are isolated from those of the host machine. 2. Hardware isolation is implemented to prevent VM escape and data exchange.

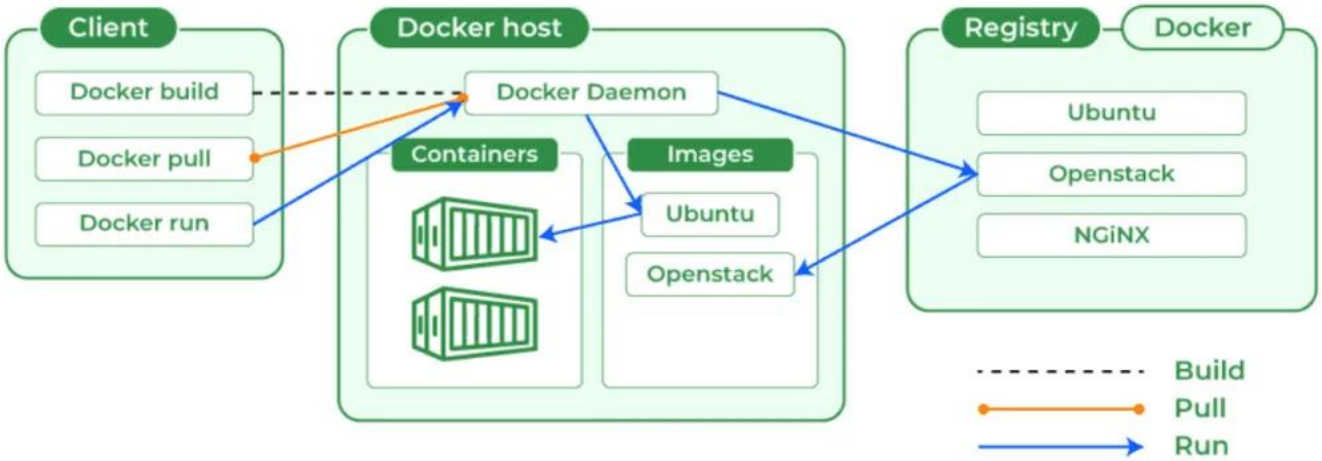
Comparison between Docker and virtual machine (Image credit from huawei.com)

Below is a brief explanation of the terms in Docker:

- □□□□□□ □□□□: Downloads images from Docker Hub if not locally available
- □□□□□□ □□□□□: Creates a local image using a Dockerfile, enabling custom images
- □□□□□□ □□□□:Uploads images to Docker Hub, allowing sharing
- □□□□□□ □□□: Takes an image to run a container, useful for starting web servers or other applications
- □□□□□□ □□□□□: Read-only templates forming the base of containers, including all application dependencies
- □□□□□□ □□□□□□: Interacts with Docker, sending instructions to the Docker daemon to execute tasks
- □□□□□□ **Daemon**: Handles all requests, including building, running, and distributing containers
- □□□□□□ □□□□□□□□□□: Include everything needed to run an application, such as code, libraries, and configurations

- □□□□□□ □□□□□□□□: Stores Docker images, with Docker Hub as a public registry and the option to create private ones

The image below is a picture of how the Docker works:



How Docker works (Image credit from geeksforgeeks.org)

B. Install Docker

In general, use the command below to install Docker on Linux:

```
curl -fsSL https://get.docker.com -o get-docker.sh
sh get-docker.sh
```

But after you execute the commands above, there is an error like this when you install it in RockyLinux:

```
ERROR: Unsupported distribution ‘rocky’
```

You have to install Docker manually using these commands:

```
sudo dnf config-manager --add-repo
https://download.docker.com/linux/rhel/docker-ce.repo
sudo dnf -y install docker-ce docker-ce-cli containerd.io docker-buildx-
plugin docker-compose-plugin
```

Or when you install Docker in OpenSUSE, you get an error like this:

ERROR: Unsupported distribution ‘opensuse-leap’

Use the commands below to install Docker in OpenSUSE:

```
sudo zypper install -y docker docker-compose docker-compose-switch
```

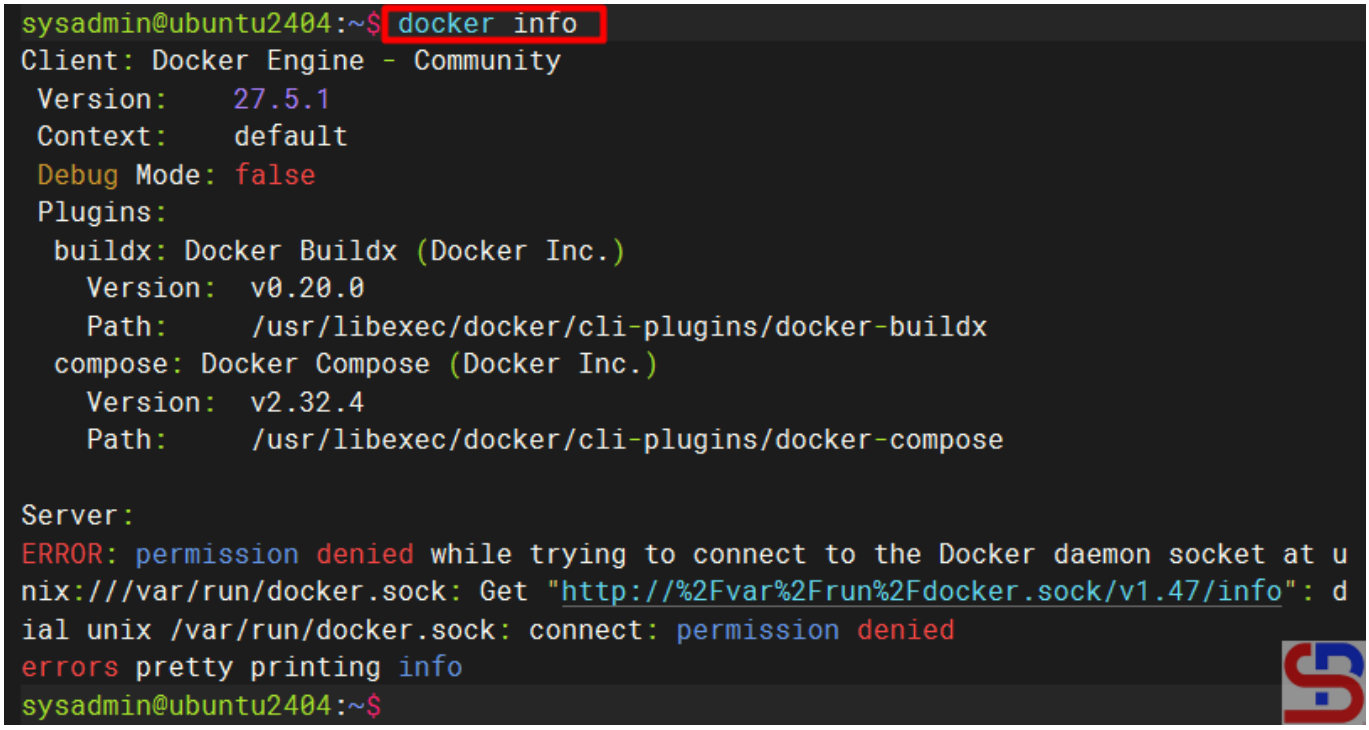
C. After installing Docker

Use the following command to run Docker:

```
sudo systemctl restart docker
sudo systemctl enable docker
```

To see the version of Docker you installed, use the command below:

```
docker info
```



Running the docker info command

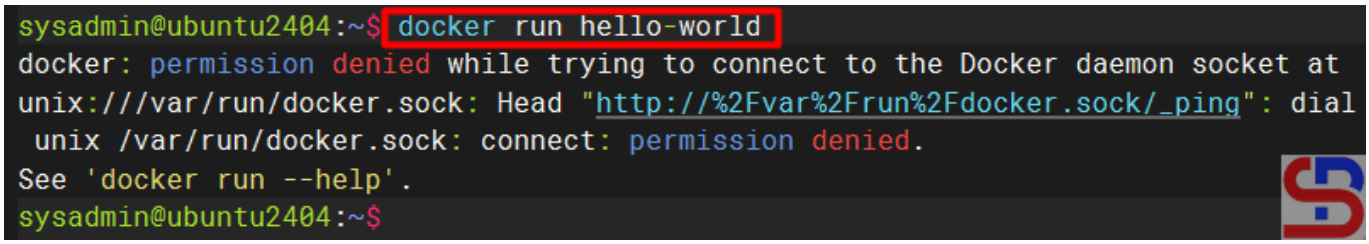
D. Test the application in Docker

After that, to see whether Docker is running well on the server, use the command below to run the hello-world

container on your server:

```
docker run hello-world
```

If you have got the error like the image below:



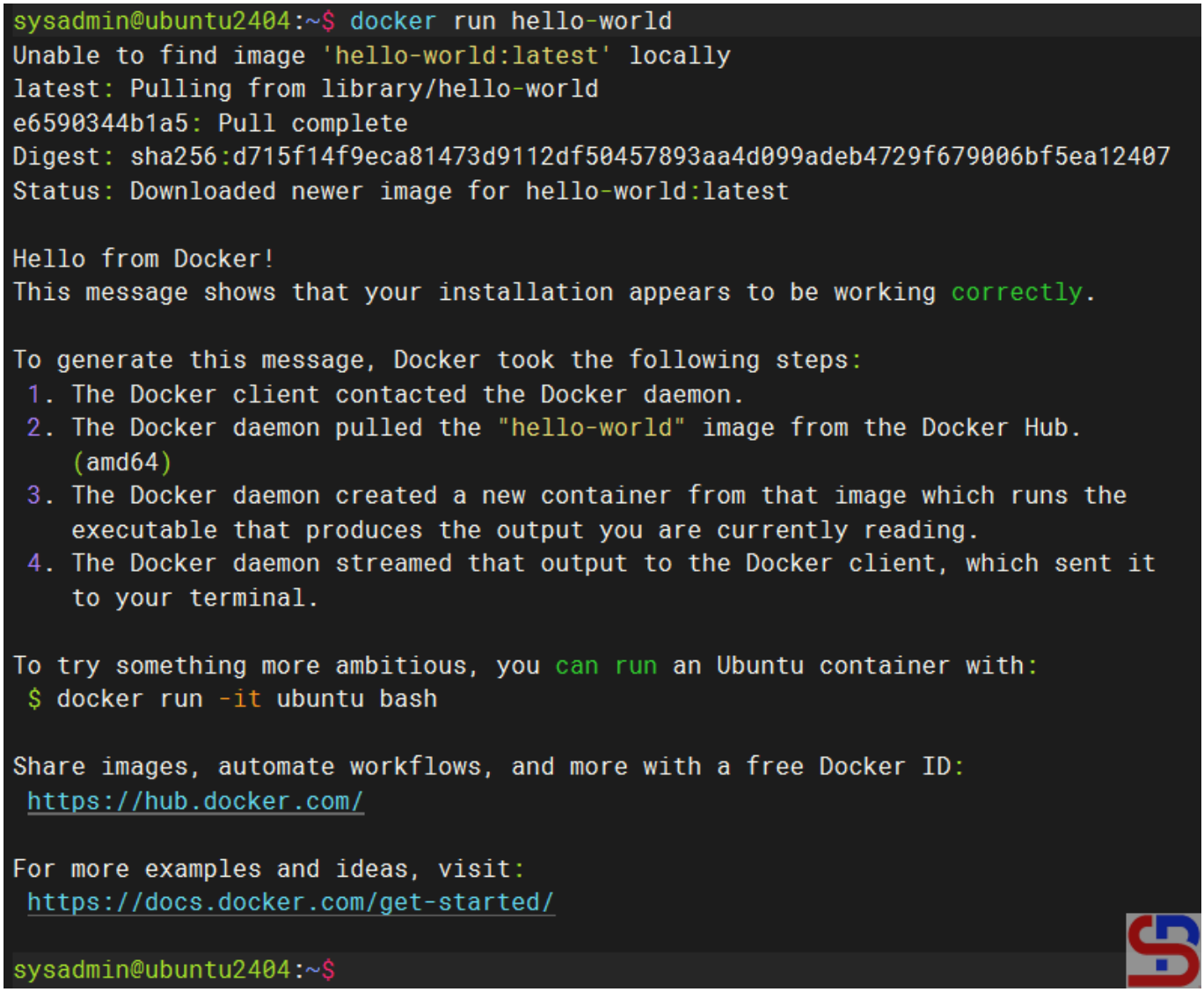
Error when running the docker run command

ERROR: permission denied while trying to connect to the Docker daemon socket at unix:///var/run/docker.sock: Get “http://%2Fvar%2Frun%2Fdocker.sock/v1.47/info”: dial unix /var/run/docker.sock: connect: permission denied

Then you have to run the following command:

```
sudo usermod -aG docker $USER
```

Log out of your server and log in again. After that, you should be able to run the Docker commands like in the image below:



Test the Docker run command

That way, your Docker application is ready to use.

Note

You don’t have to use Docker to create and run containers, but you can use other applications such as podman, buildah, cri-o, etc. However, Docker is the most popular at the moment. Also, the terms and workings of various container applications are almost the same, so if you understand the terms and workings of Docker, then you will also understand the terms and workings of other container applications. To learn about basic commands in Docker, go to this page.

References

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How to Display Server Memory Percentage on Linux?

written by sysadmin | 10 February 2025

In general, sysadmins will use the **free -m** command to see how much server memory is on the Linux server and how much is used. However, I want to display the server memory percentage on my Linux.

Problem

How to display server memory percentage on Linux?

Solution

If you run **free -m** on your Linux server, you will see something like this in the image below:

```
sysadmin@ubuntu2404:~$ free -m
               total        used        free      shared  buff/cache   available
Mem:            3916         789         682           6        2699        3127
Swap:            511           0         511
sysadmin@ubuntu2404:~$
```

Display of RAM condition

a. Display the memory used

Use the command below to display the memory used in percent form:

```
free -m | grep Mem | awk '{print $3/$2 * 100.0}' | sed 's/$/%/'
```

```
sysadmin@ubuntu2404:~$ free -m | grep Mem | awk '{print $3/$2 * 100.0}' | sed 's/$/%/'
19.8927%
sysadmin@ubuntu2404:~$
```

Used memory in percentage

b. Display available free memory

Use the command below to display available free memory in percent form:

```
free -m | grep Mem | awk '{print $4/$2 * 100.0}' | sed 's/$/%/'
```

```
sysadmin@ubuntu2404:~$ free -m | grep Mem | awk '{print $4/$2 * 100.0}' | sed 's/$/%/'
17.3136%
sysadmin@ubuntu2404:~$
```

Free memory in percentage

c. Display the cache memory

Use the command below to display the cache memory in percent form:

```
free -m | grep Mem | awk '{print $6/$2 * 100.0}' | sed 's/$/%/'
```

```
sysadmin@ubuntu2404:~$ free -m | grep Mem | awk '{print $6/$2 * 100.0}' | sed 's/$/%/'
70.046%
sysadmin@ubuntu2404:~$
```

Cache memory in percentage

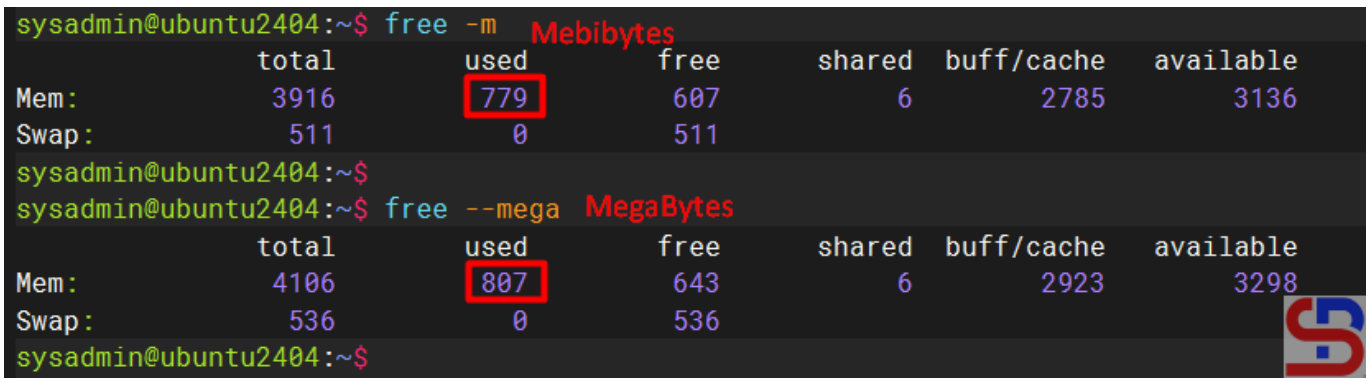
d. Integrate with bash script

If you want the percentage of memory to be put into the bash script for comparison, then the percentage should be changed from a fraction to an integer. Take a look at an example of a bash script below:

```
#!/bin/bash

# Take the percentage of memory usage
mem_usage=$(free -m | grep Mem | awk '{print $3/$2 * 100.0}')
echo Usage Memory: $mem_usage

# Change to integer for comparison
mem_usage_int=${mem_usage%.*}

# Check condition
if [ $mem_usage_int -gt 80 ]; then
    echo "High Memory: ${mem_usage_int}% used"
else
    echo "Low Memory: ${mem_usage_int}% used"
fi
```

Note

Sysadmins, including me, often think that using the **free -m** command will display memory in Megabytes (MB), even though the command will display memory in Mebibytes. To display memory in Megabytes, run the **free –mega** command, where 1 Mebibyte (MiB) is the same as 1,048 Megabytes. Look at the image below to see the difference between Mebibytes and Megabytes:



Difference between Mebibyte and Megabyte

References

stackoverflow.com
baeldung.com
mathda.com

How to Make a Linux User Have the sudo Function?

written by sysadmin | 10 February 2025

SUDO stands for “**SuperUser DO**” and it is a program for Unix-like computer operating systems that enables users to run programs with the security privileges of another user, by default, the superuser. With sudo, a normal user can install or delete an application, change the server network, or even reboot or shut down the server.

Problem

How to make a Linux user have the sudo function?

Solution

This article will explain how to make a Linux user have the sudo function on RockyLinux/AlmaLinux/CentOS, Ubuntu/Debian, and OpenSUSE distros. For example, you want to add the user john to these distros and want that user to be able to use the sudo function. As far as I know, there are two methods to do it:

1. Change the sudoers file

Open the /etc/sudoers file or use the command below:

```
visudo
```

Add to the file the user name as in the image below:

```
## Allow root to run any commands anywhere
root    ALL=(ALL)       ALL
john    ALL=(ALL)       ALL
```

Add the user in the sudoers file

After that, save the file and then try to add a new user using the user john, if there is a display like the image below:

```
[john@RockyLinux9 ~]$ sudo systemctl restart sshd

We trust you have received the usual lecture from the local System
Administrator. It usually boils down to these three things:

    #1) Respect the privacy of others.
    #2) Think before you type.
    #3) With great power comes great responsibility.

[sudo] password for john:
[john@RockyLinux9 ~]$
```

Choose number 1

Then select number **1**, and the user should successfully add a new user as in the image above.

2. Add the user to the sudo group

Add the user to the sudo group, where the name of this sudo group can vary in each distro. To see the name of the sudo group, look in the sudoers file and look for a sentence similar to '**Allows people in group to execute any command**'. For example, in RockyLinux and OpenSUSE, the name of the sudo group is **wheel**, **sudo** in Ubuntu, and don't forget to make sure to uncomment the section as in the image below:

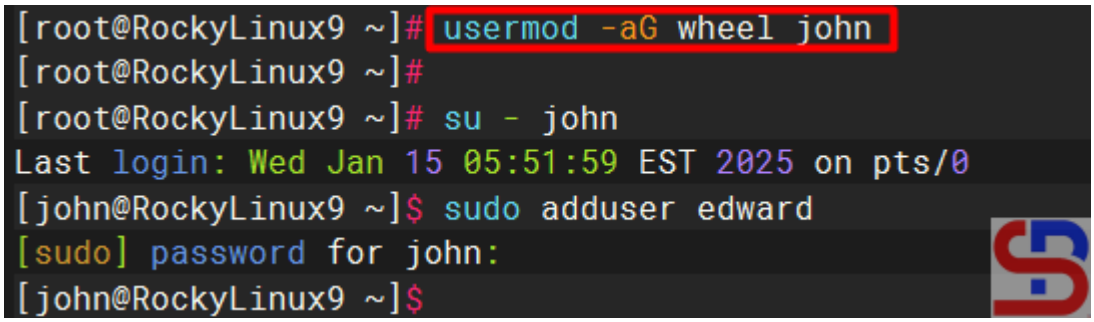
```
## Allows people in group wheel to run all commands
%wheel  ALL=(ALL)       ALL
```

Check the sudo group in the sudoers file

Then type the command below so that a user can use sudo:

RockyLinux & OpenSUSE

```
usermod -aG wheel john
```



Add the user to the sudo group

Ubuntu/Debian

```
usermod -aG sudo john
```

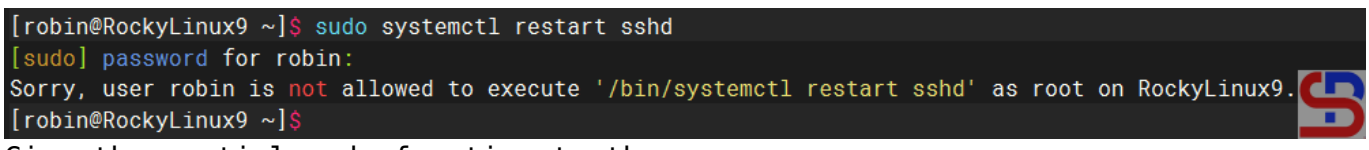
Note

The two methods above can provide the sudo feature to a user on Linux so that the user can run commands that can only be executed by root if the user uses the sudo command by writing down the password. However, if you want the bob user not to have to enter a password when running the sudo command, then in the sudoers file, type the script below:

```
bob             ALL=(ALL)       NOPASSWD: ALL
```

Use the command below if you want the robin user to only be able to perform reboot commands using sudo, but not other commands using sudo:

```
robin           ALL=(ALL)     /usr/sbin/reboot
```



Give the partial sudo function to the user

References

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askubuntu.com
phoenixnap.com
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How to Display the Timestamp in the History Command?

written by sysadmin | 10 February 2025

Displaying the timestamp in the history command is very useful for various purposes. However, in general, Linux systems do not display a timestamp when you run the history command

Problem

How to display the timestamp in the history command?

Solution

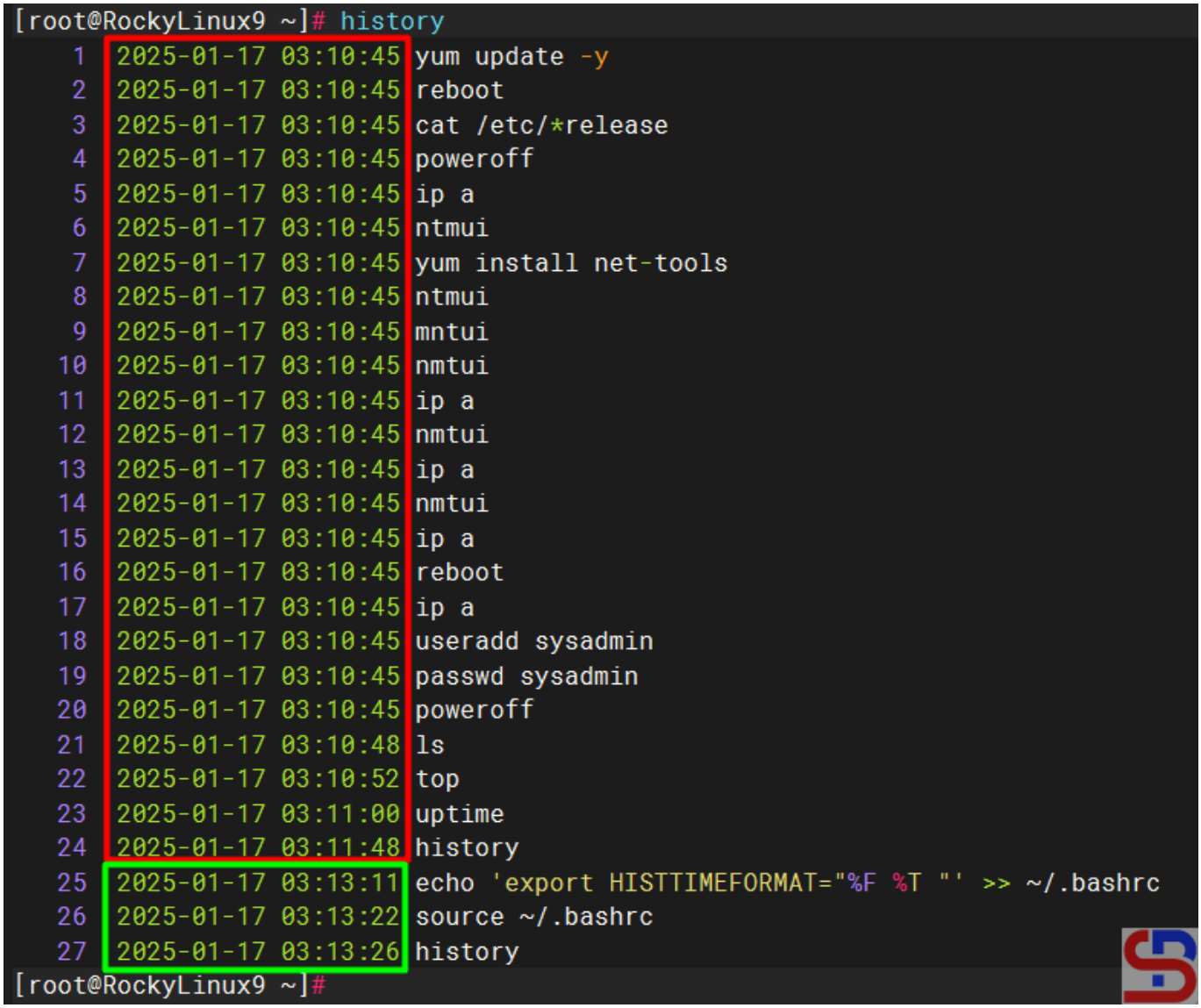
If you type the history command on your Linux server, by default, you will find that there is no timestamp, as in the image below:

```
[root@RockyLinux9 ~]# history
    1  yum update -y
    2  reboot
    3  cat /etc/*release
    4  poweroff
    5  ip a
    6  ntmui
    7  yum install net-tools
    8  ntmui
    9  mntui
   10  nmtui
   11  ip a
   12  nmtui
   13  ip a
   14  nmtui
   15  ip a
   16  reboot
   17  ip a
   18  useradd sysadmin
   19  passwd sysadmin
   20  poweroff
   21  ls
   22  top
   23  uptime
   24  history
[root@RockyLinux9 ~]#
```

The history command

So that your Linux server can display timestamps in the history command, type the command below:

```
echo 'export HISTTIMEFORMAT="%F %T "' >> ~/.bashrc
source ~/.bashrc
```



The history command with a timestamp

The image above shows that the timestamp is already visible when you type the history command. Linux commands executed for a long time will display the same timestamp (look at the image above in the red box). However, if you run another Linux command, the timestamp displayed will be the same as when you executed the Linux command (look at the image above in the green box).

Note

By default, you have to run the commands above on each user to display the timestamps in the history command. But I think it’s very tiring to do that. So, if you want to

display a timestamp in the history command for each Linux user, copy the command below:

```
sudo vi /etc/profile.d/history-timestamp.sh
```

After that, copy the script below into the file:

```
export HISTTIMEFORMAT="%F %T "
```

and then run the below script:

```
sudo chmod 644 /etc/profile.d/history-timestamp.sh
```

The history command in the new user's shell will display timestamps automatically if there is a new user on your Linux server.

References

cyberciti.biz
stackoverflow.com
tecmint.com
linuxhandbook.com

How to Install gcloud on RockyLinux?

written by sysadmin | 10 February 2025

If you use GCP in daily operations, it is recommended to use the commands in the CLI known as gcloud. This is because many commands can only be executed using gcloud rather than using the Console in the browser.

Problem

How to install gcloud on RockyLinux?

Solution

Before you access GCP and run GCP commands through your server, you must first install gcloud on your server.

A. Install gcloud

As far as I know, there are 2 methods to install gcloud on RockyLinux/AlmaLinux/CentOS, and both methods recommend using a user other than root.

1. Using the script

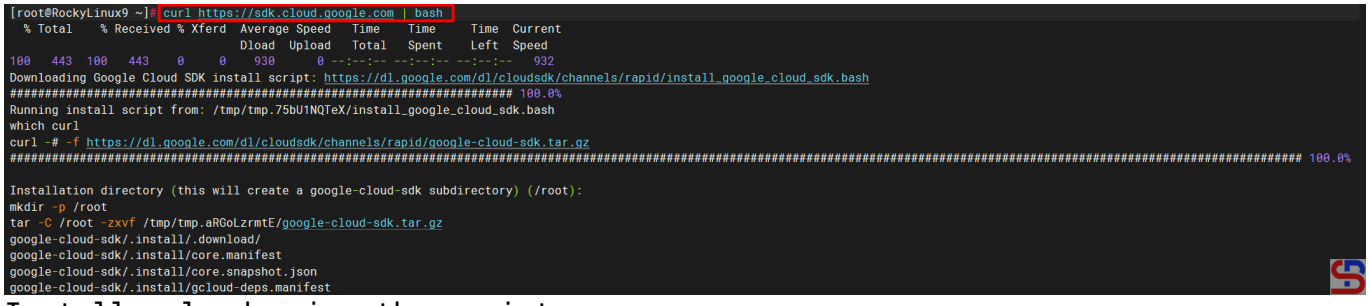
Before you download the script, install the packages using the command below:

```
yum install tar curl
```

Use the command below to download and install the script:

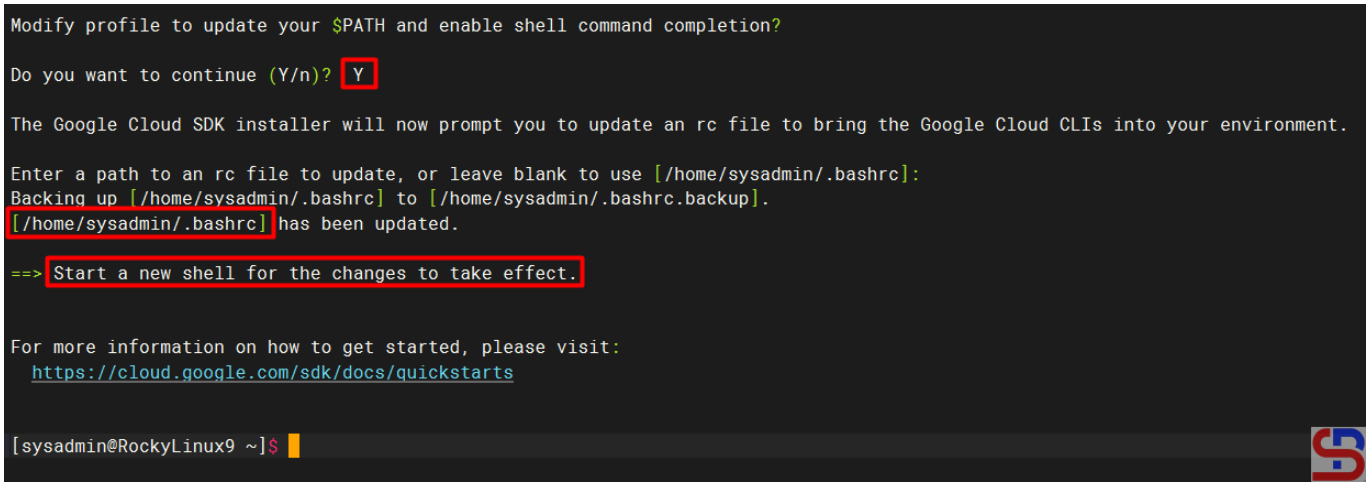
```
curl https://sdk.cloud.google.com | bash
```

Then you will see a display like the one below:



Install gcloud using the script

Wait until it’s finished, and you will see a display like the one below:



Installation complete

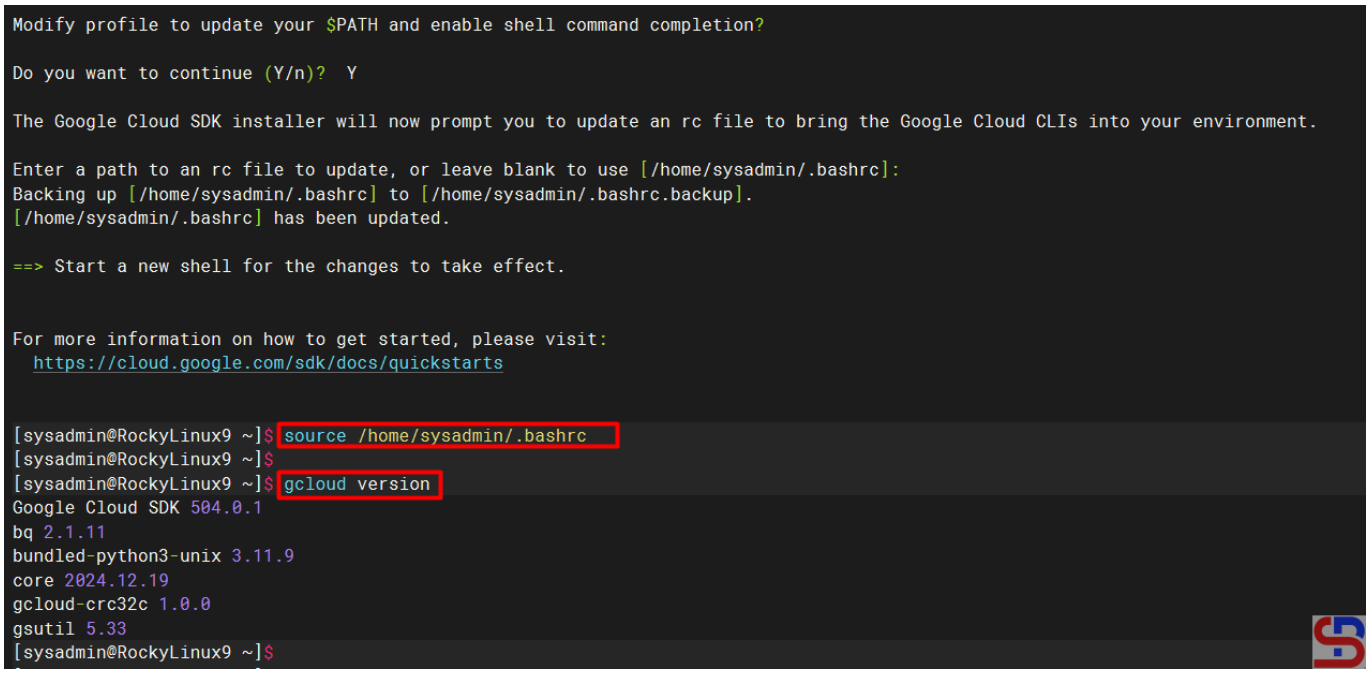
From the image above, you are asked to create a new SSH connection so that the effect can be seen, and type the command below:

```
gcloud version
```

However, you can use the command below:

```
source /home/sysadmin/.bashrc
```

So you don’t need to create a new SSH connection to run the gcloud version command, which results in the image below:



Check the result of the installation

2. Using the Repository

You have to add the Google Cloud SDK repository to your server using the following command:

```
sudo tee -a /etc/yum.repos.d/google-cloud-sdk.repo << EOM
[google-cloud-cli]
name=Google Cloud CLI
baseurl=https://packages.cloud.google.com/yum/repos/cloud-sdk-el9-x86_64
enabled=1
gpgcheck=1
repo_gpgcheck=0
gpgkey=https://packages.cloud.google.com/yum/doc/rpm-package-key.gpg
EOM
```

After that, install gcloud using the command below:

```
yum install google-cloud-sdk
```

After the installation finishes, run the following command to test the gcloud command:

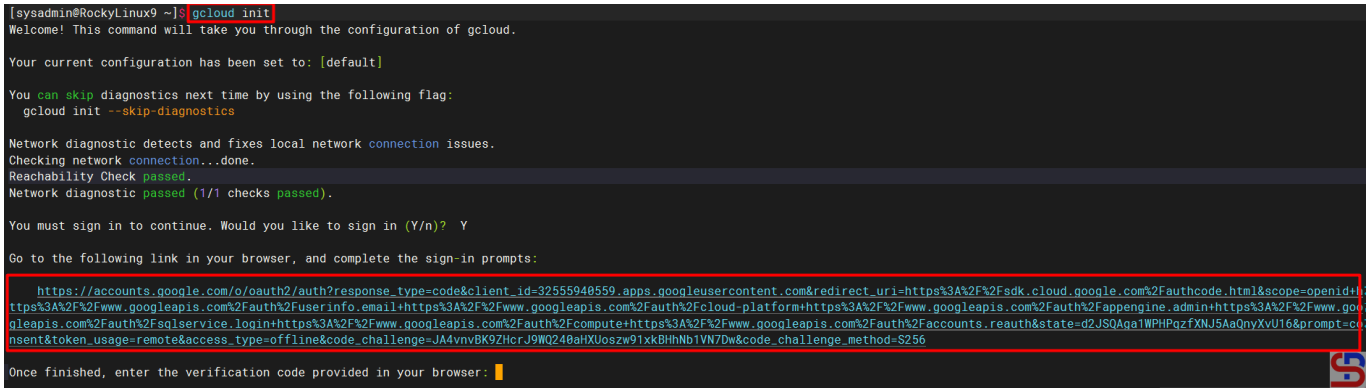
```
gcloud version
```

B. Connect to GCP

After you install gcloud on your server, type the command below:

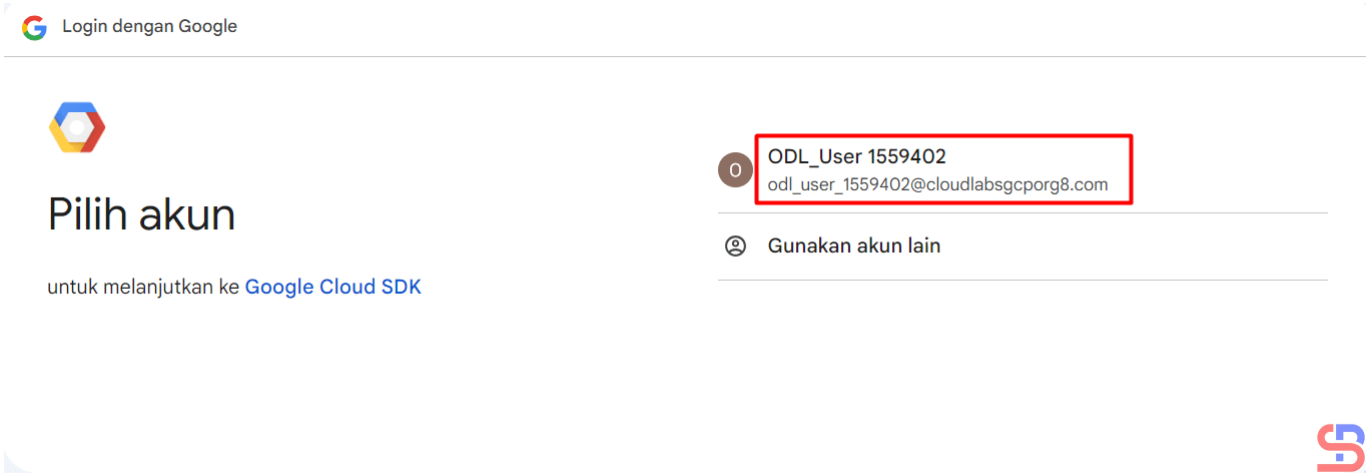
```
gcloud init
```

Then there will be a display like the image below:



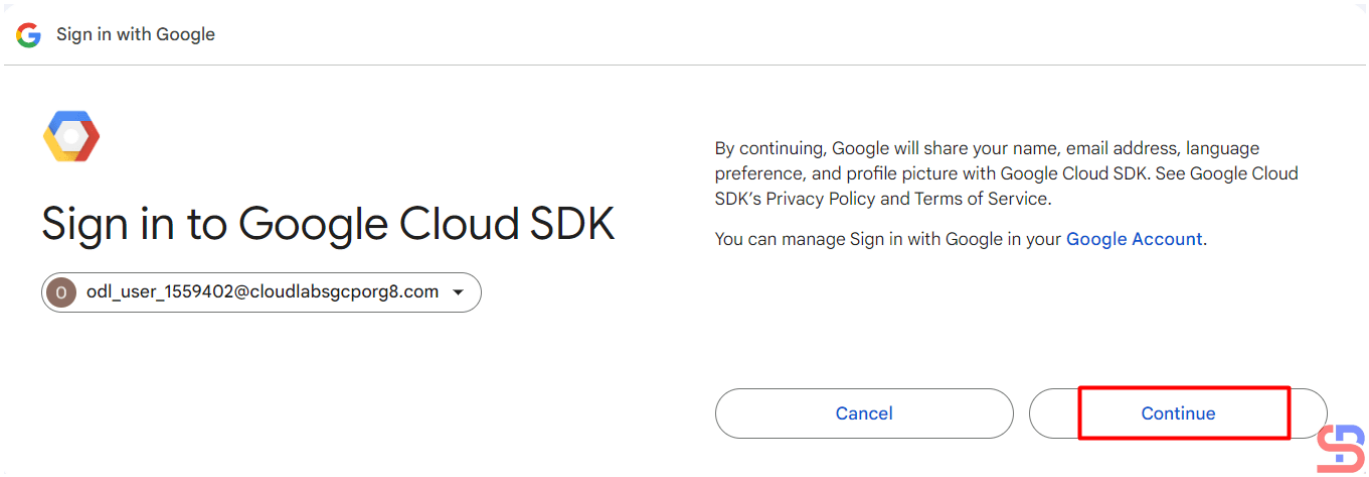
Click the link

Click the **Ctrl+Click** button in the red box to open the link in a browser, or if you have difficulty, copy what is in the red box and place it in your browser so you will see a display like the one below:



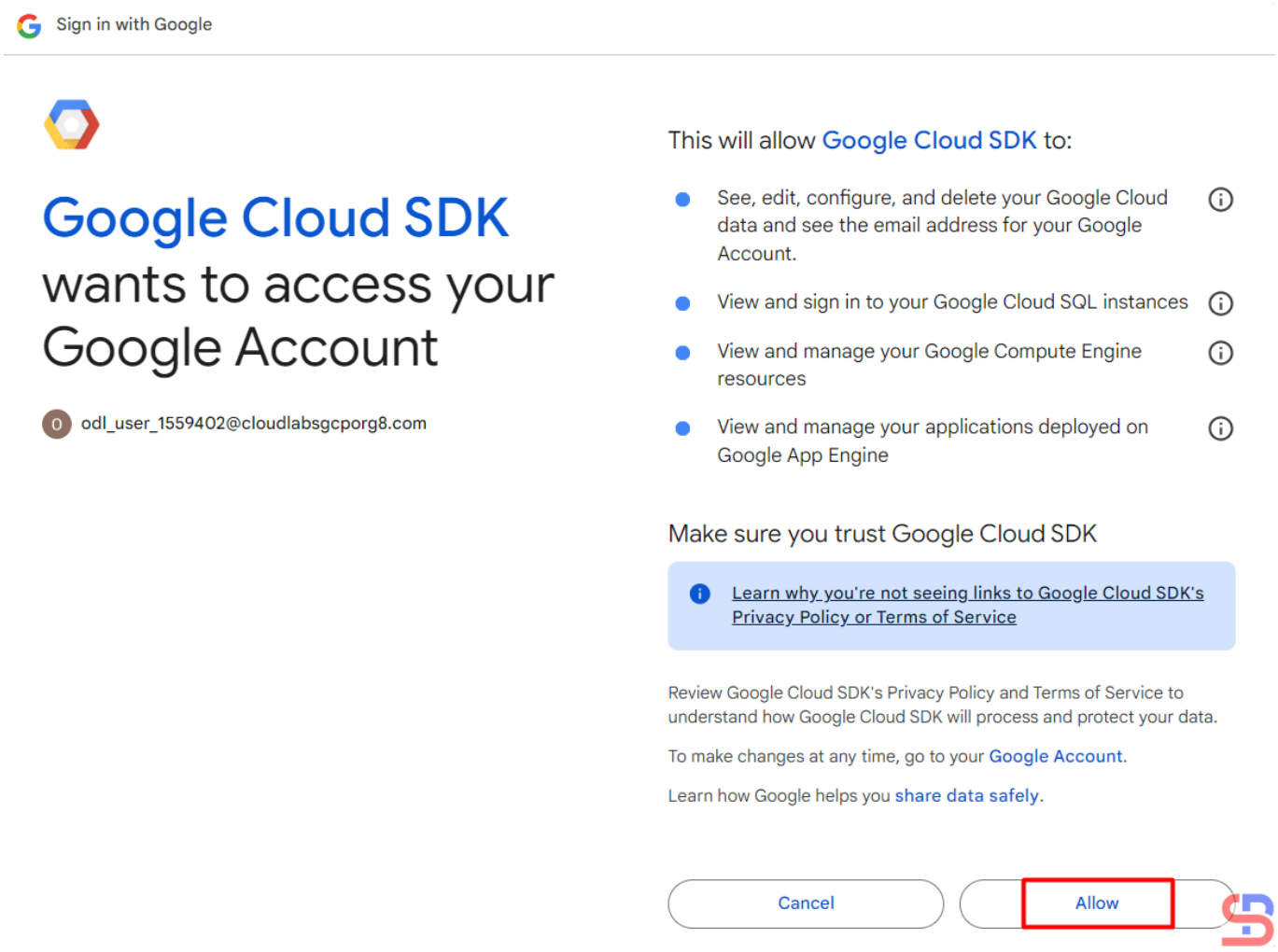
Click the account

Click on the Google account that will access GCP, then there will be a display like the image below:



Click the Continue button

Click the **Continue** button, then the display below will appear:



Click the Allow button

Click the **Allow** button, then the display below will appear:

Sign in to the gcloud CLI

You are seeing this page because you ran the following command in the gcloud CLI from this or another machine. If this is not the case, close this tab.

```
gcloud auth login --no-launch-browser
```

Enter the following verification code in gcloud CLI on the machine you want to log into. This is a credential **similar to your password** and should not be shared with others.

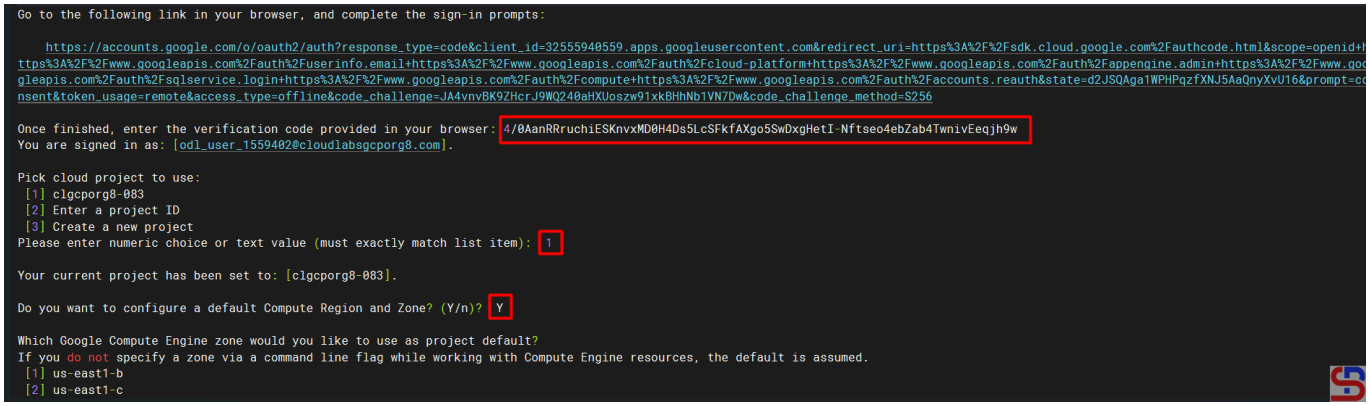
```
4/0AanRRruchiESKnvxMD0H4Ds5LcSFkfAXgo5
SwDxgHetI-Nftseo4ebZab4TwnivEeqjh9w
```

Copy

You can close this tab when you're done.

Click the Copy button

Click the **Copy** button, and paste it into the CLI on your server as in the image below:



Paste the code

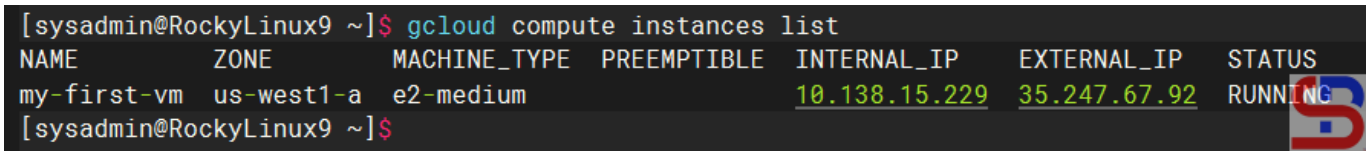
Select the project and configure the zone as in the image above. After that, the gcloud configuration is complete.

C. Test gcloud

Now, try gcloud to access your GCP. I try to list my virtual machine in GCP using the below command:

```
gcloud compute instances list
```

Then the display below will appear:



Display virtual machine in GCP using gcloud

If you get a display like the image above, you have successfully used your gcloud to access your GCP.

Note

If you have many projects on your GCP, you can choose one of these projects as the starting point for your gcloud on GCP. You can switch projects using the command:

```
gcloud config set project PROJECT_ID
```

Change **PROJECT_ID** to the project ID you want to switch to.

References

liquidweb.com
cloud.google.com
bacancytechnology.com

How to Set Up Passwordless SSH Login?

written by sysadmin | 10 February 2025

As a sysadmin, remote to a Linux server is a daily job to perform various checks on a Linux server. By default, if a sysadmin accesses a server, the sysadmin must enter a username and password. However, when the sysadmin has many servers, it is sometimes difficult for the sysadmin to enter the password for each server, especially if each server has a different password. Therefore, it needs to be made so that SSH does not need to enter a password when accessing a Linux server via SSH.

Problem

How to set up passwordless SSH Login?

Solution

There are 3 steps to setting up passwordless SSH:

1. Generate a key pair

Use ssh-keygen to generate a key pair consisting of a public key and a private key on the client computer:

```
ssh-keygen -t rsa
```

The **-t rsa** option specifies that the type of the key should be the RSA algorithm. Hit **Enter** to accept the default.

```
sysadmin@ubuntu2404:~$ ssh-keygen -t rsa
Generating public/private rsa key pair.
Enter file in which to save the key (/home/sysadmin/.ssh/id_rsa): Hit the Enter key
Enter passphrase (empty for no passphrase): Hit the Enter key
Enter same passphrase again: Hit the Enter key
Your identification has been saved in /home/sysadmin/.ssh/id_rsa
Your public key has been saved in /home/sysadmin/.ssh/id_rsa.pub
The key fingerprint is:
SHA256:gq7kX2UI7jdcr7AuArZ8ATu3zWGQON4cP6XIfHJSmKM sysadmin@ubuntu2404
The key's randomart image is:
+---[RSA 3072]----+
|                 |
|                 |
|   . =           |
| + O + o         |
|. X X = S        |
|.E & X = .       |
|o.= & O   .      |
| =.+.= + .       |
|  +o.oo .        |
+----[SHA256]-----+
sysadmin@ubuntu2404:~$
```

Running the ssh-keygen command

2. Upload the public key to the remote server

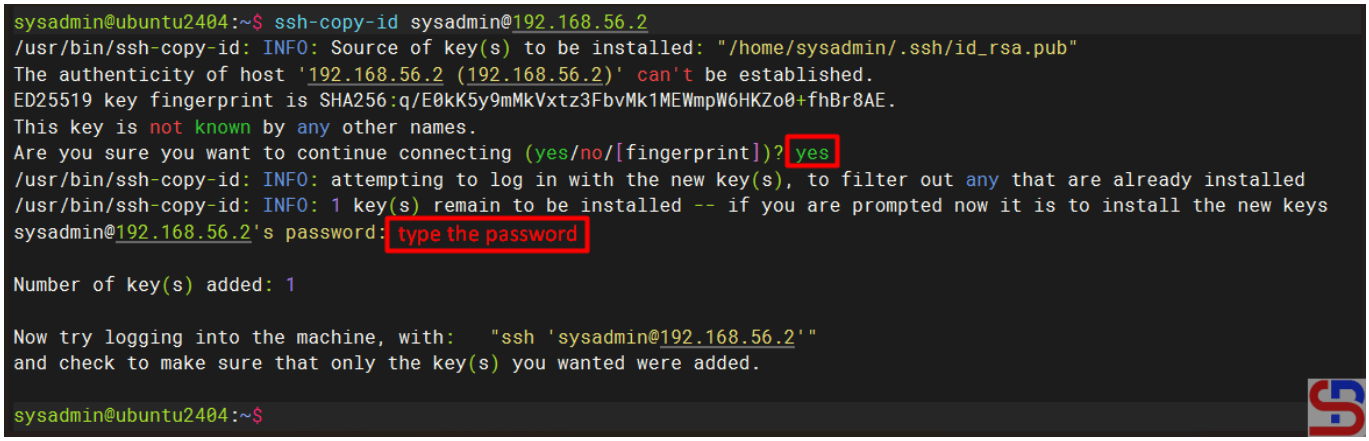
Use **ssh-copy-id** to propagate the public key to the server:

```
ssh-copy-id remote_username@remote_server_ip_address
```

For example, if you want to upload it to the server 192.168.56.2 with the username sysadmin, then use the command below:

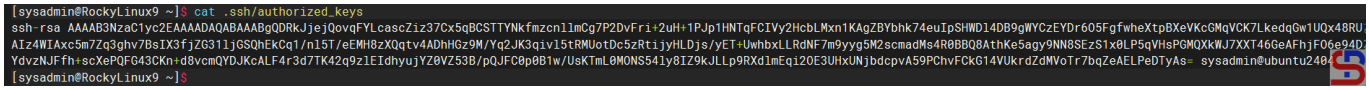
```
ssh-copy-id sysadmin@192.168.56.2
```

Type **yes** when prompted and type the password for the remote server.



Running the ssh-copy-id command

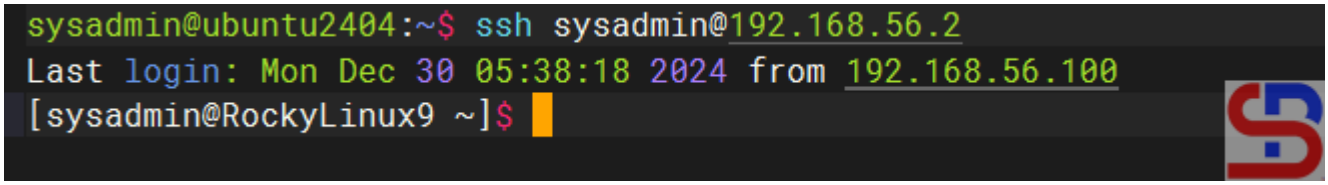
For your information, the **id_rsa.pub** file will be saved in the **.ssh/authorized_keys** file on the remote server, like in the image below:



The authorized_keys file

3. Test login via SSH

Try to connect to the server using SSH, you should be able to directly access the server without entering the password first. For example, I have 2 Linux servers, each of which uses Ubuntu OS with IP 192.168.56.100 and RockyLinux OS with IP 192.168.56.2. I want to access the RockyLinux server from the Ubuntu server without entering a password. I ran the three steps above to set up passwordless SSH on an Ubuntu server, and the results are as in the image below:



Access the server without entering a username and password

From the image above, you can see that I can directly access the server without entering the server password.

Note

By default, the system will generate a 2048-bit key in the first step when you run the ssh-keygen command. However, if you want to be more secure, you can use 4096-bit encryption by using the command below:

```
ssh-keygen -t rsa -b 4096
```

Besides RSA, you can also use several other public key algorithms, such as ECDSA or ED25519. Elliptic Curve Digital Signature Algorithm, or ECDSA, is one of the more complex public key cryptography encryption algorithms that supports three key sizes: 256, 384, and 521 bits. You can use the command below when using ECDSA:

```
ssh-keygen -t ecdsa -b 521
```

Ed25519 is an elliptic curve signing algorithm using EdDSA and Curve25519, and this is a new algorithm added in OpenSSH. You can use the command below when using ed25519:

```
ssh-keygen -t ed25519
```

Unfortunately, support for this among clients is not yet universal. Therefore, its use in general-purpose applications may not be advisable.

References

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phoenixnap.com
ssh.com
encryptionconsulting.com
cryptography.io