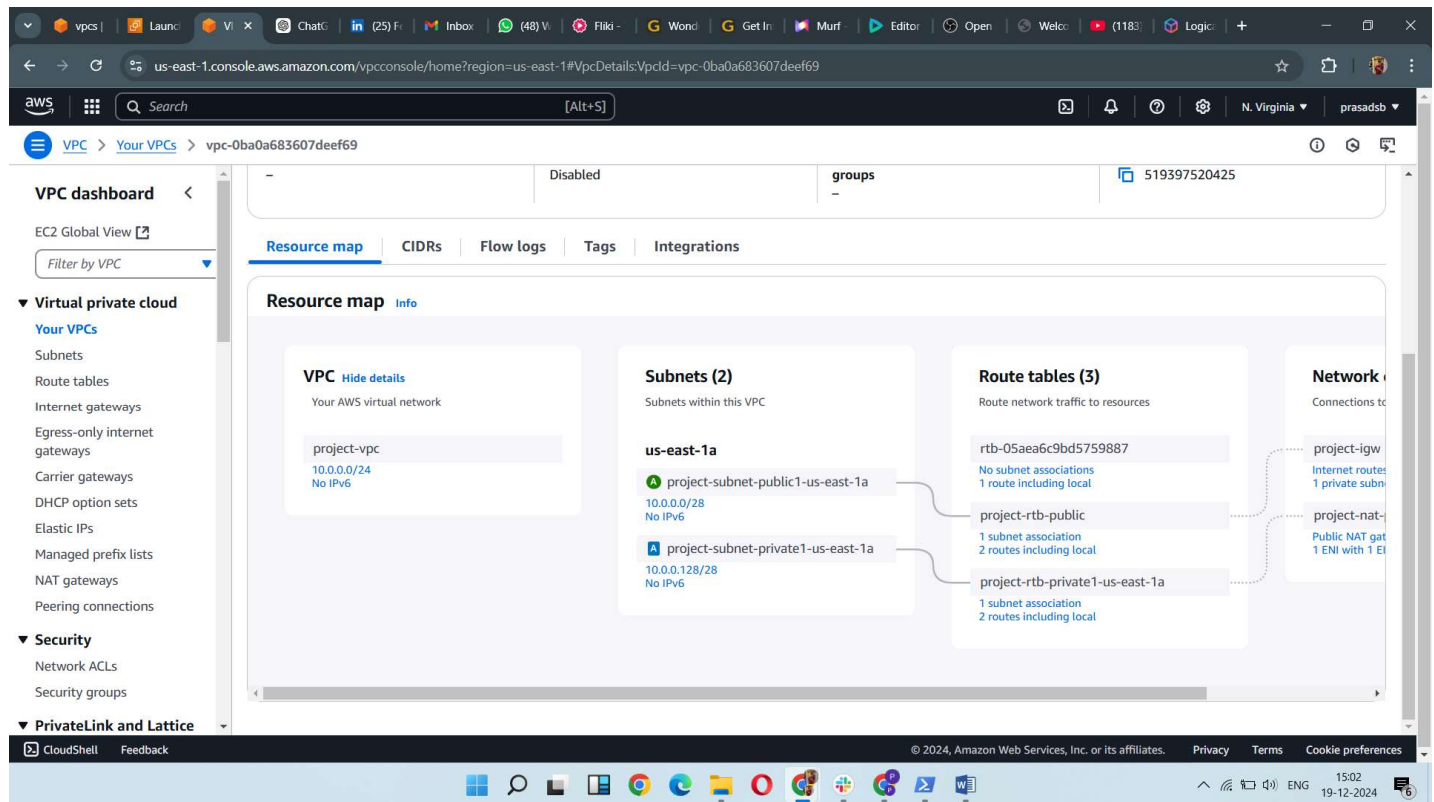


Basic Networking Topology Implementation

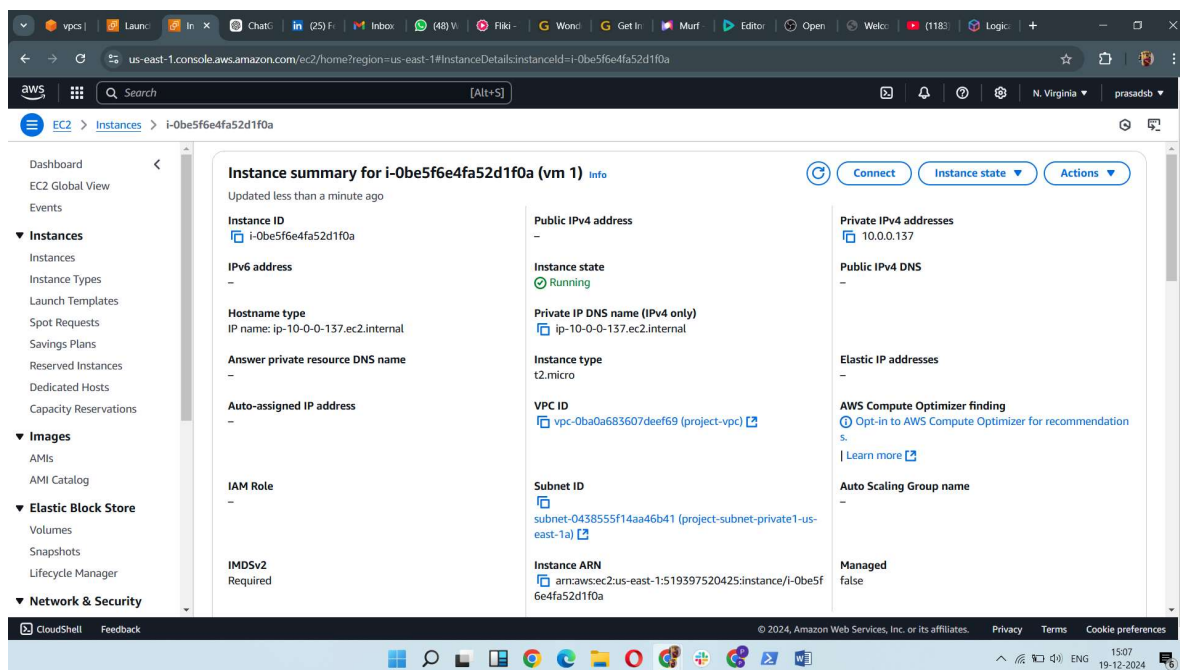
The goal of this task was to design and implement a basic networking topology with two Virtual Machines (VMs) in a cloud environment. One VM was configured as a web server, and the other as a client. SSH was used to securely transfer files between the two machines.

A Virtual Private Cloud (VPC) was created with one public subnet and one private subnet to ensure network isolation and secure communication between the instances.



Three EC2 instances were created:

- **Bastion Host (Public IP):** An EC2 instance was created in the public subnet, with a public IP for access.
- **Web Server (Private IP):** An EC2 instance was created in the private subnet, configured as a web server.
- **Client (Private IP):** Another EC2 instance was created in the private subnet, configured as the client.



us-east-1.console.aws.amazon.com/ec2/home?region=us-east-1#InstanceDetails:instanceId=i-07f087bb6956e3bdc

EC2 > Instances > i-07f087bb6956e3bdc

Instance summary for i-07f087bb6956e3bdc (vm 2)

Updated less than a minute ago

Instance ID i-07f087bb6956e3bdc	Public IPv4 address -	Private IPv4 addresses 10.0.0.138
IPv6 address -	Instance state Running	Public IPv4 DNS -
Hostname type IP name: ip-10-0-0-138.ec2.internal	Private IP DNS name (IPv4 only) ip-10-0-0-138.ec2.internal	Elastic IP addresses -
Answer private resource DNS name -	Instance type t2.micro	AWS Compute Optimizer finding Opt-in to AWS Compute Optimizer for recommendation s. Learn more
Auto-assigned IP address -	VPC ID vpc-0ba0a683607deef69 (project-vpc)	Auto Scaling Group name -
IAM Role -	Subnet ID subnet-0438555f14aa46b41 (project-subnet-private1-us-east-1a)	Managed false
IMDSv2 Required	Instance ARN arn:aws:ec2:us-east-1:519397520425:instance/i-07f087bb6956e3bdc	

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15:08 19-12-2024

us-east-1.console.aws.amazon.com/ec2/home?region=us-east-1#InstanceDetails:instanceId=i-0bd88b9e195fa9015

EC2 > Instances > i-0bd88b9e195fa9015

Instance summary for i-0bd88b9e195fa9015 (basition)

Updated less than a minute ago

Instance ID i-0bd88b9e195fa9015	Public IPv4 address 3.80.129.112 open address	Private IPv4 addresses 10.0.0.7
IPv6 address -	Instance state Running	Public IPv4 DNS ec2-3-80-129-112.compute-1.amazonaws.com open address
Hostname type IP name: ip-10-0-0-7.ec2.internal	Private IP DNS name (IPv4 only) ip-10-0-0-7.ec2.internal	Elastic IP addresses -
Answer private resource DNS name -	Instance type t2.micro	AWS Compute Optimizer finding Opt-in to AWS Compute Optimizer for recommendation s. Learn more
Auto-assigned IP address 3.80.129.112 [Public IP]	VPC ID vpc-0ba0a683607deef69 (project-vpc)	Auto Scaling Group name -
IAM Role -	Subnet ID subnet-0b62655e2c11279ae (project-subnet-public1-us-east-1a)	Managed false
IMDSv2 Required	Instance ARN arn:aws:ec2:us-east-1:519397520425:instance/i-0bd88b9e195fa9015	

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15:09 19-12-2024

- SSH keys were securely transferred from the local machine to the bastion host using SCP.
- The bastion host was then used as an intermediary to access the private instances (web server and client), bypassing the lack of public IPs on those machines.

Windows PowerShell

```
PS C:\Users\hp\downloads> scp -i "C:/Users/hp/downloads/nginx.pem" "C:/Users/hp/downloads/nginx.pem" ubuntu@3.86.178.239:/home/ubuntu/.ssh/
>>
nginx.pem
PS C:\Users\hp\downloads>
```

```
ubuntu@ip-10-0-0-7: ~/ssh
Get:29 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates/multiverse amd64 Components [940 B]
Get:30 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates/multiverse amd64 c-n-f Metadata [552 B]
Get:31 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-backports/main amd64 Components [208 B]
Get:32 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-backports/main amd64 c-n-f Metadata [112 B]
Get:33 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-backports/universe amd64 Packages [10.7 kB]
Get:34 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-backports/universe Translation-en [10.8 kB]
Get:35 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-backports/multiverse amd64 Components [212 B]
Get:36 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-backports/multiverse amd64 c-n-f Metadata [1104 B]
Get:37 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-backports/restricted amd64 Components [216 B]
Get:38 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-backports/restricted amd64 c-n-f Metadata [116 B]
Get:39 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-backports/multiverse amd64 Components [212 B]
Get:40 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-backports/multiverse amd64 c-n-f Metadata [116 B]
Get:41 http://security.ubuntu.com/ubuntu noble-security/universe Translation-en [162 kB]
Get:42 http://security.ubuntu.com/ubuntu noble-security/universe amd64 Components [52.0 kB]
Get:43 http://security.ubuntu.com/ubuntu noble-security/universe amd64 c-n-f Metadata [13.5 kB]
Get:44 http://security.ubuntu.com/ubuntu noble-security/restricted amd64 Packages [560 kB]
Get:45 http://security.ubuntu.com/ubuntu noble-security/restricted Translation-en [108 kB]
Get:46 http://security.ubuntu.com/ubuntu noble-security/restricted amd64 Components [212 B]
Get:47 http://security.ubuntu.com/ubuntu noble-security/multiverse amd64 Packages [12.2 kB]
Get:48 http://security.ubuntu.com/ubuntu noble-security/multiverse Translation-en [2940 B]
Get:49 http://security.ubuntu.com/ubuntu noble-security/multiverse amd64 Components [212 B]
Get:50 http://security.ubuntu.com/ubuntu noble-security/multiverse amd64 c-n-f Metadata [356 B]
Fetched 31.7 MB in 6s (5454 kB/s)
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
50 packages can be upgraded. Run 'apt list --upgradable' to see them.
ubuntu@ip-10-0-0-7:~$ ls
total 28
drwxr-xr-x 4 ubuntu ubuntu 4096 Dec 19 06:52 /
drwxr-xr-x 3 root root 4096 Dec 19 06:43 /
-rw-r--r-- 1 ubuntu ubuntu 220 Mar 31 2024 .bash_logout
-rw-r--r-- 1 ubuntu ubuntu 3771 Mar 31 2024 .bashrc
drwx----- 2 ubuntu ubuntu 4096 Dec 19 06:44 /
-rw-r--r-- 1 ubuntu ubuntu 807 Mar 31 2024 .profile
drwx----- 2 ubuntu ubuntu 4096 Dec 19 06:43 /
-rw-r--r-- 1 ubuntu ubuntu 0 Dec 19 06:52 .sudo_as_admin_successful
ubuntu@ip-10-0-0-7:~$ cd .ssh
-bash: cd: .ssh: No such file or directory
ubuntu@ip-10-0-0-7:~$ cd /ssh
-bash: cd: /ssh: No such file or directory
ubuntu@ip-10-0-0-7:~$ cd .ssh
ubuntu@ip-10-0-0-7:~$ ls
total 12
drwx----- 2 ubuntu ubuntu 4096 Dec 19 06:43 /
drwxr-xr-x 4 ubuntu ubuntu 4096 Dec 19 06:52 /
-rw----- 1 ubuntu ubuntu 387 Dec 19 06:43 authorized_keys
ubuntu@ip-10-0-0-7:~$ ls
total 16
drwx----- 2 ubuntu ubuntu 4096 Dec 19 06:54 /
drwxr-xr-x 4 ubuntu ubuntu 4096 Dec 19 06:52 /
-rw----- 1 ubuntu ubuntu 387 Dec 19 06:43 authorized_keys
-rw-rw-r-- 1 ubuntu ubuntu 1674 Dec 19 06:54 nginx.pem
ubuntu@ip-10-0-0-7:~$
```

ubuntu@ip-10-0-0-137:~

```
ubuntu@ip-10-0-0-7:~$ ssh -i "nginx.pem" ubuntu@10.0.0.137
The authenticity of host '10.0.0.137 (10.0.0.137)' can't be established.
ED25519 key fingerprint is SHA256:5r3W4r5rUjuu456fIXuG7gwgeGT8yfA0vbLHG3yQ.
This key is not known by any other names.
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '10.0.0.137' (ED25519) to the list of known hosts.
Welcome to Ubuntu 24.04.1 LTS (GNU/Linux 6.8.0-1018-aws x86_64)

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

System information as of Thu Dec 19 06:59:08 UTC 2024

System load:  0.29           Processes:    107
Usage of /:   24.7% of 6.71GB Users logged in:   0
Memory usage: 22%           IPv4 address for enx0: 10.0.0.137
Swap usage:   0%

Expanded Security Maintenance for Applications is not enabled.

0 updates can be applied immediately.

Enable ESM Apps to receive additional future security updates.
See https://ubuntu.com/esm or run: sudo pro status

The list of available updates is more than a week old.
To check for new updates run: sudo apt update

The programs included with the Ubuntu system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Ubuntu comes with ABSOLUTELY NO WARRANTY, to the extent permitted by
applicable law.

To run a command as administrator (user "root"), use "sudo <command>".
See "man sudo_root" for details.

ubuntu@ip-10-0-0-137:~$ sudo apt update
```

- Nginx was installed on the web server, and the appropriate firewall rules (HTTP/80) were added to the security group, enabling the client to access the web page hosted on the server.

```
ubuntu@ip-10-0-0-137: ~  
ubuntu@ip-10-0-0-137: $ nginx -v  
nginx version: nginx/1.24.0 (Ubuntu)  
ubuntu@ip-10-0-0-137: $ curl 10.0.0.137  
<!DOCTYPE html>  
<html>  
<head>  
<title>Welcome to nginx!</title>  
<style>  
html { color-scheme: light dark; }  
body { width: 35em; margin: 0 auto;  
font-family: Tahoma, Verdana, Arial, sans-serif; }  
</style>  
</head>  
<body>  
<h1>Welcome to nginx!</h1>  
<p>If you see this page, the nginx web server is successfully installed and  
working. Further configuration is required.</p>  
  
<p>For online documentation and support please refer to  
<a href="http://nginx.org/">nginx.org</a>.<br/>  
Commercial support is available at  
<a href="http://nginx.com/">nginx.com</a>.</p>  
  
<p><em>Thank you for using nginx.</em></p>  
</body>  
</html>  
ubuntu@ip-10-0-0-137: $
```

- This is the client virtual machine.

```
ubuntu@ip-10-0-0-138: ~  
ubuntu@ip-10-0-0-138: $ curl 10.0.0.137  
<!DOCTYPE html>  
<html>  
<head>  
<title>Welcome to nginx!</title>  
<style>  
html { color-scheme: light dark; }  
body { width: 35em; margin: 0 auto;  
font-family: Tahoma, Verdana, Arial, sans-serif; }  
</style>  
</head>  
<body>  
<h1>Welcome to nginx!</h1>  
<p>If you see this page, the nginx web server is successfully installed and  
working. Further configuration is required.</p>  
  
<p>For online documentation and support please refer to  
<a href="http://nginx.org/">nginx.org</a>.<br/>  
Commercial support is available at  
<a href="http://nginx.com/">nginx.com</a>.</p>  
  
<p><em>Thank you for using nginx.</em></p>  
</body>  
</html>  
ubuntu@ip-10-0-0-138: $
```

- The file transfer process was carried out using SCP, both from the client to the server and vice versa. This demonstrated the use of secure file transfer over SSH.

```
ubuntu@ip-10-0-0-137:~$ cat authorized_keys
ssh-rsa AAAAB3NzaC1yc2EAAAADAQABAAQCSFZGwC-CaudKx7CY/BuildjVzCMWpZoGv580183M4WGPazoKCI/udmliq/nx2u5p8vLydpQOSXL39QqghYckG6T31S10pAgHhlcZ4uxbJpAVFuzi+2HmemP7/rHL+IT132Txv7Fw+AIuR/4PAY848To1n05YtX00n2rQ31t6b95aevgkwOnqht53aV6C2
DxwC/X82/UJ9B/U7JH1E1at8K820uF+4i6AAVQ5Fp3vly055j417puoKAX+cas80Ec3ucUsesI08TY8FupLVH00da6jzjg39yx/n8rlarpongkwl140LXgtw5tUuP2zX3IXkzvp nginx
ubuntu@ip-10-0-0-137:~$ chmod 700 ~/.ssh
ubuntu@ip-10-0-0-137:~$ chmod 600 ~/.ssh/authorized_keys
ubuntu@ip-10-0-0-137:~$ ll
total 20
drwxr-xr-x 2 ubuntu ubuntu 4096 Dec 19 07:25 /
drwxr-xr-x 4 ubuntu ubuntu 4096 Dec 19 09:01 /
-rw-r--r-- 1 ubuntu ubuntu 387 Dec 19 06:58 authorized_keys
-rw-r--r-- 1 ubuntu ubuntu 284 Dec 19 07:29 known_hosts
-rw-r--r-- 1 ubuntu ubuntu 1674 Dec 19 07:25 nginx.pem
ubuntu@ip-10-0-0-137:~$ chmod 600 nginx.pem
ubuntu@ip-10-0-0-137:~$ scp -i /path/to/nginx.pem /home/ubuntu/file.txt ubuntu@10.0.0.138:/home/ubuntu/
Warning: Identity file /path/to/nginx.pem not accessible: No such file or directory.
ubuntu@10.0.0.138: Permission denied (publickey).
Warning: Connection closed.
scp: Connection closed
ubuntu@ip-10-0-0-137:~$ ll
total 20
drwxr-xr-x 2 ubuntu ubuntu 4096 Dec 19 07:25 /
drwxr-xr-x 4 ubuntu ubuntu 4096 Dec 19 09:01 /
-rw-r--r-- 1 ubuntu ubuntu 387 Dec 19 06:58 authorized_keys
-rw-r--r-- 1 ubuntu ubuntu 284 Dec 19 07:29 known_hosts
-rw-r--r-- 1 ubuntu ubuntu 1674 Dec 19 07:25 nginx.pem
ubuntu@ip-10-0-0-137:~$ cd ..
ubuntu@ip-10-0-0-137:~$ ll
total 32
drwxr-xr-x 4 ubuntu ubuntu 4096 Dec 19 09:01 /
drwxr-xr-x 3 root root 4096 Dec 19 06:58 /
-rw-r--r-- 1 ubuntu ubuntu 771 Dec 19 07:37 bash_history
-rw-r--r-- 1 ubuntu ubuntu 220 Mar 31 2024 .bash_logout
-rw-r--r-- 1 ubuntu ubuntu 3771 Mar 31 2024 .bashrc
drwxr-xr-x 2 ubuntu ubuntu 4096 Dec 19 06:59 /
-rw-r--r-- 1 ubuntu ubuntu 807 Mar 31 2024 .profile
drwxr-xr-x 2 ubuntu ubuntu 4096 Dec 19 07:25 /
-rw-r--r-- 1 ubuntu ubuntu 0 Dec 19 06:59 .sudo_as_admin_successful
-rw-r--r-- 1 ubuntu ubuntu 0 Dec 19 07:19 file.txt
ubuntu@ip-10-0-0-137:~$ scp -i ~/.ssh/nginx.pem /home/ubuntu/file.txt ubuntu@10.0.0.138:/home/ubuntu/
Warning: Identity file ~/.ssh/nginx.pem not accessible: No such file or directory.
ubuntu@10.0.0.138: Permission denied (publickey).
Warning: Connection closed.
scp: Connection closed
ubuntu@ip-10-0-0-137:~$ scp -i ~/.ssh/nginx.pem /home/ubuntu/file.txt ubuntu@10.0.0.138:/home/ubuntu/
file.txt
100% 0 0.0KB/s 00:00
ubuntu@ip-10-0-0-137:~$
```

```
ubuntu@ip-10-0-0-138:~$ ll
total 32
drwxr-xr-x 4 ubuntu ubuntu 4096 Dec 19 09:21 /
drwxr-xr-x 3 root root 4096 Dec 19 06:58 /
-rw-r--r-- 1 ubuntu ubuntu 371 Dec 19 07:37 bash_history
-rw-r--r-- 1 ubuntu ubuntu 220 Mar 31 2024 .bash_logout
-rw-r--r-- 1 ubuntu ubuntu 3771 Mar 31 2024 .bashrc
drwxr-xr-x 2 ubuntu ubuntu 4096 Dec 19 07:06 /
-rw-r--r-- 1 ubuntu ubuntu 807 Mar 31 2024 .profile
drwxr-xr-x 2 ubuntu ubuntu 4096 Dec 19 09:14 /
-rw-r--r-- 1 ubuntu ubuntu 0 Dec 19 07:08 .sudo_as_admin_successful
-rw-r--r-- 1 ubuntu ubuntu 0 Dec 19 09:20 file.txt
ubuntu@ip-10-0-0-138:~$ touch prasat.txt
ubuntu@ip-10-0-0-138:~$ ll
total 32
drwxr-xr-x 4 ubuntu ubuntu 4096 Dec 19 09:22 /
drwxr-xr-x 3 root root 4096 Dec 19 06:58 /
-rw-r--r-- 1 ubuntu ubuntu 371 Dec 19 07:37 bash_history
-rw-r--r-- 1 ubuntu ubuntu 220 Mar 31 2024 .bash_logout
-rw-r--r-- 1 ubuntu ubuntu 3771 Mar 31 2024 .bashrc
drwxr-xr-x 2 ubuntu ubuntu 4096 Dec 19 07:06 /
-rw-r--r-- 1 ubuntu ubuntu 807 Mar 31 2024 .profile
drwxr-xr-x 2 ubuntu ubuntu 4096 Dec 19 09:14 /
-rw-r--r-- 1 ubuntu ubuntu 0 Dec 19 07:08 .sudo_as_admin_successful
-rw-r--r-- 1 ubuntu ubuntu 0 Dec 19 09:20 file.txt
-rw-r--r-- 1 ubuntu ubuntu 0 Dec 19 09:22 prasat.txt
ubuntu@ip-10-0-0-138:~$ scp -i ~/.ssh/nginx.pem /home/ubuntu/prasat.txt ubuntu@10.0.0.137:/home/ubuntu/
The authenticity of host '10.0.0.137 (10.0.0.137)' can't be established.
ED25519 key fingerprint is SHA256:SpV4n5rUjw456fIXuG7gwgeG18YfA8v0LH0X3yQ.
This key is not known by any other names.
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '10.0.0.137' (ED25519) to the list of known hosts.
prasat.txt
100% 0 0.0KB/s 00:00
ubuntu@ip-10-0-0-138:~$
```

Basic Architecture

