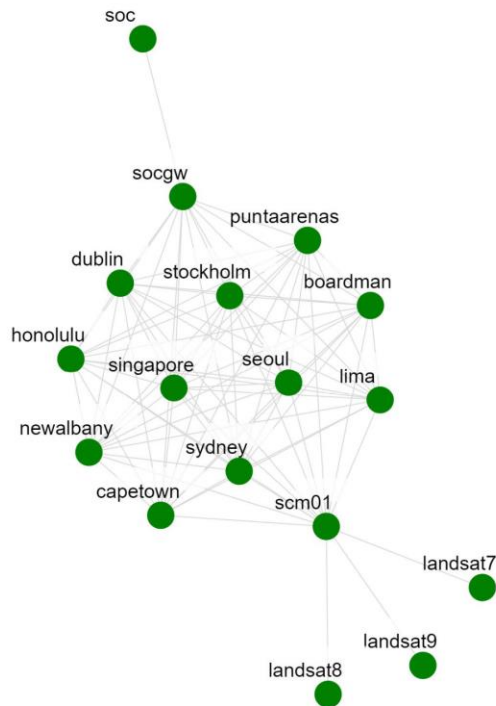# Lab 5
Jupyter Lab/Linux Networking

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CSCI 4406_60L

- ❖ To start of this lab, I created the following topology to explore similarities and differences of GNS3.

❖ Installation of net-tools packages in all the nodes:

    ○ Soc Node

```
csci3306yndw@csci3306yndw:~$ ssh soc
Warning: Permanently added 'soc' (ED25519) to the list of known hosts.
Welcome to Ubuntu 20.04.6 LTS (GNU/Linux 5.4.0-182-generic x86_64)

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

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.

csci3306yndw@soc:~$ sudo apt install net-tools
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following NEW packages will be installed:
  net-tools
0 upgraded, 1 newly installed, 0 to remove and 0 not upgraded.
Need to get 196 kB of archives.
After this operation, 864 kB of additional disk space will be used.
Get:1 http://us.archive.ubuntu.com/ubuntu focal/main amd64 net-tools amd64 1.60+git20180626.aebd88e-1ubuntu1 [196 kB]
Fetched 196 kB in 0s (472 kB/s)
Selecting previously unselected package net-tools.
(Reading database ... 105037 files and directories currently installed.)
Preparing to unpack .../net-tools_1.60+git20180626.aebd88e-1ubuntu1_amd64.deb ...
Unpacking net-tools (1.60+git20180626.aebd88e-1ubuntu1) ...
Setting up net-tools (1.60+git20180626.aebd88e-1ubuntu1) ...
Processing triggers for man-db (2.9.1-1) ...
csci3306yndw@soc:~$ exit
logout
Connection to soc closed.
```

    ○ Socgw Node

```
csci3306yndw@csci3306yndw:~$ ssh socgw
Warning: Permanently added 'socgw' (ED25519) to the list of known hosts.
Welcome to Ubuntu 20.04.6 LTS (GNU/Linux 5.4.0-182-generic x86_64)

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

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applicable law.

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

csci3306yndw@socgw:~$ sudo apt install net-tools
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following NEW packages will be installed:
  net-tools
0 upgraded, 1 newly installed, 0 to remove and 0 not upgraded.
Need to get 196 kB of archives.
After this operation, 864 kB of additional disk space will be used.
Get:1 http://us.archive.ubuntu.com/ubuntu focal/main amd64 net-tools amd64 1.60+git20180626.aebd88e-1ubuntu1 [196 kB]
Fetched 196 kB in 1s (244 kB/s)
Selecting previously unselected package net-tools.
(Reading database ... 105037 files and directories currently installed.)
Preparing to unpack .../net-tools_1.60+git20180626.aebd88e-1ubuntu1_amd64.deb ...
Unpacking net-tools (1.60+git20180626.aebd88e-1ubuntu1) ...
Setting up net-tools (1.60+git20180626.aebd88e-1ubuntu1) ...
Processing triggers for man-db (2.9.1-1) ...
csci3306yndw@socgw:~$ exit
logout
```

○ Dublin Node

```
csci3306yndw@csci3306yndw:~$ ssh dublin
Warning: Permanently added 'dublin' (ED25519) to the list of known hosts.
Welcome to Ubuntu 20.04.6 LTS (GNU/Linux 5.4.0-182-generic x86_64)

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

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individual files in /usr/share/doc/*/copyright.

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applicable law.

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

csci3306yndw@dublin:~$ sudo apt install net-tools
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following NEW packages will be installed:
  net-tools
0 upgraded, 1 newly installed, 0 to remove and 0 not upgraded.
Need to get 196 kB of archives.
After this operation, 864 kB of additional disk space will be used.
Get:1 http://us.archive.ubuntu.com/ubuntu focal/main amd64 net-tools amd64 1.60+git20180626.aebd88e-1ubuntu1 [196 kB]
Fetched 196 kB in 1s (252 kB/s)
Selecting previously unselected package net-tools.
(Reading database ... 105037 files and directories currently installed.)
Preparing to unpack .../net-tools_1.60+git20180626.aebd88e-1ubuntu1_amd64.deb ...
Unpacking net-tools (1.60+git20180626.aebd88e-1ubuntu1) ...
Setting up net-tools (1.60+git20180626.aebd88e-1ubuntu1) ...
Processing triggers for man-db (2.9.1-1) ...
csci3306yndw@dublin:~$ exit
logout
```

○ Puntaarenas Node

```
csci3306yndw@csci3306yndw:~$ ssh puntaarenas
Warning: Permanently added 'puntaarenas' (ED25519) to the list of known hosts.
Welcome to Ubuntu 20.04.6 LTS (GNU/Linux 5.4.0-182-generic x86_64)

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

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.

csci3306yndw@puntaarenas:~$ sudo apt install net-tools
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following NEW packages will be installed:
  net-tools
0 upgraded, 1 newly installed, 0 to remove and 0 not upgraded.
Need to get 196 kB of archives.
After this operation, 864 kB of additional disk space will be used.
Get:1 http://us.archive.ubuntu.com/ubuntu focal/main amd64 net-tools amd64 1.60+git20180626.aebd88e-1ubuntu1 [196 kB]
Fetched 196 kB in 1s (237 kB/s)
Selecting previously unselected package net-tools.
(Reading database ... 105037 files and directories currently installed.)
Preparing to unpack .../net-tools_1.60+git20180626.aebd88e-1ubuntu1_amd64.deb ...
Unpacking net-tools (1.60+git20180626.aebd88e-1ubuntu1) ...
Setting up net-tools (1.60+git20180626.aebd88e-1ubuntu1) ...
Processing triggers for man-db (2.9.1-1) ...
csci3306yndw@puntaarenas:~$ exit
logout
Connection to puntaarenas closed.
```

o Stockholm Node

```
csci3306yndw@csci3306yndw:~$ ssh stockholm
Warning: Permanently added 'stockholm' (ED25519) to the list of known hosts.
Welcome to Ubuntu 20.04.6 LTS (GNU/Linux 5.4.0-182-generic x86_64)

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

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.

csci3306yndw@stockholm:~$ sudo apt install net-tools
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following NEW packages will be installed:
  net-tools
0 upgraded, 1 newly installed, 0 to remove and 0 not upgraded.
Need to get 196 kB of archives.
After this operation, 864 kB of additional disk space will be used.
Get:1 http://us.archive.ubuntu.com/ubuntu focal/main amd64 net-tools amd64 1.60+git20180626.aebd88e-1ubuntu1 [196 kB]
Fetched 196 kB in 0s (477 kB/s)
Selecting previously unselected package net-tools.
(Reading database ... 105037 files and directories currently installed.)
Preparing to unpack .../net-tools_1.60+git20180626.aebd88e-1ubuntu1_amd64.deb ...
Unpacking net-tools (1.60+git20180626.aebd88e-1ubuntu1) ...
Setting up net-tools (1.60+git20180626.aebd88e-1ubuntu1) ...
Processing triggers for man-db (2.9.1-1) ...
csci3306yndw@stockholm:~$ exit
logout
Connection to stockholm closed.
```

o Honolulu Node

```
csci3306yndw@csci3306yndw:~$ ssh honolulu
Warning: Permanently added 'honolulu' (ED25519) to the list of known hosts.
Welcome to Ubuntu 20.04.6 LTS (GNU/Linux 5.4.0-182-generic x86_64)

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

The programs included with the Ubuntu system are free software;
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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.

csci3306yndw@honolulu:~$ sudo apt install net-tools
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following NEW packages will be installed:
  net-tools
0 upgraded, 1 newly installed, 0 to remove and 0 not upgraded.
Need to get 196 kB of archives.
After this operation, 864 kB of additional disk space will be used.
Get:1 http://us.archive.ubuntu.com/ubuntu focal/main amd64 net-tools amd64 1.60+git20180626.aebd88e-1ubuntu1 [196 kB]
Fetched 196 kB in 0s (477 kB/s)
Selecting previously unselected package net-tools.
(Reading database ... 105037 files and directories currently installed.)
Preparing to unpack .../net-tools_1.60+git20180626.aebd88e-1ubuntu1_amd64.deb ...
Unpacking net-tools (1.60+git20180626.aebd88e-1ubuntu1) ...
Setting up net-tools (1.60+git20180626.aebd88e-1ubuntu1) ...
Processing triggers for man-db (2.9.1-1) ...
csci3306yndw@honolulu:~$ exit
logout
Connection to honolulu closed.
```

o Boardman Node

```
csci3306yndw@csci3306yndw:~$ ssh boardman
Warning: Permanently added 'boardman' (ED25519) to the list of known hosts.
Welcome to Ubuntu 20.04.6 LTS (GNU/Linux 5.4.0-182-generic x86_64)

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

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individual files in /usr/share/doc/*/copyright.

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applicable law.

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

csci3306yndw@boardman:~$ sudo apt install net-tools
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following NEW packages will be installed:
  net-tools
0 upgraded, 1 newly installed, 0 to remove and 0 not upgraded.
Need to get 196 kB of archives.
After this operation, 864 kB of additional disk space will be used.
Get:1 http://us.archive.ubuntu.com/ubuntu focal/main amd64 net-tools amd64 1.60+git20180626.aebd88e-1ubuntu1 [196 kB]
Fetched 196 kB in 0s (478 kB/s)
Selecting previously unselected package net-tools.
(Reading database ... 105037 files and directories currently installed.)
Preparing to unpack .../net-tools_1.60+git20180626.aebd88e-1ubuntu1_amd64.deb ...
Unpacking net-tools (1.60+git20180626.aebd88e-1ubuntu1) ...
Setting up net-tools (1.60+git20180626.aebd88e-1ubuntu1) ...
Processing triggers for man-db (2.9.1-1) ...
csci3306yndw@boardman:~$ exit
logout
Connection to boardman closed.
```

o Singapore Node

```
csci3306yndw@csci3306yndw:~$ ssh singapore
Warning: Permanently added 'singapore' (ED25519) to the list of known hosts.
Welcome to Ubuntu 20.04.6 LTS (GNU/Linux 5.4.0-182-generic x86_64)

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

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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.

csci3306yndw@singapore:~$ sudo apt install net-tools
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following NEW packages will be installed:
  net-tools
0 upgraded, 1 newly installed, 0 to remove and 0 not upgraded.
Need to get 196 kB of archives.
After this operation, 864 kB of additional disk space will be used.
Get:1 http://us.archive.ubuntu.com/ubuntu focal/main amd64 net-tools amd64 1.60+git20180626.aebd88e-1ubuntu1 [196 kB]
Fetched 196 kB in 0s (476 kB/s)
Selecting previously unselected package net-tools.
(Reading database ... 105037 files and directories currently installed.)
Preparing to unpack .../net-tools_1.60+git20180626.aebd88e-1ubuntu1_amd64.deb ...
Unpacking net-tools (1.60+git20180626.aebd88e-1ubuntu1) ...
Setting up net-tools (1.60+git20180626.aebd88e-1ubuntu1) ...
Processing triggers for man-db (2.9.1-1) ...
csci3306yndw@singapore:~$ exit
logout
Connection to singapore closed.
```

Seoul Node

```
csci3306yndw@csci3306yndw:~$ ssh seoul
Warning: Permanently added 'seoul' (ED25519) to the list of known hosts.
Welcome to Ubuntu 20.04.6 LTS (GNU/Linux 5.4.0-182-generic x86_64)

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

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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.

csci3306yndw@seoul:~$ sudo apt install net-tools
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following NEW packages will be installed:
  net-tools
0 upgraded, 1 newly installed, 0 to remove and 0 not upgraded.
Need to get 196 kB of archives.
After this operation, 864 kB of additional disk space will be used.
Get:1 http://us.archive.ubuntu.com/ubuntu focal/main amd64 net-tools amd64 1.60+git20180626.aebd88e-1ubuntu1 [196 kB]
Fetched 196 kB in 1s (239 kB/s)
Selecting previously unselected package net-tools.
(Reading database ... 105037 files and directories currently installed.)
Preparing to unpack .../net-tools_1.60+git20180626.aebd88e-1ubuntu1_amd64.deb ...
Unpacking net-tools (1.60+git20180626.aebd88e-1ubuntu1) ...
Setting up net-tools (1.60+git20180626.aebd88e-1ubuntu1) ...
Processing triggers for man-db (2.9.1-1) ...
csci3306yndw@seoul:~$ exit
logout
Connection to seoul closed.
```

Newalbany Node

```
csci3306yndw@csci3306yndw:~$ ssh newalbany
Warning: Permanently added 'newalbany' (ED25519) to the list of known hosts.
Welcome to Ubuntu 20.04.6 LTS (GNU/Linux 5.4.0-182-generic x86_64)

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

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individual files in /usr/share/doc/*/copyright.

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applicable law.

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

csci3306yndw@newalbany:~$ sudo apt install net-tools
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following NEW packages will be installed:
  net-tools
0 upgraded, 1 newly installed, 0 to remove and 0 not upgraded.
Need to get 196 kB of archives.
After this operation, 864 kB of additional disk space will be used.
Get:1 http://us.archive.ubuntu.com/ubuntu focal/main amd64 net-tools amd64 1.60+git20180626.aebd88e-1ubuntu1 [196 kB]
Fetched 196 kB in 0s (477 kB/s)
Selecting previously unselected package net-tools.
(Reading database ... 105037 files and directories currently installed.)
Preparing to unpack .../net-tools_1.60+git20180626.aebd88e-1ubuntu1_amd64.deb ...
Unpacking net-tools (1.60+git20180626.aebd88e-1ubuntu1) ...
Setting up net-tools (1.60+git20180626.aebd88e-1ubuntu1) ...
Processing triggers for man-db (2.9.1-1) ...
csci3306yndw@newalbany:~$ exit
logout
Connection to newalbany closed.
```

○ Lima Node

```
csci3306yndw@csci3306yndw:~$ ssh lima
Warning: Permanently added 'lima' (ED25519) to the list of known hosts.
Welcome to Ubuntu 20.04.6 LTS (GNU/Linux 5.4.0-182-generic x86_64)

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

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applicable law.

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

csci3306yndw@lima:~$ sudo apt install net-tools
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following NEW packages will be installed:
  net-tools
0 upgraded, 1 newly installed, 0 to remove and 0 not upgraded.
Need to get 196 kB of archives.
After this operation, 864 kB of additional disk space will be used.
Get:1 http://us.archive.ubuntu.com/ubuntu focal/main amd64 net-tools amd64 1.60+git20180626.aebd88e-1ubuntu1 [196 kB]
Fetched 196 kB in 1s (252 kB/s)
Selecting previously unselected package net-tools.
(Reading database ... 105037 files and directories currently installed.)
Preparing to unpack .../net-tools_1.60+git20180626.aebd88e-1ubuntu1_amd64.deb ...
Unpacking net-tools (1.60+git20180626.aebd88e-1ubuntu1) ...
Setting up net-tools (1.60+git20180626.aebd88e-1ubuntu1) ...
Processing triggers for man-db (2.9.1-1) ...
csci3306yndw@lima:~$ exit
logout
Connection to lima closed.
```

○ Capetown Node

```
csci3306yndw@csci3306yndw:~$ ssh capetown
Warning: Permanently added 'capetown' (ED25519) to the list of known hosts.
Welcome to Ubuntu 20.04.6 LTS (GNU/Linux 5.4.0-182-generic x86_64)

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

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individual files in /usr/share/doc/*/copyright.

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applicable law.

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

csci3306yndw@capetown:~$ sudo apt install net-tools
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following NEW packages will be installed:
  net-tools
0 upgraded, 1 newly installed, 0 to remove and 0 not upgraded.
Need to get 196 kB of archives.
After this operation, 864 kB of additional disk space will be used.
Get:1 http://us.archive.ubuntu.com/ubuntu focal/main amd64 net-tools amd64 1.60+git20180626.aebd88e-1ubuntu1 [196 kB]
Fetched 196 kB in 0s (481 kB/s)
Selecting previously unselected package net-tools.
(Reading database ... 105037 files and directories currently installed.)
Preparing to unpack .../net-tools_1.60+git20180626.aebd88e-1ubuntu1_amd64.deb ...
Unpacking net-tools (1.60+git20180626.aebd88e-1ubuntu1) ...
Setting up net-tools (1.60+git20180626.aebd88e-1ubuntu1) ...
Processing triggers for man-db (2.9.1-1) ...
csci3306yndw@capetown:~$ exit
logout
Connection to capetown closed.
```

o Sydney Node

```
csci3306yndw@csci3306yndw:~$ ssh sydney
Warning: Permanently added 'sydney' (ED25519) to the list of known hosts.
Welcome to Ubuntu 20.04.6 LTS (GNU/Linux 5.4.0-182-generic x86_64)

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

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applicable law.

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

csci3306yndw@sydney:~$ sudo apt install net-tools
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following NEW packages will be installed:
  net-tools
0 upgraded, 1 newly installed, 0 to remove and 0 not upgraded.
Need to get 196 kB of archives.
After this operation, 864 kB of additional disk space will be used.
Get:1 http://us.archive.ubuntu.com/ubuntu focal/main amd64 net-tools amd64 1.60+git20180626.aebd88e-1ubuntu1 [196 kB]
Fetched 196 kB in 0s (484 kB/s)
Selecting previously unselected package net-tools.
(Reading database ... 105037 files and directories currently installed.)
Preparing to unpack .../net-tools_1.60+git20180626.aebd88e-1ubuntu1_amd64.deb ...
Unpacking net-tools (1.60+git20180626.aebd88e-1ubuntu1) ...
Setting up net-tools (1.60+git20180626.aebd88e-1ubuntu1) ...
Processing triggers for man-db (2.9.1-1) ...
csci3306yndw@sydney:~$ exit
logout
Connection to svdnev closed.
```

o SCM01 Node

```
csci3306yndw@csci3306yndw:~$ ssh scm01
Warning: Permanently added 'scm01' (ED25519) to the list of known hosts.
Welcome to Ubuntu 20.04.6 LTS (GNU/Linux 5.4.0-182-generic x86_64)

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

The programs included with the Ubuntu system are free software;
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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.

csci3306yndw@scm01:~$ sudo apt install net-tools
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following NEW packages will be installed:
  net-tools
0 upgraded, 1 newly installed, 0 to remove and 0 not upgraded.
Need to get 196 kB of archives.
After this operation, 864 kB of additional disk space will be used.
Get:1 http://us.archive.ubuntu.com/ubuntu focal/main amd64 net-tools amd64 1.60+git20180626.aebd88e-1ubuntu1 [196 kB]
Fetched 196 kB in 1s (206 kB/s)
Selecting previously unselected package net-tools.
(Reading database ... 105037 files and directories currently installed.)
Preparing to unpack .../net-tools_1.60+git20180626.aebd88e-1ubuntu1_amd64.deb ...
Unpacking net-tools (1.60+git20180626.aebd88e-1ubuntu1) ...
Setting up net-tools (1.60+git20180626.aebd88e-1ubuntu1) ...
Processing triggers for man-db (2.9.1-1) ...
csci3306yndw@scm01:~$ exit
logout
Connection to scm01 closed.
```

○ Landsat7 Node

```
csci3306yndw@csci3306yndw:~$ ssh landsat7
Warning: Permanently added 'landsat7' (ED25519) to the list of known hosts.
Welcome to Ubuntu 20.04.6 LTS (GNU/Linux 5.4.0-182-generic x86_64)

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

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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.

csci3306yndw@landsat7:~$ sudo apt install net-tools
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following NEW packages will be installed:
  net-tools
0 upgraded, 1 newly installed, 0 to remove and 0 not upgraded.
Need to get 196 kB of archives.
After this operation, 864 kB of additional disk space will be used.
Get:1 http://us.archive.ubuntu.com/ubuntu focal/main amd64 net-tools amd64 1.60+git20180626.aebd88e-1ubuntu1 [196 kB]
Fetched 196 kB in 1s (244 kB/s)
Selecting previously unselected package net-tools.
(Reading database ... 105037 files and directories currently installed.)
Preparing to unpack .../net-tools_1.60+git20180626.aebd88e-1ubuntu1_amd64.deb ...
Unpacking net-tools (1.60+git20180626.aebd88e-1ubuntu1) ...
Setting up net-tools (1.60+git20180626.aebd88e-1ubuntu1) ...
Processing triggers for man-db (2.9.1-1) ...
csci3306yndw@landsat7:~$ exit
logout
Connection to landsat7 closed.
```

○ Landsat8 Node

```
csci3306yndw@csci3306yndw:~$ ssh landsat8
Warning: Permanently added 'landsat8' (ED25519) to the list of known hosts.
Welcome to Ubuntu 20.04.6 LTS (GNU/Linux 5.4.0-182-generic x86_64)

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

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.

csci3306yndw@landsat8:~$ sudo apt install net-tools
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following NEW packages will be installed:
  net-tools
0 upgraded, 1 newly installed, 0 to remove and 0 not upgraded.
Need to get 196 kB of archives.
After this operation, 864 kB of additional disk space will be used.
Get:1 http://us.archive.ubuntu.com/ubuntu focal/main amd64 net-tools amd64 1.60+git20180626.aebd88e-1ubuntu1 [196 kB]
Fetched 196 kB in 1s (245 kB/s)
Selecting previously unselected package net-tools.
(Reading database ... 105037 files and directories currently installed.)
Preparing to unpack .../net-tools_1.60+git20180626.aebd88e-1ubuntu1_amd64.deb ...
Unpacking net-tools (1.60+git20180626.aebd88e-1ubuntu1) ...
Setting up net-tools (1.60+git20180626.aebd88e-1ubuntu1) ...
Processing triggers for man-db (2.9.1-1) ...
csci3306yndw@landsat8:~$ exit
logout
Connection to landsat8 closed.
```

Landsat9 Node

```
csci3306yndw@csci3306yndw:~$ ssh landsat9
Warning: Permanently added 'landsat9' (ED25519) to the list of known hosts.
Welcome to Ubuntu 20.04.6 LTS (GNU/Linux 5.4.0-182-generic x86_64)

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

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.

csci3306yndw@landsat9:~$ sudo apt install net-tools
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following NEW packages will be installed:
  net-tools
0 upgraded, 1 newly installed, 0 to remove and 0 not upgraded.
Need to get 196 kB of archives.
After this operation, 864 kB of additional disk space will be used.
Get:1 http://us.archive.ubuntu.com/ubuntu focal/main amd64 net-tools amd64 1.60+git20180626.aebd88e-1ubuntu1 [196 kB]
Fetched 196 kB in 1s (211 kB/s)
Selecting previously unselected package net-tools.
(Reading database ... 105037 files and directories currently installed.)
Preparing to unpack .../net-tools_1.60+git20180626.aebd88e-1ubuntu1_amd64.deb ...
Unpacking net-tools (1.60+git20180626.aebd88e-1ubuntu1) ...
Setting up net-tools (1.60+git20180626.aebd88e-1ubuntu1) ...
Processing triggers for man-db (2.9.1-1) ...
csci3306yndw@landsat9:~$ exit
logout
Connection to landsat9 closed.
```

❖ Route/Ifconfigs on all nodes:

o **Soc Node:**

```
csci3306yndw@soc:~$ route
Kernel IP routing table
Destination     Gateway         Genmask          Flags Metric Ref    Use Iface
default         172.30.0.1      0.0.0.0          UG    512    0        0 eth0
10.5.2.0        0.0.0.0         255.255.255.0    U     0      0        0 eth1
172.30.0.0      0.0.0.0         255.255.0.0      U     0      0        0 eth0
172.30.0.1      0.0.0.0         255.255.255.255  UH    512    0        0 eth0
192.168.254.0   172.30.0.1      255.255.255.0    UG    99     0        0 eth0
csci3306yndw@soc:~$ ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 172.30.0.24  netmask 255.255.0.0  broadcast 172.30.255.255
        inet6 fe80::400c:e9ff:fef6:50e2  prefixlen 64  scopeid 0x20<link>
        ether 42:0c:e9:f6:50:e2  txqueuelen 1000  (Ethernet)
        RX packets 4224  bytes 541116 (541.1 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 3427  bytes 397814 (397.8 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 10.5.2.2  netmask 255.255.255.0  broadcast 10.5.2.255
        inet6 fe80::201b:9aff:fe03:61c8  prefixlen 64  scopeid 0x20<link>
        ether 22:1b:9a:03:61:c8  txqueuelen 1000  (Ethernet)
        RX packets 114  bytes 8432 (8.4 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 37  bytes 2686 (2.6 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING>  mtu 65536
        inet 127.0.0.1  netmask 255.0.0.0
        inet6 ::1  prefixlen 128  scopeid 0x10<host>
        loop  txqueuelen 1000  (Local Loopback)
        RX packets 0  bytes 0 (0.0 B)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 0  bytes 0 (0.0 B)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

I see that the default IP address and IP address 192.168.254.0 are the same. Looks like the Soc node's generated IP address is 10.5.2.0. Additionally, eth0 and eth1: These are the Ethernet interfaces for Soc Node. They have

unique MAC addresses (e.g., 42:0c:e9:f6:50:e2 for eth0) and IP addresses (e.g., 172.30.0.24 for eth0).

RX packets: Received packets and their total bytes.

TX packets: Transmitted packets and their total bytes.

Errors, dropped, overruns, frame, carrier, collisions: These fields show any issues with packet transmission or reception.

lo: This is the loopback interface, used for internal communication within the host. It has the IP address 127.0.0.1.

- o **Socgw Node:**

```
csci3306yndw@socgw:~$ route
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
default         172.30.0.1      0.0.0.0         UG    512    0        0 eth0
10.5.1.0        0.0.0.0         255.255.255.0   U     0      0        0 eth1
10.5.2.0        0.0.0.0         255.255.255.0   U     0      0        0 eth2
172.30.0.0      0.0.0.0         255.255.0.0     U     0      0        0 eth0
172.30.0.1      0.0.0.0         255.255.255.255 UH    512    0        0 eth0
192.168.254.0   172.30.0.1      255.255.255.0   UG    99     0        0 eth0
csci3306yndw@socgw:~$ ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 172.30.0.25  netmask 255.255.0.0  broadcast 172.30.255.255
        inet6 fe80::f8fe:f4ff:fee9:5300  prefixlen 64  scopeid 0x20<link>
        ether fa:fe:f4:e9:53:00  txqueuelen 1000  (Ethernet)
        RX packets 4171  bytes 537958 (537.9 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 3361  bytes 401060 (401.0 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 10.5.1.1  netmask 255.255.255.0  broadcast 10.5.1.255
        inet6 fe80::18df:4bff:fe76:7118  prefixlen 64  scopeid 0x20<link>
        ether 1a:df:4b:76:71:18  txqueuelen 1000  (Ethernet)
        RX packets 656  bytes 47152 (47.1 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 37  bytes 2686 (2.6 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

eth2: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 10.5.2.1  netmask 255.255.255.0  broadcast 10.5.2.255
        inet6 fe80::6084:24ff:fe54:7ae5  prefixlen 64  scopeid 0x20<link>
        ether 62:84:24:54:7a:e5  txqueuelen 1000  (Ethernet)
        RX packets 108  bytes 7892 (7.8 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 37  bytes 2686 (2.6 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING>  mtu 65536
        inet 127.0.0.1  netmask 255.0.0.0
        inet6 ::1  prefixlen 128  scopeid 0x10<host>
        loop  txqueuelen 1000  (Local Loopback)
        RX packets 0  bytes 0 (0.0 B)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 0  bytes 0 (0.0 B)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

The default IP address for Socgw Node is 172.30.0.1.

eth 0:

- ▪ IP Address: 172.30.0.25
- ▪ MAC Address: fa:fe:f4:e9:53:00
- ▪ RX/TX Packets: 4171/3361

eth 1:

- ▪ IP Address: 10.5.1.1
- ▪ MAC Address: 1a:df:4b:76:71:18
- ▪ RX/TX Packets: 656/37

eth 2:

- IP Address: 10.5.2.1
- MAC Address: 62:84:24:54:7a:e5
- RX/TX Packets: 108/37

lo (Loopback):

- IP Address: 127.0.0.1

o **Dublin Node:**

```
csci3306yndw@dublin:~$ route
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
default         172.30.0.1      0.0.0.0         UG    512    0        0 eth0
10.1.7.0        0.0.0.0         255.255.255.0   U     0      0        0 eth1
10.5.1.0        0.0.0.0         255.255.255.0   U     0      0        0 eth2
172.30.0.0      0.0.0.0         255.255.0.0     U     0      0        0 eth0
172.30.0.1      0.0.0.0         255.255.255.255 UH    512    0        0 eth0
192.168.254.0   172.30.0.1      255.255.255.0   UG    99     0        0 eth0
csci3306yndw@dublin:~$ ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 172.30.0.13  netmask 255.255.0.0  broadcast 172.30.255.255
        inet6 fe80::4c34:77ff:fe25:2aa5  prefixlen 64  scopeid 0x20<link>
        ether 4e:34:77:25:2a:a5  txqueuelen 1000  (Ethernet)
        RX packets 4176  bytes 536969 (536.9 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 3387  bytes 406321 (406.3 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 10.1.7.1  netmask 255.255.255.0  broadcast 10.1.7.255
        inet6 fe80::ec32:abff:fee9:65ad  prefixlen 64  scopeid 0x20<link>
        ether ee:32:ab:e9:65:ad  txqueuelen 1000  (Ethernet)
        RX packets 168  bytes 12132 (12.1 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 37  bytes 2686 (2.6 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

eth2: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 10.5.1.9  netmask 255.255.255.0  broadcast 10.5.1.255
        inet6 fe80::459:17ff:feb9:a040  prefixlen 64  scopeid 0x20<link>
        ether 06:59:17:b9:a0:40  txqueuelen 1000  (Ethernet)
        RX packets 655  bytes 47122 (47.1 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 37  bytes 2686 (2.6 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING>  mtu 65536
        inet 127.0.0.1  netmask 255.0.0.0
        inet6 ::1  prefixlen 128  scopeid 0x10<host>
        loop  txqueuelen 1000  (Local Loopback)
        RX packets 0  bytes 0 (0.0 B)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 0  bytes 0 (0.0 B)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

eth 0:

- IP Address: 172.30.0.13
- MAC Address: 4e:34:77:25:2a:a5
- RX/TX Packets: 4176/3387

eth 1:

- IP Address: 10.1.7.1
- MAC Address: ee:32:ab:e9:65:ad
- RX/TX Packets: 168/37

eth 2:

- IP Address: 10.5.1.9
- MAC Address: 06:59:17:b9:a0:40

■ RX/TX Packets: 655/37

lo (Loopback):

■ IP Address: 127.0.0.1

o **Puntaarenas Node:**

```
csci3306yndw@puntaarenas:~$ route
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
default         172.30.0.1      0.0.0.0         UG    512    0        0 eth0
10.1.10.0       0.0.0.0         255.255.255.0   U     0      0        0 eth1
10.5.1.0        0.0.0.0         255.255.255.0   U     0      0        0 eth2
172.30.0.0      0.0.0.0         255.255.0.0     U     0      0        0 eth0
172.30.0.1      0.0.0.0         255.255.255.255 UH    512    0        0 eth0
192.168.254.0   172.30.0.1      255.255.255.0   UG    99     0        0 eth0
csci3306yndw@puntaarenas:~$ ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 172.30.0.20  netmask 255.255.0.0  broadcast 172.30.255.255
        inet6 fe80::c449:6eff:fe00:3494  prefixlen 64  scopeid 0x20<link>
        ether c6:49:6e:00:34:94  txqueuelen 1000  (Ethernet)
        RX packets 4268  bytes 547362 (547.3 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 3430  bytes 427307 (427.3 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 10.1.10.1  netmask 255.255.255.0  broadcast 10.1.10.255
        inet6 fe80::b49a:52ff:fef8:30f  prefixlen 64  scopeid 0x20<link>
        ether b6:9a:52:f8:03:0f  txqueuelen 1000  (Ethernet)
        RX packets 163  bytes 11562 (11.5 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 37  bytes 2686 (2.6 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

eth2: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 10.5.1.12  netmask 255.255.255.0  broadcast 10.5.1.255
        inet6 fe80::7465:bbff:feac:8e49  prefixlen 64  scopeid 0x20<link>
        ether 76:65:bb:ac:8e:49  txqueuelen 1000  (Ethernet)
        RX packets 654  bytes 46892 (46.8 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 38  bytes 2756 (2.7 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING>  mtu 65536
        inet 127.0.0.1  netmask 255.0.0.0
        inet6 ::1  prefixlen 128  scopeid 0x10<host>
        loop  txqueuelen 1000  (Local Loopback)
        RX packets 0  bytes 0 (0.0 B)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 0  bytes 0 (0.0 B)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

eth 0:

■ IP Address: 172.30.0.20

■ MAC Address: c6:49:6e:00:34:94

■ RX/TX Packets: 4268/3430

eth 1:

■ IP Address: 10.1.10.1

■ MAC Address: b6:9a:52:f8:03:0f

■ RX/TX Packets: 163/37

eth 2:

■ IP Address: 10.5.1.12

■ MAC Address: 76:65:bb:ac:8e:49

■ RX/TX Packets: 654/38

lo (Loopback):

■ IP Address: 127.0.0.1

o Stockholm Node:

```
csci3306yndw@stockholm:~$ route
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
default         172.30.0.1      0.0.0.0         UG    512    0        0 eth0
10.1.2.0        0.0.0.0         255.255.255.0   U     0      0        0 eth1
10.5.1.0        0.0.0.0         255.255.255.0   U     0      0        0 eth2
172.30.0.0      0.0.0.0         255.255.0.0     U     0      0        0 eth0
172.30.0.1      0.0.0.0         255.255.255.255 UH    512    0        0 eth0
192.168.254.0   172.30.0.1      255.255.255.0   UG    99     0        0 eth0
csci3306yndw@stockholm:~$ ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 172.30.0.26  netmask 255.255.0.0  broadcast 172.30.255.255
        inet6 fe80::58d8:97ff:fe9a:b741  prefixlen 64  scopeid 0x20<link>
        ether 5a:d8:97:9a:b7:41  txqueuelen 1000  (Ethernet)
        RX packets 4190  bytes 537905 (537.9 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 3412  bytes 418080 (418.0 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 10.1.2.1  netmask 255.255.255.0  broadcast 10.1.2.255
        inet6 fe80::187e:e5ff:fe54:3d41  prefixlen 64  scopeid 0x20<link>
        ether 1a:7e:e5:54:3d:41  txqueuelen 1000  (Ethernet)
        RX packets 164  bytes 11712 (11.7 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 37  bytes 2686 (2.6 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

eth2: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 10.5.1.4  netmask 255.255.255.0  broadcast 10.5.1.255
        inet6 fe80::d847:44ff:fe05:77c6  prefixlen 64  scopeid 0x20<link>
        ether da:47:44:05:77:c6  txqueuelen 1000  (Ethernet)
        RX packets 653  bytes 46902 (46.9 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 37  bytes 2686 (2.6 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING>  mtu 65536
        inet 127.0.0.1  netmask 255.0.0.0
        inet6 ::1  prefixlen 128  scopeid 0x10<host>
        loop  txqueuelen 1000  (Local Loopback)
        RX packets 0  bytes 0 (0.0 B)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 0  bytes 0 (0.0 B)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

eth 0:

- IP Address: 172.30.0.26
- MAC Address: 5a:d8:97:9a:b7:41
- RX/TX Packets: 4190/3412

eth 1:

- IP Address: 10.1.2.1
- MAC Address: 1a:7e:e5:54:3d:41
- RX/TX Packets: 164/37

eth 2:

- IP Address: 10.5.1.4
- MAC Address: da:47:44:05:77:c6
- RX/TX Packets: 653/37

lo (Loopback):

- IP Address: 127.0.0.1

o Honolulu Node:

```
csci3306yndw@honolulu:~$ route
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
default         172.30.0.1      0.0.0.0         UG    512    0        0 eth0
10.1.4.0        0.0.0.0         255.255.255.0   U     0      0        0 eth1
10.5.1.0        0.0.0.0         255.255.255.0   U     0      0        0 eth2
172.30.0.0      0.0.0.0         255.255.0.0     U     0      0        0 eth0
172.30.0.1      0.0.0.0         255.255.255.255 UH    512    0        0 eth0
192.168.254.0   172.30.0.1      255.255.255.0   UG    99     0        0 eth0
csci3306yndw@honolulu:~$ ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 172.30.0.14  netmask 255.255.0.0  broadcast 172.30.255.255
        inet6 fe80::8066:39ff:fe3d:8633  prefixlen 64  scopeid 0x20<link>
        ether 82:66:39:3d:86:33  txqueuelen 1000  (Ethernet)
        RX packets 4258  bytes 542139 (542.1 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 3484  bytes 424244 (424.2 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 10.1.4.1  netmask 255.255.255.0  broadcast 10.1.4.255
        inet6 fe80::68f4:32ff:fedf:aa79  prefixlen 64  scopeid 0x20<link>
        ether 6a:f4:32:df:aa:79  txqueuelen 1000  (Ethernet)
        RX packets 169  bytes 12062 (12.0 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 38  bytes 2756 (2.7 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

eth2: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 10.5.1.6  netmask 255.255.255.0  broadcast 10.5.1.255
        inet6 fe80::9c87:11ff:feee:d8ab  prefixlen 64  scopeid 0x20<link>
        ether 9e:87:11:ee:d8:ab  txqueuelen 1000  (Ethernet)
        RX packets 670  bytes 48072 (48.0 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 38  bytes 2756 (2.7 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING>  mtu 65536
        inet 127.0.0.1  netmask 255.0.0.0
        inet6 ::1  prefixlen 128  scopeid 0x10<host>
        loop  txqueuelen 1000  (Local Loopback)
        RX packets 0  bytes 0 (0.0 B)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 0  bytes 0 (0.0 B)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

eth 0:
- IP Address: 172.30.0.14
- MAC Address: 82:66:39:3d:86:33
- RX/TX Packets: 4258/3484

eth 1:
- IP Address: 10.1.4.1
- MAC Address: 6a:f4:32:df:aa:79
- RX/TX Packets: 169/38

eth 2:
- IP Address: 10.5.1.6
- MAC Address: 9e:87:11:ee:d8:ab
- RX/TX Packets: 670/38

lo (Loopback):
- IP Address: 127.0.0.1

o Boardman Node:

```
csci3306yndw@boardman:~$ route
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
default         172.30.0.1      0.0.0.0         UG    512    0        0 eth0
10.1.5.0        0.0.0.0         255.255.255.0   U     0      0        0 eth1
10.5.1.0        0.0.0.0         255.255.255.0   U     0      0        0 eth2
172.30.0.0      0.0.0.0         255.255.0.0     U     0      0        0 eth0
172.30.0.1      0.0.0.0         255.255.255.255 UH    512    0        0 eth0
192.168.254.0   172.30.0.1      255.255.255.0   UG    99     0        0 eth0
csci3306yndw@boardman:~$ ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 172.30.0.11  netmask 255.255.0.0  broadcast 172.30.255.255
        inet6 fe80::c84a:6bff:fe4f:61f9  prefixlen 64  scopeid 0x20<link>
        ether ca:4a:6b:4f:61:f9  txqueuelen 1000  (Ethernet)
        RX packets 4254  bytes 542439 (542.4 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 3487  bytes 424846 (424.8 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 10.1.5.1  netmask 255.255.255.0  broadcast 10.1.5.255
        inet6 fe80::78eb:69ff:feb1:9599  prefixlen 64  scopeid 0x20<link>
        ether 7a:eb:69:b1:95:99  txqueuelen 1000  (Ethernet)
        RX packets 170  bytes 12116 (12.1 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 38  bytes 2756 (2.7 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

eth2: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 10.5.1.7  netmask 255.255.255.0  broadcast 10.5.1.255
        inet6 fe80::4ca:29ff:fe08:ecef  prefixlen 64  scopeid 0x20<link>
        ether 06:ca:29:08:ec:ef  txqueuelen 1000  (Ethernet)
        RX packets 666  bytes 47812 (47.8 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 38  bytes 2756 (2.7 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING>  mtu 65536
        inet 127.0.0.1  netmask 255.0.0.0
        inet6 ::1  prefixlen 128  scopeid 0x10<host>
        loop  txqueuelen 1000  (Local Loopback)
        RX packets 0  bytes 0 (0.0 B)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 0  bytes 0 (0.0 B)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

eth 0:
- IP Address: 172.30.0.11
- MAC Address: ca:4a:6b:4f:61:f9
- RX/TX Packets: 4254/3487

eth 1:
- IP Address: 10.1.5.1
- MAC Address: 7a:eb:69:b1:95:99
- RX/TX Packets: 170/38

eth 2:
- IP Address: 10.5.1.7
- MAC Address: 06:ca:29:08:ec:ef
- RX/TX Packets: 666/38

lo (Loopback):
- IP Address: 127.0.0.1

- # Singapore Node:

```
csci3306yndw@singapore:~$ route
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
default         172.30.0.1      0.0.0.0         UG    512    0        0 eth0
10.1.1.0        0.0.0.0         255.255.255.0   U     0      0        0 eth1
10.5.1.0        0.0.0.0         255.255.255.0   U     0      0        0 eth2
172.30.0.0      0.0.0.0         255.255.0.0     U     0      0        0 eth0
172.30.0.1      0.0.0.0         255.255.255.255 UH    512    0        0 eth0
192.168.254.0   172.30.0.1      255.255.255.0   UG    99     0        0 eth0
csci3306yndw@singapore:~$ ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 172.30.0.23  netmask 255.255.0.0  broadcast 172.30.255.255
        inet6 fe80::9852:d1ff:fec1:e121  prefixlen 64  scopeid 0x20<link>
        ether 9a:52:d1:c1:e1:21  txqueuelen 1000  (Ethernet)
        RX packets 4330  bytes 547988 (547.9 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 3504  bytes 429287 (429.2 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 10.1.1.1  netmask 255.255.255.0  broadcast 10.1.1.255
        inet6 fe80::c401:87ff:fe06:e43b  prefixlen 64  scopeid 0x20<link>
        ether c6:01:87:06:e4:3b  txqueuelen 1000  (Ethernet)
        RX packets 181  bytes 13118 (13.1 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 38  bytes 2756 (2.7 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

eth2: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 10.5.1.3  netmask 255.255.255.0  broadcast 10.5.1.255
        inet6 fe80::3c8e:37ff:fe13:86f  prefixlen 64  scopeid 0x20<link>
        ether 3e:8e:37:13:08:6f  txqueuelen 1000  (Ethernet)
        RX packets 697  bytes 50582 (50.5 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 38  bytes 2756 (2.7 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING>  mtu 65536
        inet 127.0.0.1  netmask 255.0.0.0
        inet6 ::1  prefixlen 128  scopeid 0x10<host>
        loop  txqueuelen 1000  (Local Loopback)
        RX packets 0  bytes 0 (0.0 B)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 0  bytes 0 (0.0 B)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

eth 0:
  - IP Address: 172.30.0.23
  - MAC Address: 9a:52:d1:c1:e1:21
  - RX/TX Packets: 4330/3504

eth 1:
  - IP Address: 10.1.1.1
  - MAC Address: c6:01:87:06:e4:3b
  - RX/TX Packets: 181/38

eth 2:
  - IP Address: 10.5.1.3
  - MAC Address: 3e:8e:37:13:08:6f
  - RX/TX Packets: 697/38

lo (Loopback):
  - IP Address: 127.0.0.1

o Seoul Node:

```
csci3306yndw@seoul:~$ route
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
default         172.30.0.1      0.0.0.0         UG    512    0        0 eth0
10.1.0.0        0.0.0.0         255.255.255.0   U     0      0        0 eth1
10.5.1.0        0.0.0.0         255.255.255.0   U     0      0        0 eth2
172.30.0.0      0.0.0.0         255.255.0.0     U     0      0        0 eth0
172.30.0.1      0.0.0.0         255.255.255.255 UH    512    0        0 eth0
192.168.254.0   172.30.0.1      255.255.255.0   UG    99     0        0 eth0
csci3306yndw@seoul:~$ ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 172.30.0.22  netmask 255.255.0.0  broadcast 172.30.255.255
        inet6 fe80::aca1:9ff:fe7e:932d  prefixlen 64  scopeid 0x20<link>
        ether ae:a1:09:7e:93:2d  txqueuelen 1000  (Ethernet)
        RX packets 4314  bytes 546776 (546.7 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 3508  bytes 418377 (418.3 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 10.1.0.1  netmask 255.255.255.0  broadcast 10.1.0.255
        inet6 fe80::e489:22ff:fe9f:bef8  prefixlen 64  scopeid 0x20<link>
        ether e6:89:22:9f:be:f8  txqueuelen 1000  (Ethernet)
        RX packets 191  bytes 14118 (14.1 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 39  bytes 2826 (2.8 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

eth2: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 10.5.1.2  netmask 255.255.255.0  broadcast 10.5.1.255
        inet6 fe80::bc96:c3ff:feee:a0c4  prefixlen 64  scopeid 0x20<link>
        ether be:96:c3:ee:a0:c4  txqueuelen 1000  (Ethernet)
        RX packets 715  bytes 52154 (52.1 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 38  bytes 2756 (2.7 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING>  mtu 65536
        inet 127.0.0.1  netmask 255.0.0.0
        inet6 ::1  prefixlen 128  scopeid 0x10<host>
        loop  txqueuelen 1000  (Local Loopback)
        RX packets 0  bytes 0 (0.0 B)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 0  bytes 0 (0.0 B)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

eth 0:
- IP Address: 172.30.0.22
- MAC Address: ae:a1:09:7e:93:2d
- RX/TX Packets: 4314/3508

eth 1:
- IP Address: 10.1.0.1
- MAC Address: e6:89:22:9f:be:f8
- RX/TX Packets: 191/39

eth 2:
- IP Address: 10.5.1.2
- MAC Address: be:96:c3:ee:a0:c4
- RX/TX Packets: 715/38

lo (Loopback):
- IP Address: 127.0.0.1

o Newalbany Node:

```
csci3306yndw@newalbany:~$ route
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
default         172.30.0.1      0.0.0.0         UG    512    0        0 eth0
10.1.9.0        0.0.0.0         255.255.255.0   U     0      0        0 eth1
10.5.1.0        0.0.0.0         255.255.255.0   U     0      0        0 eth2
172.30.0.0      0.0.0.0         255.255.0.0     U     0      0        0 eth0
172.30.0.1      0.0.0.0         255.255.255.255 UH    512    0        0 eth0
192.168.254.0   172.30.0.1      255.255.255.0   UG    99     0        0 eth0
csci3306yndw@newalbany:~$ ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 172.30.0.19  netmask 255.255.0.0  broadcast 172.30.255.255
        inet6 fe80::d0cd:d1ff:fe51:c1cd  prefixlen 64  scopeid 0x20<link>
        ether d2:cd:d1:51:c1:cd  txqueuelen 1000  (Ethernet)
        RX packets 4314  bytes 549101 (549.1 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 3510  bytes 430622 (430.6 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 10.1.9.1  netmask 255.255.255.0  broadcast 10.1.9.255
        inet6 fe80::884e:f5ff:fec2:7dd8  prefixlen 64  scopeid 0x20<link>
        ether 8a:4e:f5:c2:7d:d8  txqueuelen 1000  (Ethernet)
        RX packets 186  bytes 13632 (13.6 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 38  bytes 2756 (2.7 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

eth2: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 10.5.1.11  netmask 255.255.255.0  broadcast 10.5.1.255
        inet6 fe80::3cc6:31ff:fedd:7685  prefixlen 64  scopeid 0x20<link>
        ether 3e:c6:31:dd:76:85  txqueuelen 1000  (Ethernet)
        RX packets 678  bytes 48656 (48.6 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 38  bytes 2756 (2.7 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING>  mtu 65536
        inet 127.0.0.1  netmask 255.0.0.0
        inet6 ::1  prefixlen 128  scopeid 0x10<host>
        loop  txqueuelen 1000  (Local Loopback)
        RX packets 0  bytes 0 (0.0 B)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 0  bytes 0 (0.0 B)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

eth 0:
- IP Address: 172.30.0.19
- MAC Address: d2:cd:d1:51:c1:cd
- RX/TX Packets: 4314/3510

eth 1:
- IP Address: 10.1.9.1
- MAC Address: 8a:4e:f5:c2:7d:d8
- RX/TX Packets: 186/38

eth 2:
- IP Address: 10.5.1.11
- MAC Address: 3e:c6:31:dd:76:85
- RX/TX Packets: 678/38

lo (Loopback):
- IP Address: 127.0.0.1

o Lima Node:

```
csci3306yndw@lima:~$ route
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
default         172.30.0.1      0.0.0.0         UG    512    0        0 eth0
10.1.8.0        0.0.0.0         255.255.255.0   U     0      0        0 eth1
10.5.1.0        0.0.0.0         255.255.255.0   U     0      0        0 eth2
172.30.0.0      0.0.0.0         255.255.0.0     U     0      0        0 eth0
172.30.0.1      0.0.0.0         255.255.255.255 UH    512    0        0 eth0
192.168.254.0   172.30.0.1      255.255.255.0   UG    99     0        0 eth0
csci3306yndw@lima:~$ ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 172.30.0.18  netmask 255.255.0.0  broadcast 172.30.255.255
        inet6 fe80::9047:95ff:fe64:ac57  prefixlen 64  scopeid 0x20<link>
        ether 92:47:95:64:ac:57  txqueuelen 1000  (Ethernet)
        RX packets 4344  bytes 547958 (547.9 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 3524  bytes 417380 (417.3 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 10.1.8.1  netmask 255.255.255.0  broadcast 10.1.8.255
        inet6 fe80::4c14:22ff:fe6e:eadd  prefixlen 64  scopeid 0x20<link>
        ether 4e:14:22:6e:ea:dd  txqueuelen 1000  (Ethernet)
        RX packets 198  bytes 14668 (14.6 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 38  bytes 2756 (2.7 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

eth2: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 10.5.1.10  netmask 255.255.255.0  broadcast 10.5.1.255
        inet6 fe80::7a:8bff:fe13:4e96  prefixlen 64  scopeid 0x20<link>
        ether 02:7a:8b:13:4e:96  txqueuelen 1000  (Ethernet)
        RX packets 707  bytes 51482 (51.4 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 38  bytes 2756 (2.7 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING>  mtu 65536
        inet 127.0.0.1  netmask 255.0.0.0
        inet6 ::1  prefixlen 128  scopeid 0x10<host>
        loop  txqueuelen 1000  (Local Loopback)
        RX packets 0  bytes 0 (0.0 B)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 0  bytes 0 (0.0 B)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

eth 0:
- IP Address: 172.30.0.18
- MAC Address: 92:47:95:64:ac:57
- RX/TX Packets: 4344/3524

eth 1:
- IP Address: 10.1.8.1
- MAC Address: 4e:14:22:6e:ea:dd
- RX/TX Packets: 198/38

eth 2:
- IP Address: 10.5.1.10
- MAC Address: 02:7a:8b:13:4e:96
- RX/TX Packets: 707/38

lo (Loopback):
- IP Address: 127.0.0.1

o Capetown Node:

```
csci3306yndw@capetown:~$ route
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
default         172.30.0.1      0.0.0.0         UG    512    0        0 eth0
10.1.6.0        0.0.0.0         255.255.255.0   U     0      0        0 eth1
10.5.1.0        0.0.0.0         255.255.255.0   U     0      0        0 eth2
172.30.0.0      0.0.0.0         255.255.0.0     U     0      0        0 eth0
172.30.0.1      0.0.0.0         255.255.255.255 UH    512    0        0 eth0
192.168.254.0   172.30.0.1      255.255.255.0   UG    99     0        0 eth0
csci3306yndw@capetown:~$ ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 172.30.0.12  netmask 255.255.0.0  broadcast 172.30.255.255
        inet6 fe80::24f9:8cff:fe88:606e  prefixlen 64  scopeid 0x20<link>
        ether 26:f9:8c:88:60:6e  txqueuelen 1000  (Ethernet)
        RX packets 4337  bytes 547543 (547.5 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 3532  bytes 430176 (430.1 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 10.1.6.1  netmask 255.255.255.0  broadcast 10.1.6.255
        inet6 fe80::ecd4:91ff:fee8:66da  prefixlen 64  scopeid 0x20<link>
        ether ee:d4:91:e8:66:da  txqueuelen 1000  (Ethernet)
        RX packets 171  bytes 12186 (12.1 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 38  bytes 2756 (2.7 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

eth2: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 10.5.1.8  netmask 255.255.255.0  broadcast 10.5.1.255
        inet6 fe80::b06b:ceff:fee3:7dfd  prefixlen 64  scopeid 0x20<link>
        ether b2:6b:ce:e3:7d:fd  txqueuelen 1000  (Ethernet)
        RX packets 677  bytes 48582 (48.5 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 38  bytes 2756 (2.7 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING>  mtu 65536
        inet 127.0.0.1  netmask 255.0.0.0
        inet6 ::1  prefixlen 128  scopeid 0x10<host>
        loop  txqueuelen 1000  (Local Loopback)
        RX packets 0  bytes 0 (0.0 B)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 0  bytes 0 (0.0 B)
        TX errors 0  dropped 0  overruns 0  carrier 0  collisions 0
```

eth 0:
- IP Address: 172.30.0.12
- MAC Address: 26:f9:8c:88:60:6e
- RX/TX Packets: 4337/3532

eth 1:
- IP Address: 10.1.6.1
- MAC Address: ee:d4:91:e8:66:da
- RX/TX Packets: 171/38

eth 2:
- IP Address: 10.5.1.8
- MAC Address: b2:6b:ce:e3:7d:fd
- RX/TX Packets: 677/38

lo (Loopback):
- IP Address: 127.0.0.1

o **Sydney Node:**

```
csci3306yndw@sydney:~$ route
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
default         172.30.0.1      0.0.0.0         UG    512    0        0 eth0
10.1.3.0        0.0.0.0         255.255.255.0   U     0      0        0 eth1
10.5.1.0        0.0.0.0         255.255.255.0   U     0      0        0 eth2
172.30.0.0      0.0.0.0         255.255.0.0     U     0      0        0 eth0
172.30.0.1      0.0.0.0         255.255.255.255 UH    512    0        0 eth0
192.168.254.0   172.30.0.1      255.255.255.0   UG    99     0        0 eth0
csci3306yndw@sydney:~$ ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 172.30.0.27  netmask 255.255.0.0  broadcast 172.30.255.255
        inet6 fe80::4063:46ff:fe12:81e7  prefixlen 64  scopeid 0x20<link>
        ether 42:63:46:12:81:e7  txqueuelen 1000  (Ethernet)
        RX packets 4315  bytes 545569 (545.5 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 3533  bytes 424816 (424.8 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 10.1.3.1  netmask 255.255.255.0  broadcast 10.1.3.255
        inet6 fe80::54e3:43ff:fe6a:88cb  prefixlen 64  scopeid 0x20<link>
        ether 56:e3:43:6a:88:cb  txqueuelen 1000  (Ethernet)
        RX packets 171  bytes 12202 (12.2 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 38  bytes 2756 (2.7 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

eth2: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 10.5.1.5  netmask 255.255.255.0  broadcast 10.5.1.255
        inet6 fe80::90fa:34ff:fe6f:2a57  prefixlen 64  scopeid 0x20<link>
        ether 92:fa:34:6f:2a:57  txqueuelen 1000  (Ethernet)
        RX packets 671  bytes 48146 (48.1 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 39  bytes 2826 (2.8 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING>  mtu 65536
        inet 127.0.0.1  netmask 255.0.0.0
        inet6 ::1  prefixlen 128  scopeid 0x10<host>
        loop  txqueuelen 1000  (Local Loopback)
        RX packets 0  bytes 0 (0.0 B)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 0  bytes 0 (0.0 B)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

eth 0:
- IP Address: 172.30.0.27
- MAC Address: 42:63:46:12:81:e7
- RX/TX Packets: 4315/3533

eth 1:
- IP Address: 10.1.3.1
- MAC Address: 56:e3:43:6a:88:cb
- RX/TX Packets: 171/38

eth 2:
- IP Address: 10.5.1.5
- MAC Address: 92:fa:34:6f:2a:57
- RX/TX Packets: 671/39

lo (Loopback):
- IP Address: 127.0.0.1

○ **SCM01 Node:**

```
csci3306yndw@scm01:~$ route
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
default         172.30.0.1      0.0.0.0         UG    512    0        0 eth0
10.3.0.0        0.0.0.0         255.255.255.0   U     0      0        0 eth1
10.3.1.0        0.0.0.0         255.255.255.0   U     0      0        0 eth2
10.3.2.0        0.0.0.0         255.255.255.0   U     0      0        0 eth3
10.3.3.0        0.0.0.0         255.255.255.0   U     0      0        0 eth4
10.3.4.0        0.0.0.0         255.255.255.0   U     0      0        0 eth5
10.3.5.0        0.0.0.0         255.255.255.0   U     0      0        0 eth6
10.3.6.0        0.0.0.0         255.255.255.0   U     0      0        0 eth7
10.3.7.0        0.0.0.0         255.255.255.0   U     0      0        0 eth8
10.3.8.0        0.0.0.0         255.255.255.0   U     0      0        0 eth9
10.3.9.0        0.0.0.0         255.255.255.0   U     0      0        0 eth10
10.3.10.0       0.0.0.0         255.255.255.0   U     0      0        0 eth11
10.4.0.0        0.0.0.0         255.255.255.0   U     0      0        0 eth12
10.4.1.0        0.0.0.0         255.255.255.0   U     0      0        0 eth13
10.4.2.0        0.0.0.0         255.255.255.0   U     0      0        0 eth14
172.30.0.0      0.0.0.0         255.255.0.0     U     0      0        0 eth0
172.30.0.1      0.0.0.0         255.255.255.255 UH    512    0        0 eth0
192.168.254.0   172.30.0.1      255.255.255.0   UG    99     0        0 eth0
```

```
csc13306yndv@scr01:~$ ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 172.30.0.21  netmask 255.255.0.0  broadcast 172.30.255.255
        inet6 fe80::e8e2:68ff:fe54:8f46  prefixlen 64  scopeid 0x20<link>
        ether ea:e2:68:54:8f:46  txqueuelen 1000  (Ethernet)
        RX packets 4384  bytes 561325 (561.3 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 3580  bytes 427770 (427.7 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 10.3.0.1  netmask 255.255.255.0  broadcast 10.3.0.255
        inet6 fe80::98e2:3fff:fef7:ab92  prefixlen 64  scopeid 0x20<link>
        ether 9a:e2:03:f7:ab:92  txqueuelen 1000  (Ethernet)
        RX packets 173  bytes 12342 (12.3 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 39  bytes 2826 (2.8 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

eth2: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 10.3.1.1  netmask 255.255.255.0  broadcast 10.3.1.255
        inet6 fe80::8fb:4aff:fedb:d42a  prefixlen 64  scopeid 0x20<link>
        ether 0a:fb:4a:db:d4:2a  txqueuelen 1000  (Ethernet)
        RX packets 171  bytes 12282 (12.2 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 38  bytes 2756 (2.7 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

eth3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 10.3.2.1  netmask 255.255.255.0  broadcast 10.3.2.255
        inet6 fe80::e4b1:76ff:fe50:fd8c  prefixlen 64  scopeid 0x20<link>
        ether e6:b1:76:50:fd:8c  txqueuelen 1000  (Ethernet)
        RX packets 170  bytes 12206 (12.0 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 38  bytes 2756 (2.7 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

eth4: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 10.3.3.1  netmask 255.255.255.0  broadcast 10.3.3.255
        inet6 fe80::f407:b4ff:fe86:9701  prefixlen 64  scopeid 0x20<link>
        ether f6:07:b4:86:97:01  txqueuelen 1000  (Ethernet)
        RX packets 171  bytes 12282 (12.2 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 38  bytes 2756 (2.7 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

eth5: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 10.3.4.1  netmask 255.255.255.0  broadcast 10.3.4.255
        inet6 fe80::7802:8dff:fe41:9674  prefixlen 64  scopeid 0x20<link>
        ether 7a:02:8d:41:96:74  txqueuelen 1000  (Ethernet)
        RX packets 168  bytes 11976 (11.9 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 38  bytes 2756 (2.7 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

eth6: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 10.3.5.1  netmask 255.255.255.0  broadcast 10.3.5.255
        inet6 fe80::f8ed:56ff:fe2f:f6d5  prefixlen 64  scopeid 0x20<link>
        ether fa:ed:56:2f:f6:d5  txqueuelen 1000  (Ethernet)
        RX packets 171  bytes 12182 (12.1 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 38  bytes 2756 (2.7 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

eth7: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 10.3.6.1  netmask 255.255.255.0  broadcast 10.3.6.255
        inet6 fe80::dc34:8cff:fe86:60b0  prefixlen 64  scopeid 0x20<link>
        ether de:34:8c:86:60:b0  txqueuelen 1000  (Ethernet)
        RX packets 171  bytes 12282 (12.2 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 38  bytes 2756 (2.7 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

eth8: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 10.3.7.1  netmask 255.255.255.0  broadcast 10.3.7.255
        inet6 fe80::e408:dbff:fea2:bdfd  prefixlen 64  scopeid 0x20<link>
        ether e6:08:db:a2:bd:fd  txqueuelen 1000  (Ethernet)
        RX packets 168  bytes 11976 (11.9 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 38  bytes 2756 (2.7 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

eth9: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 10.3.8.1  netmask 255.255.255.0  broadcast 10.3.8.255
```

eth 0:
- IP Address: 172.30.0.21
- MAC Address: ea:e2:68:54:8f:46
- RX/TX Packets: 4384/3580

eth 1:
- IP Address: 10.3.0.1
- MAC Address: 9a:e2:03:f7:ab:92

- - RX/TX Packets: 173/39

eth 2:
  - IP Address: 10.3.1.1
  - MAC Address: 0a:fb:4a:eb:d4:2a
  - RX/TX Packets: 171/38

eth 3:
  - IP Address: 10.3.2.1
  - MAC Address: e6:0d:76:50:fd:0c
  - RX/TX Packets: 170/38

eth 4:
  - IP Address: 10.3.3.1
  - MAC Address: f6:07:b4:b5:97:01
  - RX/TX Packets: 171/38

eth 5:
  - IP Address: 10.3.4.1
  - MAC Address: 7a:02:8d:41:96:74
  - RX/TX Packets: 168/38

eth 6:
  - IP Address: 10.3.5.1
  - MAC Address: fa:ed:56:2f:f6:d6
  - RX/TX Packets: 171/38

eth 7:
  - IP Address: 10.3.6.1
  - MAC Address: de:34:8c:85:60:b0
  - RX/TX Packets: 171/38

eth 8:
  - IP Address: 10.3.7.1
  - MAC Address: e6:98:db:a2:bd:fd
  - RX/TX Packets: 168/38

eth 9:
  - IP Address: 10.3.8.1
  - MAC Address: 56:e8:47:f2:f0:03
  - RX/TX Packets: 171/38

eth 10:
  - IP Address: 10.3.9.1
  - MAC Address: b2:b4:9d:44:29:66
  - RX/TX Packets: 177/38

eth 11:
- IP Address: 10.3.10.1
- MAC Address: 1a:74:36:1e:c0:98
- RX/TX Packets: 170/39

eth 12:
- IP Address: 10.4.0.1
- MAC Address: 22:91:61:c0:f1:06
- RX/TX Packets: 169/38

eth 13:
- IP Address: 10.4.1.1
- MAC Address: 3a:2e:32:ce:59:cb
- RX/TX Packets: 169/38

eth 14:
- IP Address: 10.4.2.1
- MAC Address: 8e:90:50:20:5e:89
- RX/TX Packets: 108/39

lo (Loopback):
- IP Address: 127.0.0.1

- ## Landsat7 Node:

```
csci3306yndw@landsat7:~$ route
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
default         172.30.0.1      0.0.0.0         UG    512    0        0 eth0
10.2.2.0        0.0.0.0         255.255.255.0   U     0      0        0 eth1
172.30.0.0      0.0.0.0         255.255.0.0     U     0      0        0 eth0
172.30.0.1      0.0.0.0         255.255.255.255 UH    512    0        0 eth0
192.168.254.0   172.30.0.1      255.255.255.0   UG    99     0        0 eth0
csci3306yndw@landsat7:~$ ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 172.30.0.15  netmask 255.255.0.0  broadcast 172.30.255.255
        inet6 fe80::b88c:3aff:fea7:9ec0  prefixlen 64  scopeid 0x20<link>
        ether ba:8c:3a:a7:9e:c0  txqueuelen 1000  (Ethernet)
        RX packets 4370  bytes 549335 (549.3 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 3546  bytes 432362 (432.3 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 10.2.2.1  netmask 255.255.255.0  broadcast 10.2.2.255
        inet6 fe80::d063:7fff:fe40:d7df  prefixlen 64  scopeid 0x20<link>
        ether d2:63:7f:40:d7:df  txqueuelen 1000  (Ethernet)
        RX packets 118  bytes 8728 (8.7 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 38  bytes 2756 (2.7 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING>  mtu 65536
        inet 127.0.0.1  netmask 255.0.0.0
        inet6 ::1  prefixlen 128  scopeid 0x10<host>
        loop  txqueuelen 1000  (Local Loopback)
        RX packets 0  bytes 0 (0.0 B)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 0  bytes 0 (0.0 B)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

eth 0:
- IP Address: 172.30.0.15
- MAC Address: ba:8c:3a:a7:9e:c0
- RX/TX Packets: 4370/3546

eth 1:

- IP Address: 10.2.2.1
- MAC Address: d2:63:7f:40:d7:df
- RX/TX Packets: 118/38

lo (Loopback):
- IP Address: 127.0.0.1

o **Landsat8 Node:**

```
csci3306yndw@landsat8:~$ route
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
default         172.30.0.1      0.0.0.0         UG    512    0        0 eth0
10.2.1.0        0.0.0.0         255.255.255.0   U     0      0        0 eth1
172.30.0.0      0.0.0.0         255.255.255.0   U     0      0        0 eth0
172.30.0.1      0.0.0.0         255.255.255.255 UH    512    0        0 eth0
192.168.254.0   172.30.0.1      255.255.255.0   UG    99     0        0 eth0
csci3306yndw@landsat8:~$ ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 172.30.0.16  netmask 255.255.0.0  broadcast 172.30.255.255
        inet6 fe80::6487:cfff:fe91:1ce6  prefixlen 64  scopeid 0x20<link>
        ether 66:87:cf:91:1c:e6  txqueuelen 1000  (Ethernet)
        RX packets 4417  bytes 554325 (554.3 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 3559  bytes 433848 (433.8 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 10.2.1.1  netmask 255.255.255.0  broadcast 10.2.1.255
        inet6 fe80::2487:41ff:feb9:23cc  prefixlen 64  scopeid 0x20<link>
        ether 26:87:41:b9:23:cc  txqueuelen 1000  (Ethernet)
        RX packets 190  bytes 13972 (13.9 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 38  bytes 2756 (2.7 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING>  mtu 65536
        inet 127.0.0.1  netmask 255.0.0.0
        inet6 ::1  prefixlen 128  scopeid 0x10<host>
        loop  txqueuelen 1000  (Local Loopback)
        RX packets 0  bytes 0 (0.0 B)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 0  bytes 0 (0.0 B)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

eth 0:
- IP Address: 172.30.0.16
- MAC Address: 66:87:cf:91:1c:e6
- RX/TX Packets: 4417/3559

eth 1:
- IP Address: 10.2.1.1
- MAC Address: 26:87:41:b9:23:cc
- RX/TX Packets: 190/38

lo (Loopback):
- IP Address: 127.0.0.1

o Landsat9 Node:

```
csci3306yndw@landsat9:~$ route
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
default         172.30.0.1      0.0.0.0         UG    512    0        0 eth0
10.2.0.0        0.0.0.0         255.255.255.0   U     0      0        0 eth1
172.30.0.0      0.0.0.0         255.255.0.0     U     0      0        0 eth0
172.30.0.1      0.0.0.0         255.255.255.255 UH    512    0        0 eth0
192.168.254.0   172.30.0.1      255.255.255.0   UG    99     0        0 eth0
csci3306yndw@landsat9:~$ ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 172.30.0.17  netmask 255.255.0.0  broadcast 172.30.255.255
        inet6 fe80::f874:3bff:fe8e:273a  prefixlen 64  scopeid 0x20<link>
        ether fa:74:3b:8e:27:3a  txqueuelen 1000  (Ethernet)
        RX packets 4425  bytes 554429 (554.4 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 3578  bytes 435622 (435.6 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 10.2.0.1  netmask 255.255.255.0  broadcast 10.2.0.255
        inet6 fe80::100d:42ff:fe5f:f1aa  prefixlen 64  scopeid 0x20<link>
        ether 12:0d:42:5f:f1:aa  txqueuelen 1000  (Ethernet)
        RX packets 191  bytes 14022 (14.0 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 39  bytes 2826 (2.8 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING>  mtu 65536
        inet 127.0.0.1  netmask 255.0.0.0
        inet6 ::1  prefixlen 128  scopeid 0x10<host>
        loop  txqueuelen 1000  (Local Loopback)
        RX packets 0  bytes 0 (0.0 B)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 0  bytes 0 (0.0 B)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

eth 0:
- IP Address: 172.30.0.17
- MAC Address: fa:74:3b:8e:27:3a
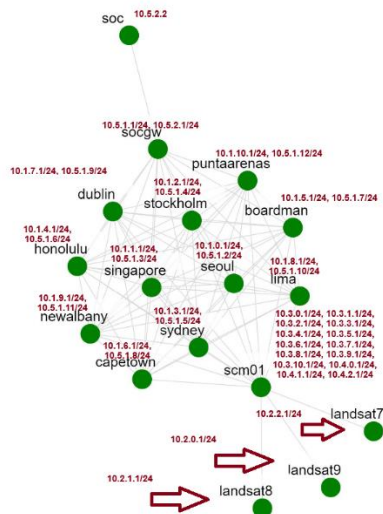- RX/TX Packets: 4425/3578

eth 1:
- IP Address: 10.2.0.1
- MAC Address: 12:0d:42:5f:f1:aa
- RX/TX Packets: 191/39

lo (Loopback):
- IP Address: 127.0.0.1

❖ Adding IP Addresses to Topology

❖ Connecting some of the nodes to allow connectivity:

o ### Soc Node:

```
csci3306yndw@soc:~$ sudo route add -net 10.5.2.0 netm
ask 255.255.255.0 gw 10.5.2.1 dev eth1
csci3306yndw@soc:~$ ping 10.5.2.1
PING 10.5.2.1 (10.5.2.1) 56(84) bytes of data.
64 bytes from 10.5.2.1: icmp_seq=1 ttl=64 time=0.652 ms
64 bytes from 10.5.2.1: icmp_seq=2 ttl=64 time=0.425 ms
64 bytes from 10.5.2.1: icmp_seq=3 ttl=64 time=0.393 ms
64 bytes from 10.5.2.1: icmp_seq=4 ttl=64 time=0.388 ms
64 bytes from 10.5.2.1: icmp_seq=5 ttl=64 time=0.468 ms
64 bytes from 10.5.2.1: icmp_seq=6 ttl=64 time=0.384 ms
64 bytes from 10.5.2.1: icmp_seq=7 ttl=64 time=0.399 ms
64 bytes from 10.5.2.1: icmp_seq=8 ttl=64 time=0.395 ms
^C
--- 10.5.2.1 ping statistics ---
8 packets transmitted, 8 received, 0% packet loss, time 7145ms
rtt min/avg/max/mdev = 0.384/0.438/0.652/0.084 ms
```

o ### Socgw Node:

```
csci3306yndw@socgw:~$ sudo route add -net 10.5.2.0 netmask 255.255.255.0 gw 10.5.2.1 eth2
csci3306yndw@socgw:~$ ping 10.5.2.1
PING 10.5.2.1 (10.5.2.1) 56(84) bytes of data.
64 bytes from 10.5.2.1: icmp_seq=1 ttl=64 time=0.030 ms
64 bytes from 10.5.2.1: icmp_seq=2 ttl=64 time=0.057 ms
64 bytes from 10.5.2.1: icmp_seq=3 ttl=64 time=0.018 ms
^C
--- 10.5.2.1 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2029ms
rtt min/avg/max/mdev = 0.018/0.035/0.057/0.016 ms
```

o **Dublin Node:**

```
csci3306yndw@dublin:~$ sudo route add -net 10.5.1.0 netmask 255.255.255.0 gw 10.5.1.1 eth2
csci3306yndw@dublin:~$ route
Kernel IP routing table
Destination     Gateway          Genmask          Flags Metric Ref    Use Iface
default         172.30.0.1       0.0.0.0          UG    512    0        0 eth0
10.1.7.0        0.0.0.0          255.255.255.0    U     0      0        0 eth1
10.5.1.0        10.5.1.1         255.255.255.0    UG    0      0        0 eth2
10.5.1.0        0.0.0.0          255.255.255.0    U     0      0        0 eth2
172.30.0.0      0.0.0.0          255.255.0.0      U     0      0        0 eth0
172.30.0.1      0.0.0.0          255.255.255.255 UH    512    0        0 eth0
192.168.254.0   172.30.0.1       255.255.255.0    UG    99     0        0 eth0
```

o **SCM01 Node:**

```
csci3306yndw@scm01:~$ sudo route add -net 10.3.0.0 netmask 255.255.255.0 gw 10.3.0.1 eth1
csci3306yndw@scm01:~$ route
Kernel IP routing table
Destination     Gateway          Genmask          Flags Metric Ref    Use Iface
default         172.30.0.1       0.0.0.0          UG    512    0        0 eth0
10.3.0.0        10.3.0.1         255.255.255.0    UG    0      0        0 eth1
10.3.0.0        0.0.0.0          255.255.255.0    U     0      0        0 eth1
10.3.1.0        0.0.0.0          255.255.255.0    U     0      0        0 eth2
10.3.2.0        0.0.0.0          255.255.255.0    U     0      0        0 eth3
10.3.3.0        0.0.0.0          255.255.255.0    U     0      0        0 eth4
10.3.4.0        0.0.0.0          255.255.255.0    U     0      0        0 eth5
10.3.5.0        0.0.0.0          255.255.255.0    U     0      0        0 eth6
10.3.6.0        0.0.0.0          255.255.255.0    U     0      0        0 eth7
10.3.7.0        0.0.0.0          255.255.255.0    U     0      0        0 eth8
10.3.8.0        0.0.0.0          255.255.255.0    U     0      0        0 eth9
10.3.9.0        0.0.0.0          255.255.255.0    U     0      0        0 eth10
10.3.10.0       0.0.0.0          255.255.255.0    U     0      0        0 eth11
10.4.0.0        0.0.0.0          255.255.255.0    U     0      0        0 eth12
10.4.1.0        0.0.0.0          255.255.255.0    U     0      0        0 eth13
10.4.2.0        0.0.0.0          255.255.255.0    U     0      0        0 eth14
172.30.0.0      0.0.0.0          255.255.0.0      U     0      0        0 eth0
172.30.0.1      0.0.0.0          255.255.255.255 UH    512    0        0 eth0
192.168.254.0   172.30.0.1       255.255.255.0    UG    99     0        0 eth0
```

o **Honolulu Node:**

```
csci3306yndw@honolulu:~$ sudo route add -net 10.1.4.0 netmask 255.255.255.0 gw 10.1.4.1 eth1
csci3306yndw@honolulu:~$ route
Kernel IP routing table
Destination     Gateway          Genmask          Flags Metric Ref    Use Iface
default         172.30.0.1       0.0.0.0          UG    512    0        0 eth0
10.1.4.0        10.1.4.1         255.255.255.0    UG    0      0        0 eth1
10.1.4.0        0.0.0.0          255.255.255.0    U     0      0        0 eth1
10.5.1.0        0.0.0.0          255.255.255.0    U     0      0        0 eth2
172.30.0.0      0.0.0.0          255.255.0.0      U     0      0        0 eth0
172.30.0.1      0.0.0.0          255.255.255.255 UH    512    0        0 eth0
192.168.254.0   172.30.0.1       255.255.255.0    UG    99     0        0 eth0
```

❖ **Summary:**

From this lab, I learned that ifconfig command is used to see the interface configurations for each interface connected to the node (in this case). Linux allows for a high degree of customization and flexibility, as you can manually configure routes and interfaces. Linux machines often have multiple network interfaces (e.g., eth0, eth1) that can be configured individually. Linux uses command-line tools for manual configuration, while GNS3 uses router-specific commands within a simulated environment. GNS3 offers a graphical interface for designing and visualizing networks, whereas Linux relies on command-line output.