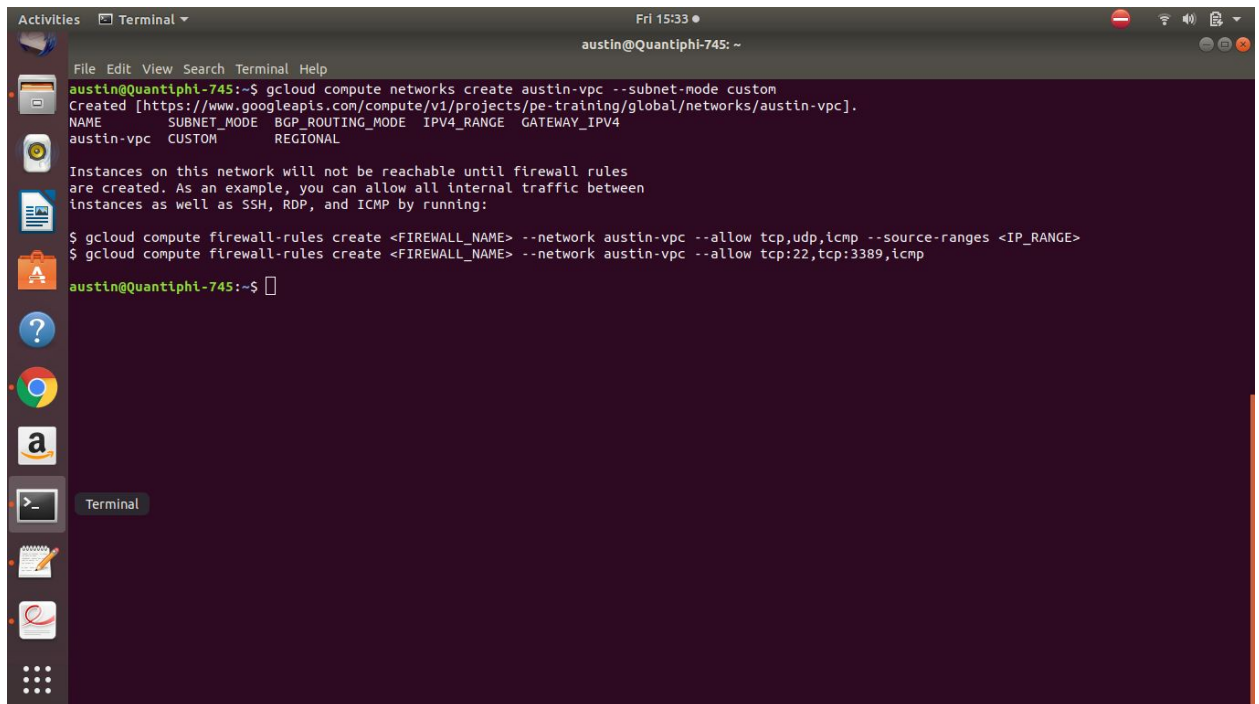


1. Launch instance with only private ip and configure NAT so instance can access Internet.
(Need to use network tags)

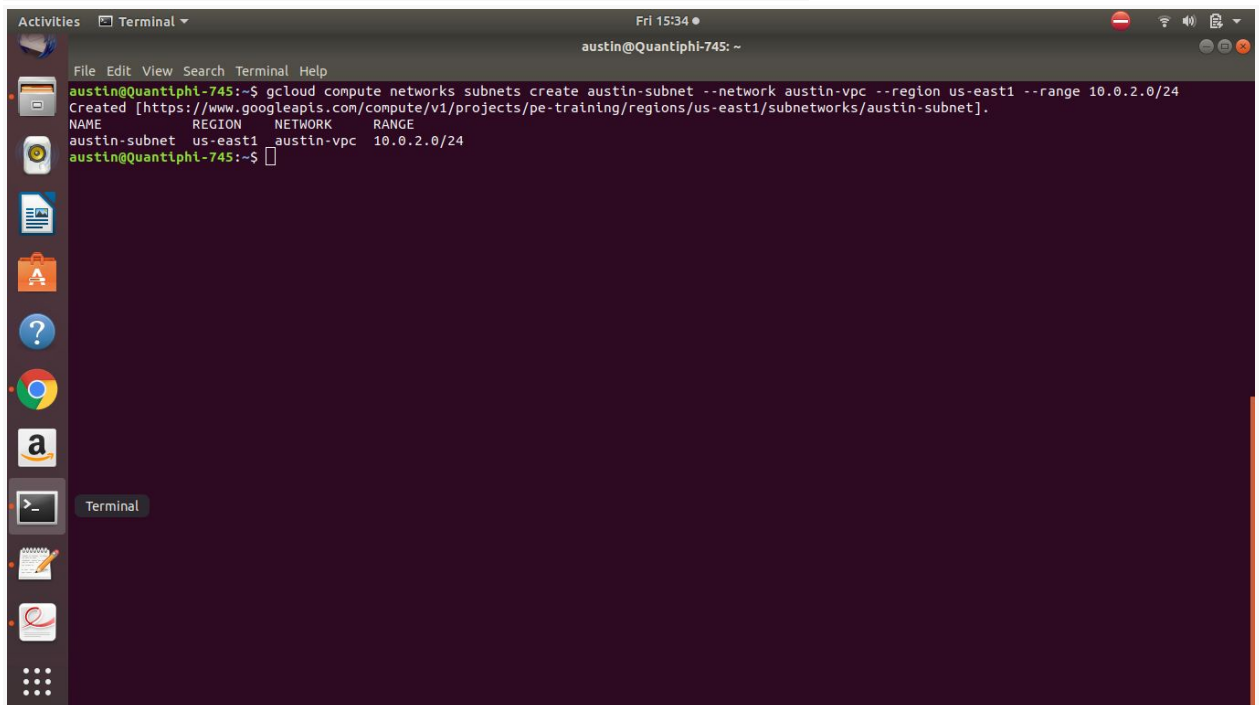
```
gcloud compute networks create austin-vpc --subnet-mode custom
```



A terminal window titled 'austin@Quantiphi-745: ~' showing the execution of gcloud commands. The first command creates a VPC network named 'austin-vpc' with a custom subnet mode. The output shows the network is created at a specific URL. A table displays the network details: NAME (austin-vpc), SUBNET_MODE (CUSTOM), BGP_ROUTING_MODE (REGIONAL), IPV4_RANGE, and GATEWAY_IPV4. A message states that instances on this network will not be reachable until firewall rules are created. Two example firewall rules are provided: one to allow all internal traffic and another to allow SSH, RDP, and ICMP. The second command creates a firewall rule named 'austin-vpc' that allows TCP traffic on ports 22 and 3389, and ICMP traffic.

```
File Edit View Search Terminal Help
austin@Quantiphi-745:~$ gcloud compute networks create austin-vpc --subnet-mode custom
Created [https://www.googleapis.com/compute/v1/projects/pe-training/global/networks/austin-vpc].
NAME      SUBNET_MODE  BGP_ROUTING_MODE  IPV4_RANGE  GATEWAY_IPV4
austin-vpc  CUSTOM      REGIONAL
Instances on this network will not be reachable until firewall rules
are created. As an example, you can allow all internal traffic between
instances as well as SSH, RDP, and ICMP by running:
$ gcloud compute firewall-rules create <FIREWALL_NAME> --network austin-vpc --allow tcp,udp,icmp --source-ranges <IP_RANGE>
$ gcloud compute firewall-rules create <FIREWALL_NAME> --network austin-vpc --allow tcp:22,tcp:3389,icmp
austin@Quantiphi-745:~$
```

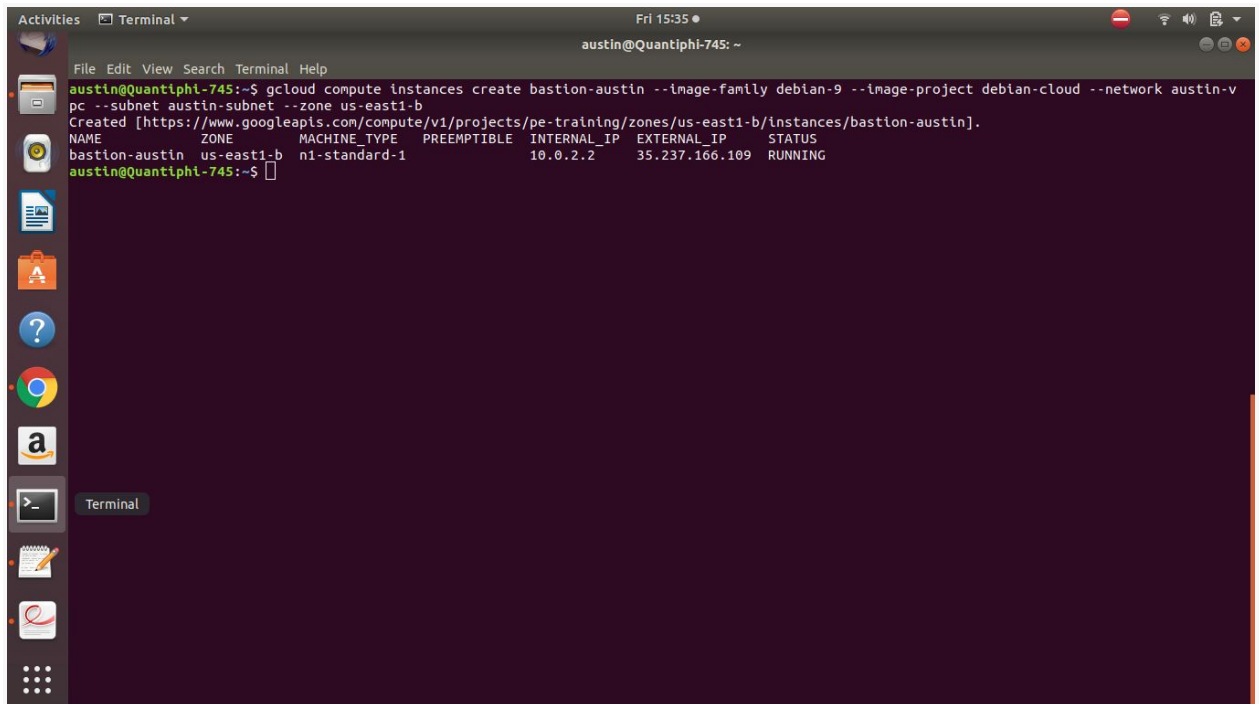
```
gcloud compute networks subnets create austin-subnet --network
austin-vpc --region us-east1 --range 10.0.2.0/24
```



A terminal window titled 'austin@Quantiphi-745: ~' showing the execution of a gcloud command to create a subnet. The command creates a subnet named 'austin-subnet' within the 'austin-vpc' network, in the 'us-east1' region, with the IP range '10.0.2.0/24'. The output shows the subnet is created at a specific URL. A table displays the subnet details: NAME (austin-subnet), REGION (us-east1), NETWORK (austin-vpc), and RANGE (10.0.2.0/24).

```
File Edit View Search Terminal Help
austin@Quantiphi-745:~$ gcloud compute networks subnets create austin-subnet --network austin-vpc --region us-east1 --range 10.0.2.0/24
Created [https://www.googleapis.com/compute/v1/projects/pe-training/regions/us-east1/subnetworks/austin-subnet].
NAME      REGION  NETWORK  RANGE
austin-subnet  us-east1  austin-vpc  10.0.2.0/24
austin@Quantiphi-745:~$
```

```
gcloud compute instances create bastion-austin --image-family debian-9 --image-project debian-cloud --network austin-vpc --subnet austin-subnet --zone us-east1-b
```

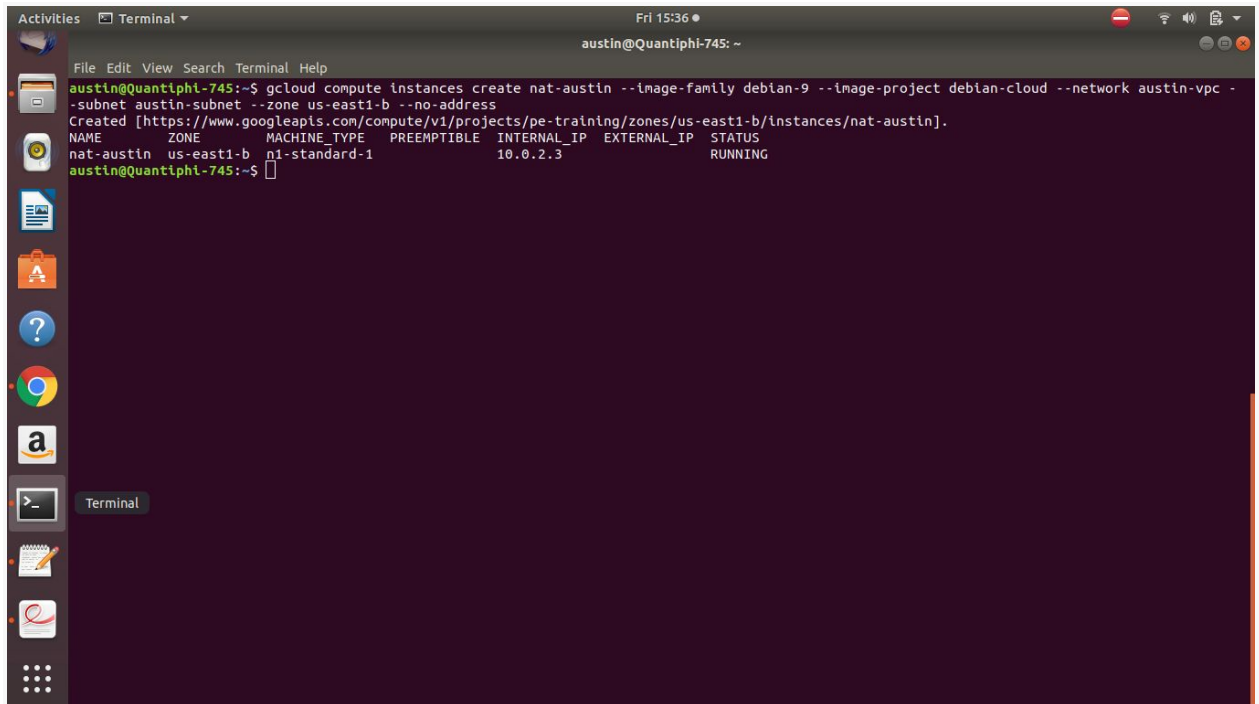
A terminal window titled 'Terminal' with a menu bar (File, Edit, View, Search, Terminal, Help) and a status bar (Fri 15:35, austin@Quantiphi-745: ~). The terminal shows the execution of a gcloud command to create an instance named 'bastion-austin'. The output indicates the instance was created successfully and provides a table of its details.

```
austin@Quantiphi-745:~$ gcloud compute instances create bastion-austin --image-family debian-9 --image-project debian-cloud --network austin-vpc --subnet austin-subnet --zone us-east1-b
Created [https://www.googleapis.com/compute/v1/projects/pe-training/zones/us-east1-b/instances/bastion-austin].
```

NAME	ZONE	MACHINE_TYPE	PREEMPTIBLE	INTERNAL_IP	EXTERNAL_IP	STATUS
bastion-austin	us-east1-b	n1-standard-1		10.0.2.2	35.237.166.109	RUNNING

```
austin@Quantiphi-745:~$
```

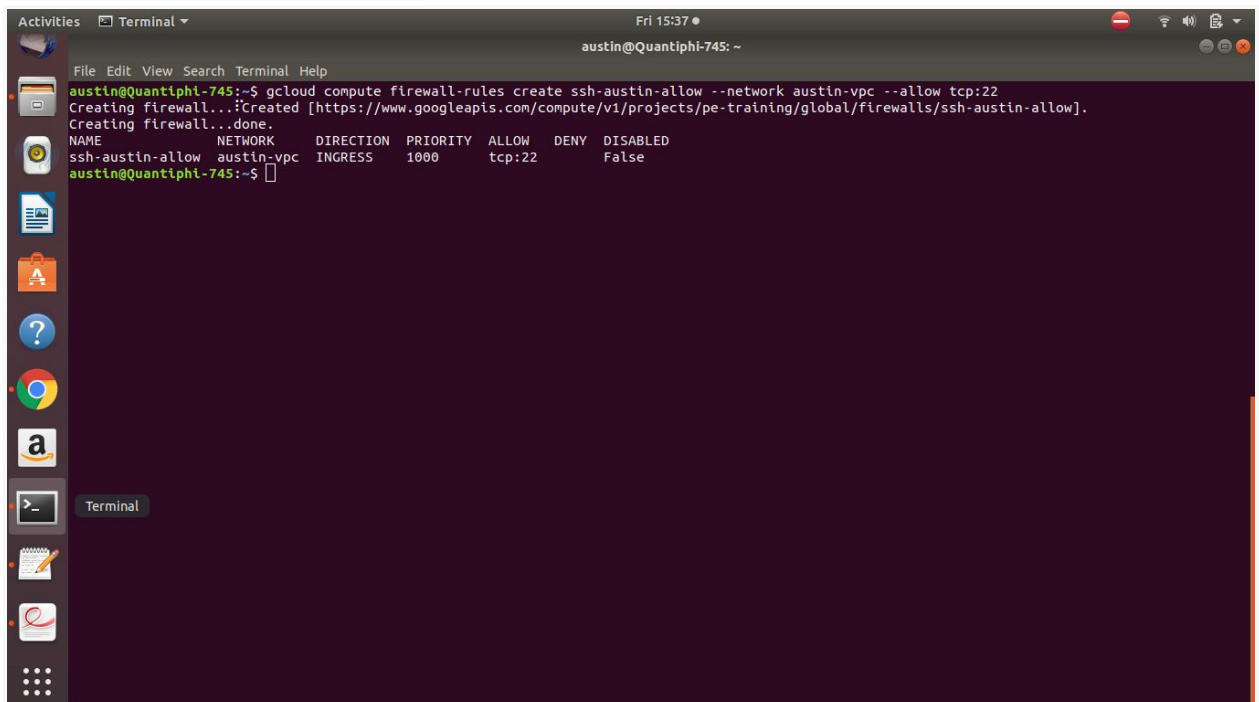
```
gcloud compute instances create nat-austin --image-family debian-9 --image-project debian-cloud --network austin-vpc --subnet austin-subnet --zone us-east1-b --no-address
```



A terminal window titled 'austin@Quantiphi-745: ~' showing the execution of the `gcloud compute instances create` command. The command creates an instance named 'nat-austin' in the 'us-east1-b' zone, using the 'n1-standard-1' machine type and the 'austin-vpc' network. The output shows the instance is in a 'RUNNING' state with an internal IP of 10.0.2.3.

```
austin@Quantiphi-745:~$ gcloud compute instances create nat-austin --image-family debian-9 --image-project debian-cloud --network austin-vpc --subnet austin-subnet --zone us-east1-b --no-address
Created [https://www.googleapis.com/compute/v1/projects/pe-training/zones/us-east1-b/instances/nat-austin].
NAME        ZONE        MACHINE_TYPE  PREEMPTIBLE  INTERNAL_IP  EXTERNAL_IP  STATUS
nat-austin  us-east1-b  n1-standard-1  false        10.0.2.3       
austin@Quantiphi-745:~$
```

```
gcloud compute firewall-rules create ssh-austin-allow --network
austin-vpc --allow tcp:22
```

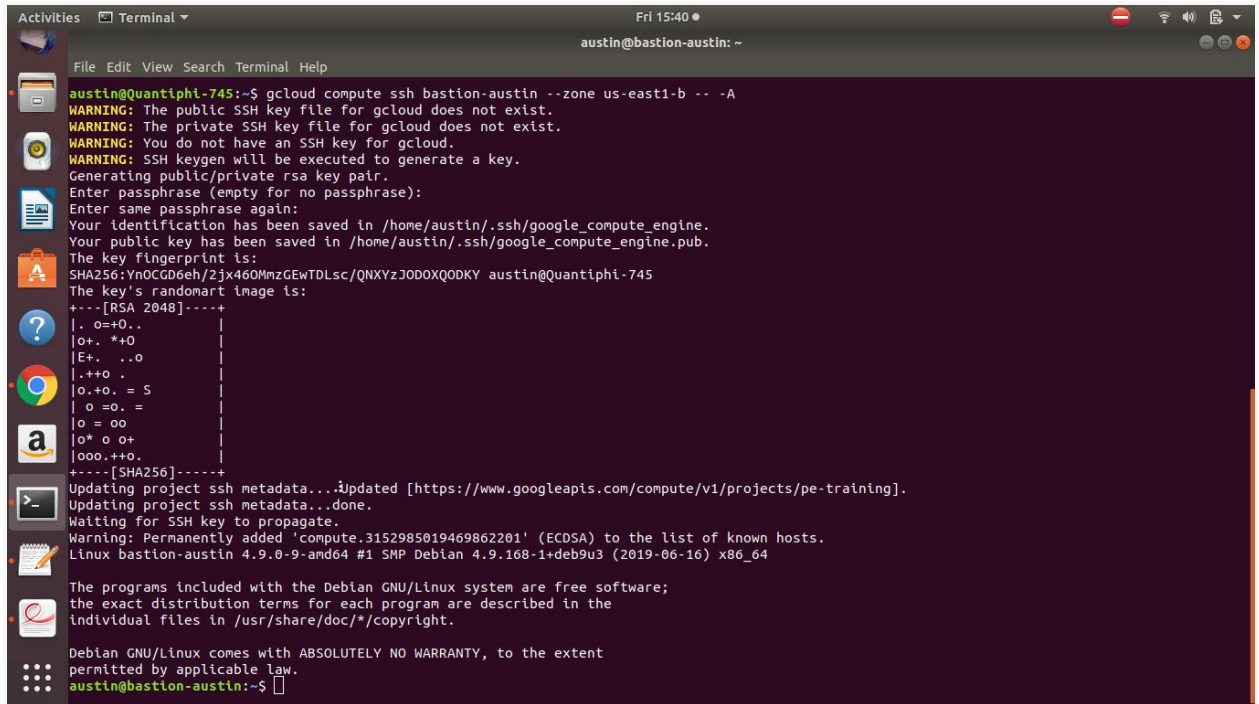


A terminal window titled 'austin@Quantiphi-745: ~' showing the execution of the `gcloud compute firewall-rules create` command. The command creates a firewall rule named 'ssh-austin-allow' in the 'austin-vpc' network, allowing TCP traffic on port 22. The output shows the rule is created successfully.

```
austin@Quantiphi-745:~$ gcloud compute firewall-rules create ssh-austin-allow --network austin-vpc --allow tcp:22
Creating firewall...Created [https://www.googleapis.com/compute/v1/projects/pe-training/global/firewalls/ssh-austin-allow].
Creating firewall...done.
NAME        NETWORK  DIRECTION  PRIORITY  ALLOW  DENY  DISABLED
ssh-austin-allow  austin-vpc  INGRESS    1000      tcp:22    
austin@Quantiphi-745:~$
```

```
ssh-add ~/.ssh/google_compute_engine
```

```
gcloud compute ssh bastion-austin --zone us-east1-b -- -A
```



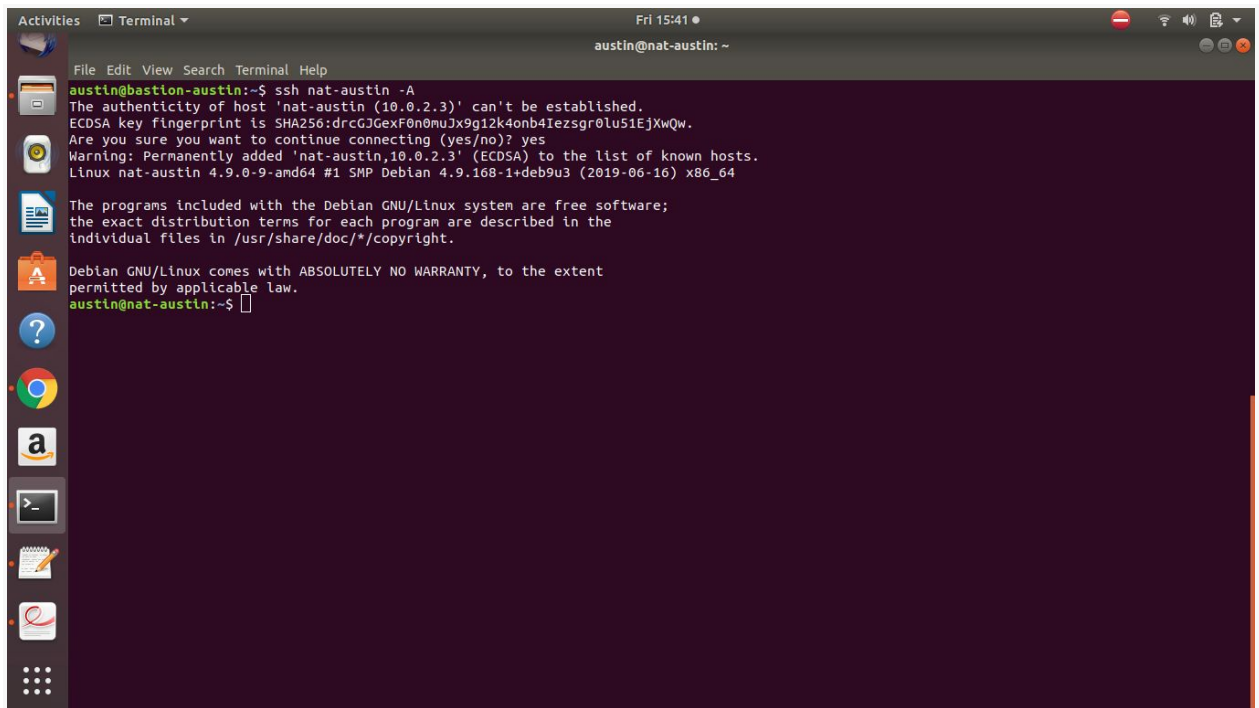
A terminal window titled 'Terminal' with a menu bar (File, Edit, View, Search, Terminal, Help) and a status bar (Fri 15:40, austin@bastion-austin: ~). The terminal shows the execution of the command `gcloud compute ssh bastion-austin --zone us-east1-b -- -A` from the prompt `austin@Quantiphi-745:~$`. The output includes several warnings about missing SSH key files, the generation of a new RSA key pair, and the saving of the public key to `/home/austin/.ssh/google_compute_engine.pub`. It also displays the key fingerprint and the randomart image. The terminal then shows the process of updating project metadata and SSH metadata, followed by a warning about adding a new ECDSA host key for `bastion-austin`. The prompt changes to `austin@bastion-austin:~$`.

```
austin@Quantiphi-745:~$ gcloud compute ssh bastion-austin --zone us-east1-b -- -A
WARNING: The public SSH key file for gcloud does not exist.
WARNING: The private SSH key file for gcloud does not exist.
WARNING: You do not have an SSH key for gcloud.
WARNING: SSH keygen will be executed to generate a key.
Generating public/private rsa key pair.
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in /home/austin/.ssh/google_compute_engine.
Your public key has been saved in /home/austin/.ssh/google_compute_engine.pub.
The key fingerprint is:
SHA256:YnOCGd6eh/2jx460MmzGEwTDLsc/QNXyz3D0XQODKY austin@Quantiphi-745
The key's randomart image is:
+---[RSA 2048]-----+
| . o+=O.. |
|o+ . *+O |
|E+ . ..o |
|.++o . |
|o.+o. = S |
| o =O. = |
|o = oo |
|* o o+ |
|ooo.++o. |
+---[SHA256]-----+
Updating project ssh metadata...Updated [https://www.googleapis.com/compute/v1/projects/pe-training].
Updating project ssh metadata...done.
Waiting for SSH key to propagate.
Warning: Permanently added 'compute.3152985019469862201' (ECDSA) to the list of known hosts.
Linux bastion-austin 4.9.0-9-amd64 #1 SMP Debian 4.9.168-1+deb9u3 (2019-06-16) x86_64

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

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
austin@bastion-austin:~$
```

```
ssh nat-austin -A
```



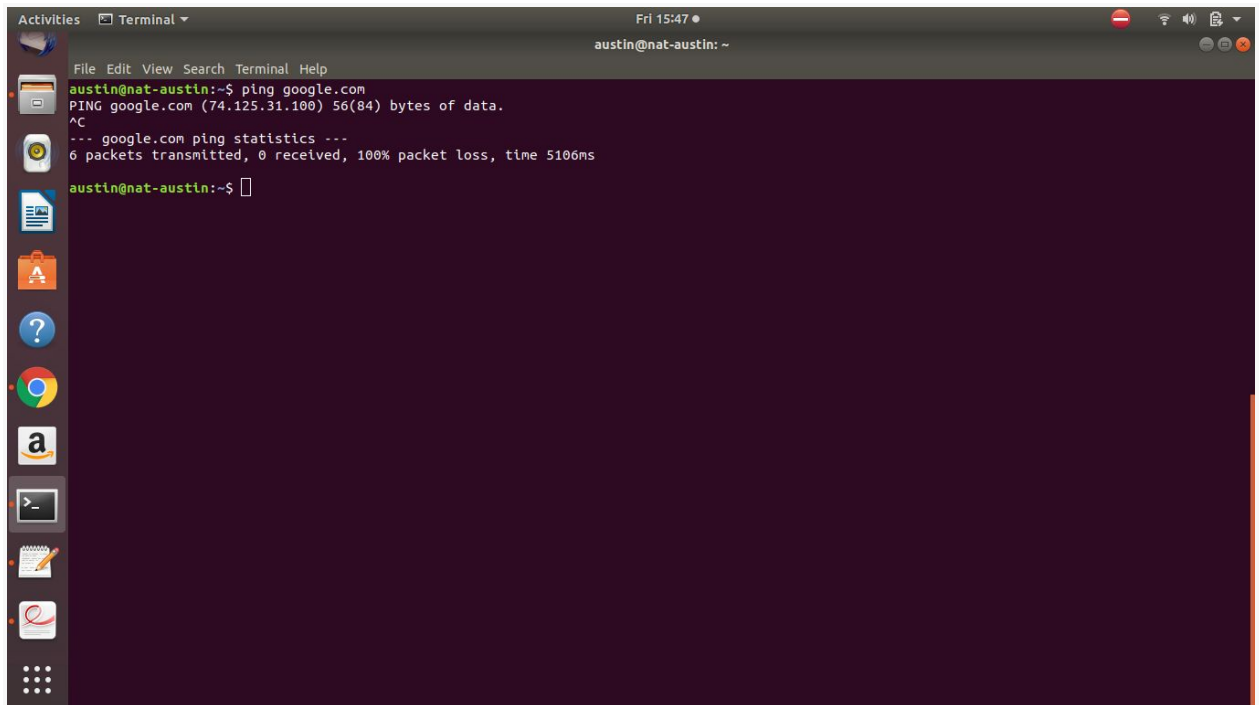
A terminal window titled 'Terminal' with a menu bar (File, Edit, View, Search, Terminal, Help) and a status bar (Fri 15:41, austin@nat-austin: ~). The terminal shows the execution of the command `ssh nat-austin -A` from the prompt `austin@bastion-austin:~$`. The output includes a warning about the authenticity of the host `nat-austin`, the ECDSA key fingerprint, and the user's confirmation to continue connecting. The terminal then shows the process of updating the list of known hosts and the prompt changes to `austin@nat-austin:~$`.

```
austin@bastion-austin:~$ ssh nat-austin -A
The authenticity of host 'nat-austin (10.0.2.3)' can't be established.
ECDSA key fingerprint is SHA256:drcGJGexF0n0muJx9g12k4onb4Iezsgr0lu51EjXwQw.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added 'nat-austin,10.0.2.3' (ECDSA) to the list of known hosts.
Linux nat-austin 4.9.0-9-amd64 #1 SMP Debian 4.9.168-1+deb9u3 (2019-06-16) x86_64

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permitted by applicable law.
austin@nat-austin:~$
```

Cannot ping google.com because there is no internet access

A screenshot of a Linux terminal window. The window title is "Terminal" and the user is "austin@nat-austin". The terminal shows the command "ping google.com" being executed. The output indicates that 6 packets were transmitted but 0 were received, resulting in a 100% packet loss. The user then presses the Ctrl+C key to stop the command.

```
File Edit View Search Terminal Help
austin@nat-austin:~$ ping google.com
PING google.com (74.125.31.100) 56(84) bytes of data.
^C
--- google.com ping statistics ---
6 packets transmitted, 0 received, 100% packet loss, time 5106ms
austin@nat-austin:~$
```

```
gcloud compute routers create nat-austin-router --network austin-vpc
--region us-east1
```

```
gcloud compute routers nats create nat-aus-config --router-region
us-east1 --router nat-austin-router --nat-all-subnet-ip-ranges
--auto-allocate-nat-external-ips
```

```
Activities  Terminal  Fri 15:43
austin@Quantiphi-745: ~
File Edit View Search Terminal Help
austin@Quantiphi-745:~$ gcloud compute routers nats create nat-aus-config --router-region us-east1 --router nat-austin-router --nat-all-subnet
-ip-ranges --auto-allocate-nat-external-ips
Creating NAT [nat-aus-config] in router [nat-austin-router]...done.
austin@Quantiphi-745:~$
```

```
gcloud compute ssh bastion-austin --zone us-east1-b -- -A
```

```
ssh nat-austin -A
```

```
Activities  Terminal  Fri 15:44
austin@nat-austin: ~
File Edit View Search Terminal Help
austin@Quantiphi-745:~$ gcloud compute ssh bastion-austin --zone us-east1-b -- -A
Linux bastion-austin 4.9.0-9-amd64 #1 SMP Debian 4.9.168-1+deb9u3 (2019-06-16) x86_64

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permitted by applicable law.
Last login: Fri Jun 21 10:10:26 2019 from 59.152.53.122
austin@bastion-austin:~$ ssh nat-austin -A
Linux nat-austin 4.9.0-9-amd64 #1 SMP Debian 4.9.168-1+deb9u3 (2019-06-16) x86_64

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

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
Last login: Fri Jun 21 10:11:01 2019 from 10.0.2.2
austin@nat-austin:~$ ping google.com
PING google.com (173.194.217.102) 56(84) bytes of data:
64 bytes from vw-in-f102.1e100.net (173.194.217.102): icmp_seq=1 ttl=52 time=0.858 ms
64 bytes from vw-in-f102.1e100.net (173.194.217.102): icmp_seq=2 ttl=52 time=0.312 ms
64 bytes from vw-in-f102.1e100.net (173.194.217.102): icmp_seq=3 ttl=52 time=0.316 ms
64 bytes from vw-in-f102.1e100.net (173.194.217.102): icmp_seq=4 ttl=52 time=0.363 ms
64 bytes from vw-in-f102.1e100.net (173.194.217.102): icmp_seq=5 ttl=52 time=0.304 ms
64 bytes from vw-in-f102.1e100.net (173.194.217.102): icmp_seq=6 ttl=52 time=0.330 ms
64 bytes from vw-in-f102.1e100.net (173.194.217.102): icmp_seq=7 ttl=52 time=0.321 ms
64 bytes from vw-in-f102.1e100.net (173.194.217.102): icmp_seq=8 ttl=52 time=0.306 ms
^C
--- google.com ping statistics ---
8 packets transmitted, 8 received, 0% packet loss, time 7152ms
rtt min/avg/max/mdev = 0.304/0.388/0.858/0.179 ms
austin@nat-austin:~$
```

