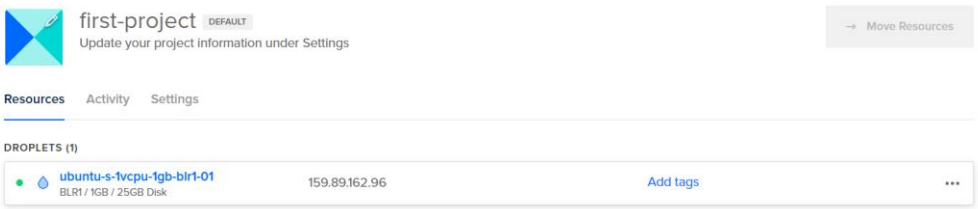
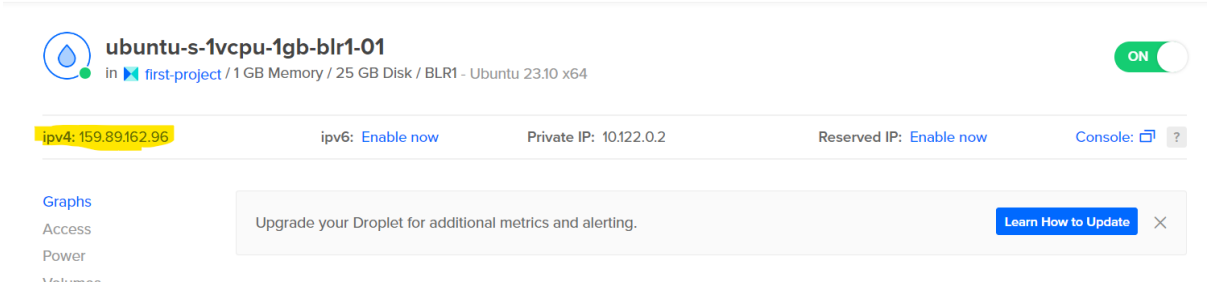
Setup server on DigitalOcean:

To Create Droplets (Cloud Servers) in Digital Ocean : https://cloud.digitalocean.com/

- Click CREATE -> Select Droplets
- Choose region which is near to your Geo location -> **Bangalore**
- Choose an image -> **Ubuntu**
- Version -> **23.10 x 64**
- Choose Size -> Droplet Type: **Shared CPU**
- CPU Options: REGULAR Disk Type: **SSD**
- Choose Authentication Method -> **SSH Key** (Recommended) as we are going to establish connection between our local machine and cloud server
    - Command to generate SSH key on Windows: **ssh-keygen -t rsa -b 4096 -C your_email@example.com**
- Click Create Droplet. Droplet will be created as shown below:



- The ipv4: **159.89.162.96** in the Droplet is the Public IP address of the server



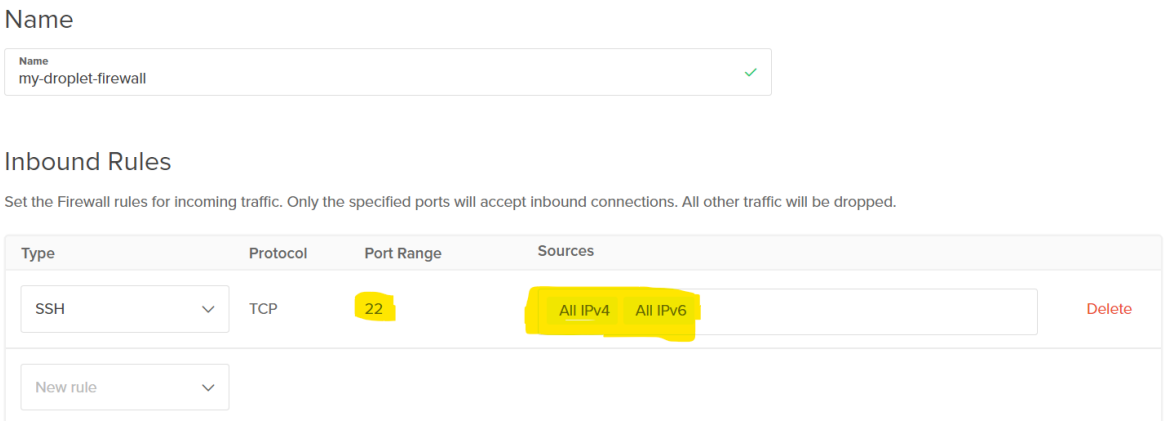
- In the Digital Ocean, when we create a server, it is publicly accessible on all ports. By default server is not protected. So basically, it is not protected by Firewall, this is a bad security practice.
- Configure Firewall to protect server and using Firewall configs we will explicitly allow public access to specific ports that we want to expose like web server, ssh port and so on.
    - Configure Firewall = Closing access by default
    - Selectively open the ports which we need
- In order to connect to server, we are going to need SSH into it. And the SSH port is 22 and which means we have to allow access to our Ubuntu server on port 22, so that we can SSH into it.

What is SSH?

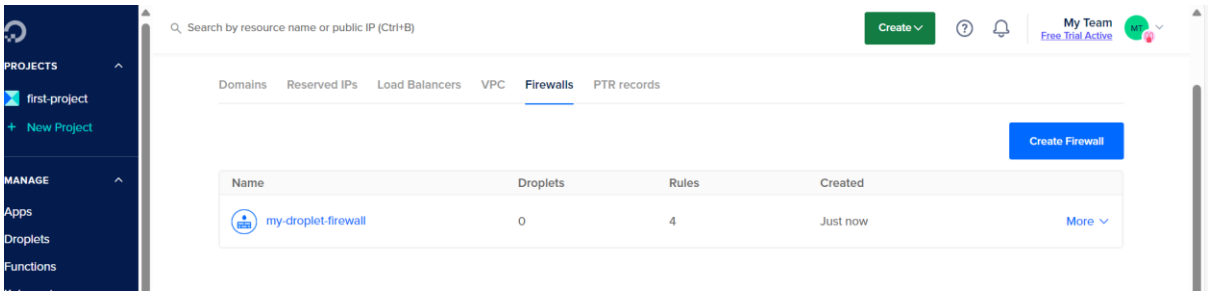
SSH stands for Secure Shell. It's a cryptographic network protocol used to establish a secure connection between a client and a server over an unsecured network. SSH provides a secure channel over an insecure network by encrypting the data exchanged between the two parties, thus protecting it from eavesdropping, interception, and tampering.

Configure Firewall rules for the Droplets:

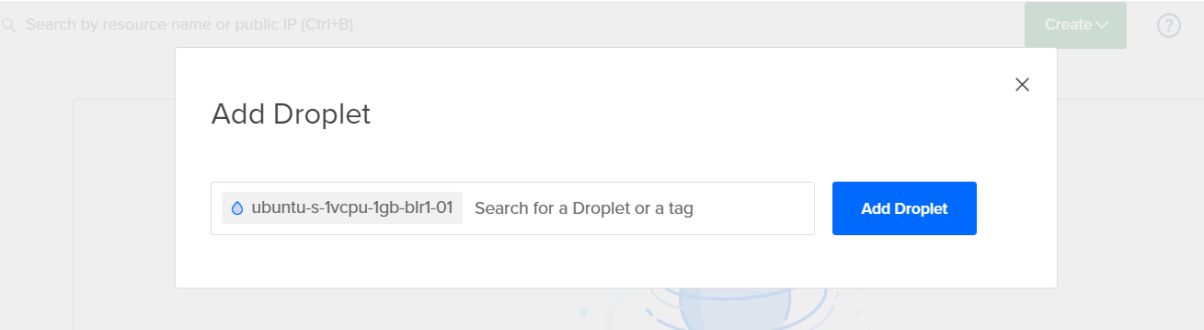
- Go to the respective Droplets Networking menu/ Go to networking in the left side menu outside the droplet
- Firewall is for all of DigitalOcean.
- Click Create Firewall
- By default, in the Inbound rules, it gives the port range as 22 and sources as all IPv4, all IPv6



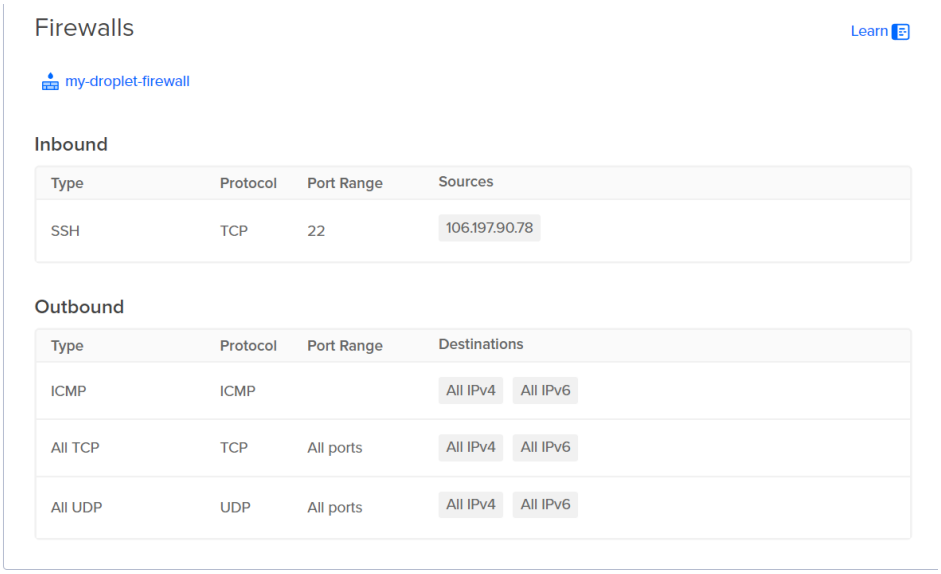
- Change the Source value to your PC IP Address because we need to configure only our PC IP or rang of Ips. IP addresses are dynamic, so whenever you restart your PC, the IP address will change, so update it accordingly in the Firewall config
    - Use this link to find your IP: https://whatismyipaddress.com/
- Leave the Outbound rule to default values
- Then, click create firewall



- Next, assign the droplets to the Firewall rule which we configured.



- Inbound -> On which port does our droplet allow connections.
- Outbound -> To which destination our droplet/server actually talk to. So this is opening our droplet to internet because obviously we need to download Java and Docker and install them. So it needs internet connection



Establish connection between your local machine (PC) and remote host (Server):

- Copy the IP address of the droplet: ipv4: **159.89.162.96**

- Go to terminal and run this command “ssh root@159.89.162.96”
- Now we’re on our Ubuntu Server

```
C:\Users\dines>ssh root@159.89.162.96
The authenticity of host '159.89.162.96 (159.89.162.96)' can't be established.
ED25519 key fingerprint is SHA256:v+8AncBwA+0XH7J+ynkU/bXCK7YMjnrwIXDVkrLjo+k.
This key is not known by any other names
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '159.89.162.96' (ED25519) to the list of known hosts.
Connection closed by 159.89.162.96 port 22

C:\Users\dines>ssh root@159.89.162.96
Welcome to Ubuntu 23.10 (GNU/Linux 6.5.0-9-generic x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/advantage

  System information as of Thu Feb 22 05:48:06 UTC 2024

  System load:  0.0               Processes:             95
  Usage of /:   8.7% of 23.17GB   Users logged in:       0
  Memory usage: 37%               IPv4 address for eth0: 159.89.162.96
  Swap usage:   0%                IPv4 address for eth0: 10.47.0.5

43 updates can be applied immediately.
```

- Now the state of the machine is completely clean, we can install applications like java, docker etc,.

Install Java on Droplet:

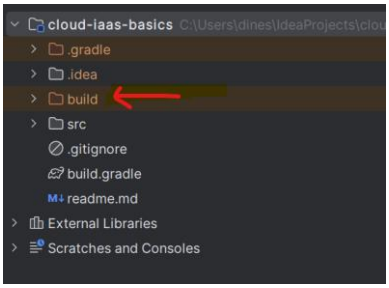
- Run: apt update
- Run: apt install openjdk-8-jre-headless

Deploy and run application artifact on Droplet:

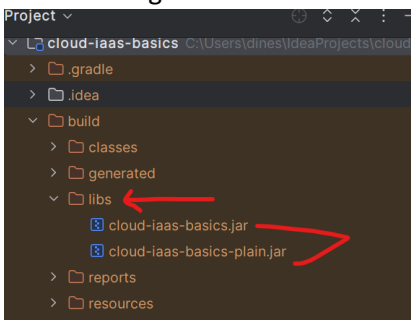
Next, we are going to perform the below operations:

1. Build Jar file locally
2. Copy to remote server
3. Run App on the remote server

1. **Build Jar file locally:**
    - Clone the project: https://github.com/Dinesh-DevOps55/cloud-iaas-basics
    - Since this is a Gradle project, we are going to build Gradle
    - Run the command: "**gradle build**", as a result build folder will be created and build will be successful



- Inside the build -> libs folder, there are jar files. Now we need to run this JAR files in Ubuntu server on Digital Ocean.



- To run jar files on ubuntu server on Digital ocean:
  - Run the command "**scp build/libs/cloud-iaas-basics.jar root@159.89.162.96:/root**"
  - Scp = secure copy
  - build/libs/cloud-iaas-basics.jar = jar file path
  - root@159.89.162.96 = Droplet IP address
  - :/root = Path where this Jar file end up.

  Output:

```
C:\Users\dines\IdeaProjects\cloud-iaas-basics>scp build/libs/cloud-iaas-basics.jar root@159.89.162.96:/root
cloud-iaas-basics.jar                                                                    100%   17MB   3.2MB/s   00:05

C:\Users\dines\IdeaProjects\cloud-iaas-basics>
```

- Now go new terminal
  - Connect your local machine to remote server: **ssh root@159.89.162.96**

```
root@ubuntu-s-1vcpu-1gb-bl

Microsoft Windows [Version 10.0.22621.3155]
(c) Microsoft Corporation. All rights reserved.

C:\Users\dines>ssh root@159.89.162.96
Welcome to Ubuntu 23.10 (GNU/Linux 6.5.0-9-generic x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/advantage

  System information as of Fri Feb 23 04:13:18 UTC 2024

  System load:  0.02              Processes:             96
  Usage of /:   9.9% of 23.17GB   Users logged in:       1
  Memory usage: 38%               IPv4 address for eth0: 159.89.162.96
  Swap usage:   0%                IPv4 address for eth0: 10.47.0.5

50 updates can be applied immediately.
8 of these updates are standard security updates.
To see these additional updates run: apt list --upgradable


*** System restart required ***
Last login: Fri Feb 23 03:52:01 2024 from 106.217.20.183
root@ubuntu-s-1vcpu-1gb-blr1-01:~#
```

- Run **ls** command to list the files present in the droplet. As a result you will see the jar file which is uploaded to droplet from your local machine.

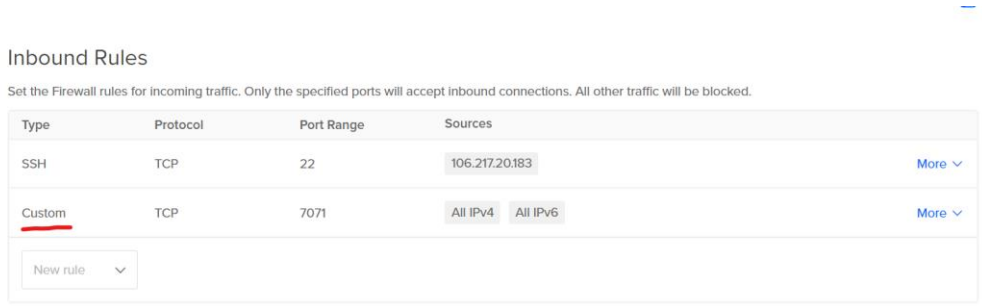
```
root@ubuntu-s-1vcpu-1gb-blr1-01:~# ls
cloud-iaas-basics.jar  snap
root@ubuntu-s-1vcpu-1gb-blr1-01:~#
```

- Since we have already installed java on the droplet, we can execute Java commands
- Run the command: **java -jar cloud-iaas-basics.jar**

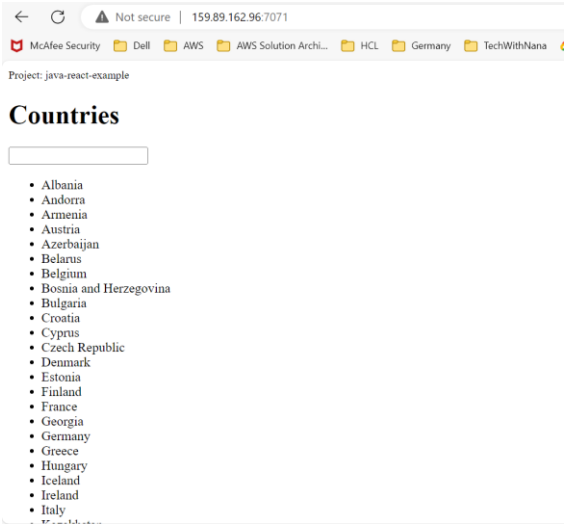
Now, the application is started and it's listening to the Tomcat server port: 7071

```
root@ubuntu-s-1vcpu-1gb-blr1-01:~# java -jar cloud-iaas-basics.jar

  .   ____          _            __ _ _
 /\\ / ___'_ __ _ _(_)_ __  __ _ \ \ \ \
( ( )\___ | '_ | '_| | '_ \/ _` | \ \ \ \
 \\/  ___)| |_)| | | | | || (_| |  ) ) ) )
  '  |____| .__|_| |_|_| |_\__, | / / / /
 =========|_|==============|___/=/_/_/_/
 :: Spring Boot ::                (v2.7.11)

2024-02-23 04:17:00.887  INFO 28358 --- [           main] com.coditorium.sandbox.Application       : Starting Application using Java
1.8.0_392 on ubuntu-s-1vcpu-1gb-blr1-01 with PID 28358 (/root/cloud-iaas-basics.jar started by root in /root)
2024-02-23 04:17:00.897  INFO 28358 --- [           main] com.coditorium.sandbox.Application       : No active profile set, falling b
ack to 1 default profile: "default"
2024-02-23 04:17:01.143  INFO 28358 --- [           main] .e.DevToolsPropertyDefaultsPostProcessor : For additional web related loggi
ng consider setting the 'logging.level.web' property to 'DEBUG'
2024-02-23 04:17:04.480  INFO 28358 --- [           main] o.s.b.w.embedded.tomcat.TomcatWebServer  : Tomcat initialized with port(s):
 7071 (http)
2024-02-23 04:17:04.515  INFO 28358 --- [           main] o.apache.catalina.core.StandardService   : Starting service [Tomcat]
2024-02-23 04:17:04.516  INFO 28358 --- [           main] org.apache.catalina.core.StandardEngine  : Starting Servlet engine: [Apache
 Tomcat/9.0.74]
2024-02-23 04:17:04.783  INFO 28358 --- [           main] o.a.c.c.C.[Tomcat].[localhost].[/]       : Initializing Spring embedded Web
ApplicationContext
2024-02-23 04:17:04.786  INFO 28358 --- [           main] w.s.c.ServletWebServerApplicationContext : Root WebApplicationContext: init
ialization completed in 3640 ms
2024-02-23 04:17:06.194  INFO 28358 --- [           main] o.s.b.a.w.s.WelcomePageHandlerMapping    : Adding welcome page: class path
resource [static/index.html]
2024-02-23 04:17:06.663  INFO 28358 --- [           main] o.s.b.w.embedded.tomcat.TomcatWebServer  : Tomcat started on port(s): 7071
(http) with context path ''
2024-02-23 04:17:06.686  INFO 28358 --- [           main] com.coditorium.sandbox.Application       : Started Application in 7.254 sec
onds (JVM running for 8.406)
```

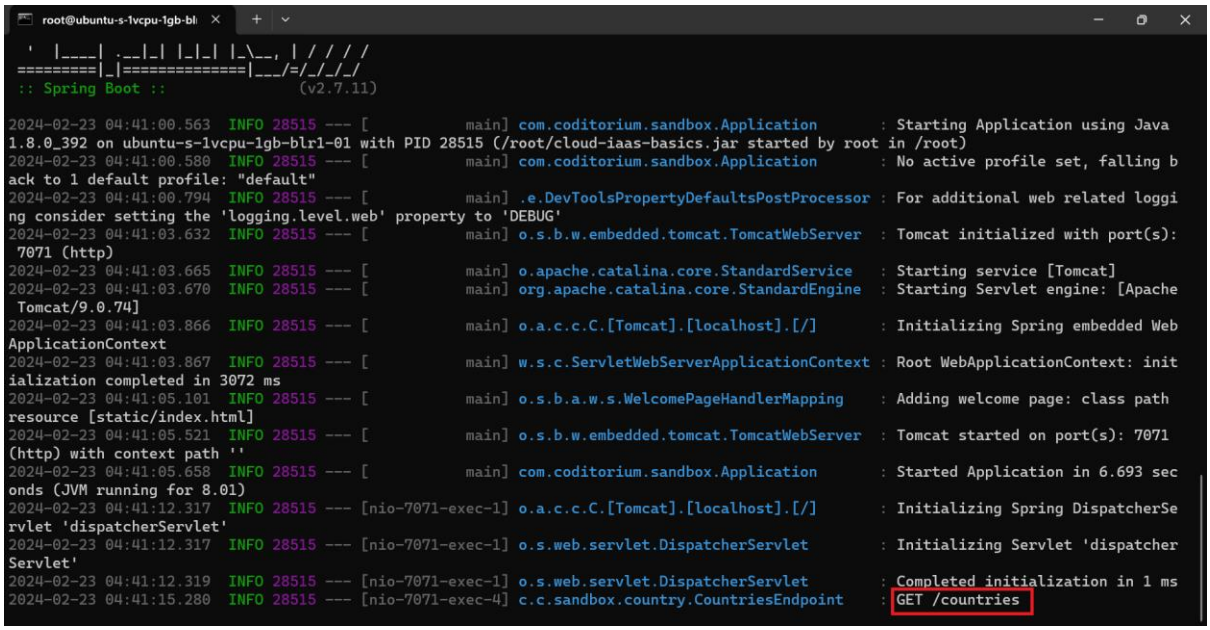
- Next, we need to access this application from web server. We have public IP address, however we don't port opened to access the application. So add this port in the firewall rule.
- Add custom firewall rule in the Inbound rule



- Now access the application from web browser using the droplet IP and the port 159.89.162.96:7071



After opening the application in browser, go to server terminal, here you can find **GET/Countries ,**meaning we are fetching the countries details in the web server.



sudo netstat -tuln | grep 7071

```
root@ubuntu-s-1vcpu-1gb-blr1-01:~# sudo netstat -tuln | grep 7071
tcp6       10      0 :::7071                 :::*                    LISTEN
root@ubuntu-s-1vcpu-1gb-blr1-01:~#
```

‘**`netstat`** is a command-line tool used for displaying network connections, routing tables, interface statistics, masquerade connections, and multicast memberships

java -jar cloud-iaas-basics.jar => This command is for attached mode. In attached mode, a process or program is running within a terminal session, and it has a direct connection to the input and output streams of the terminal. The program is actively interacting with the terminal, displaying output in real-time and reading input from the user as needed.

java -jar cloud-iaas-basics.jar & => This command is for detached mode. In detached mode, a process or program is running independently of any terminal session. It is not directly connected to the input and output streams of a terminal. The program runs in the background, without any interaction with the terminal. It may continue running even after the user logs out of the terminal session.

Create and Configure a Linux user on a Cloud Server:

Create a separate Linux User (NOT Root)

Security Best Practices:

As a security best practices, you should not execute services, applications using Root user because with root user you're providing application the privileges.

- Create a separate User for every application
- Give it only the permission it needs to run the App
- Don't work with the Root User

Create user in the ubuntu server:

- Command: **adduser dinesh55**

  As a result, **dinesh55** user group has been created and also **dinesh55** user has been created.

```
root@ubuntu-s-1vcpu-1gb-blr1-01:~# adduser dinesh55
info: Adding user `dinesh55' ...
info: Selecting UID/GID from range 1000 to 59999 ...
info: Adding new group `dinesh55' (1000) ...
info: Adding new user `dinesh55' (1000) with group `dinesh55 (1000)' ...
info: Creating home directory `/home/dinesh55' ...
info: Copying files from `/etc/skel' ...
New password:
Retype new password:
passwd: password updated successfully
Changing the user information for dinesh55
Enter the new value, or press ENTER for the default
        Full Name []: dinesh55
        Room Number []:
        Work Phone []:
        Home Phone []:
        Other []:
Is the information correct? [Y/n] Y
info: Adding new user `dinesh55' to supplemental / extra groups `users' ...
info: Adding user `dinesh55' to group `users' ...
```

- However, I need to allow the user dinesh55 to execute some of the commands that root user can execute. So now we're going to add this user to sudo group which has root privileges.
- Command: **usermod -aG sudo dinesh55**

  usermod: This command is used to modify user account properties.

  -aG sudo: These options tell usermod to add the user to the specified group(s). -a stands for append (add), and -G specifies the group(s) to which the user will be added. In this case, the user is being added to the sudo group.

- To switch one user to another, command: **su – dinesh55**

```
root@ubuntu-s-1vcpu-1gb-blr1-01:~# su - dinesh55
To run a command as administrator (user "root"), use "sudo <command>".
See "man sudo_root" for details.

dinesh55@ubuntu-s-1vcpu-1gb-blr1-01:~$
```

  $**: The prompt ending with a **dollar sign ($) typically indicates a regular or standard user.
  #: The prompt ending with a **hash symbol (#)** typically indicates the root user or superuser

- **exit** command is used to log out from user and also to log out from server.

```
dinesh55@ubuntu-s-1vcpu-1gb-blr1-01:~$ exit
logout
root@ubuntu-s-1vcpu-1gb-blr1-01:~# exit
logout
Connection to 159.89.162.96 closed.

C:\Users\dines>ssh dinesh@159.89.162.96
dinesh@159.89.162.96: Permission denied (publickey).

C:\Users\dines>
```

- If I try to login to server via the standard user dinesh55, server will deny it. This is because I have to add the SSH key to the standard user dinesh55 like we did for root user.

```
C:\Users\dines>ssh dinesh@159.89.162.96
dinesh@159.89.162.96: Permission denied (publickey).

C:\Users\dines>
```

To add the SSH key to standard user dinesh55:

- Create .**ssh** directory in the user dinesh55: **mkdir .ssh**
- Add your public SSH key (which was already added in the droplet) in a new file inside the **.ssh** directory: **sudo vim .ssh/authorized_key** (Because of ssh we used sudo command)
- Now login to the server using standard user **dinesh55**, it will validate the SSH key and allow this user to connect to the server.

  We're going to do the same for every application we install here. For Nexus, we will be creating nexus user and Jenkins, Jenkins user. Even the official document says, we shouldn't start the application with Root User.