PA197 Lab03 – GNS3

Martin Cihlář
cihlar@ics.muni.cz

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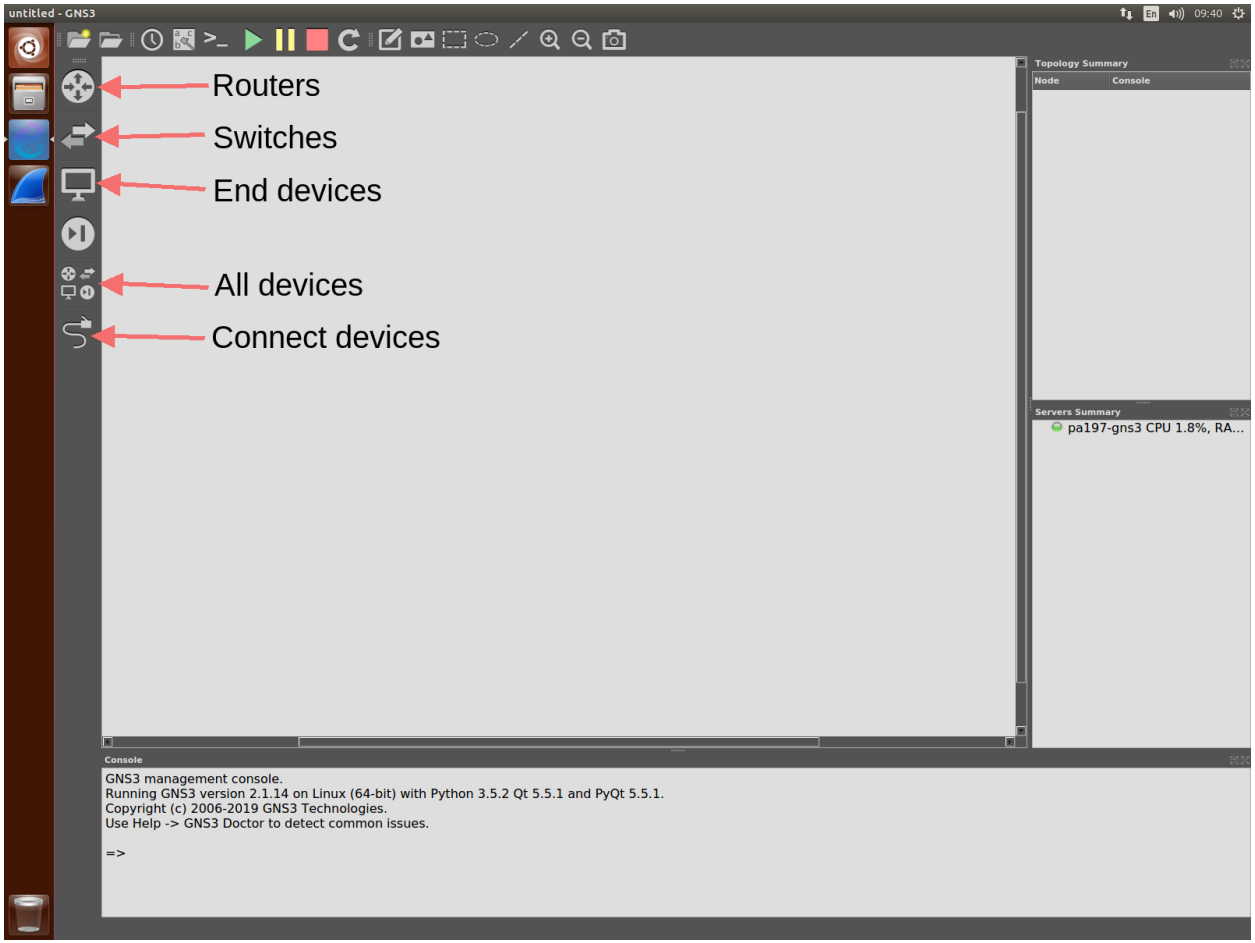
Aims

- Using GNS3
- Task 1 - simple network
- Campus network topology
- Task 2 - example Campus network

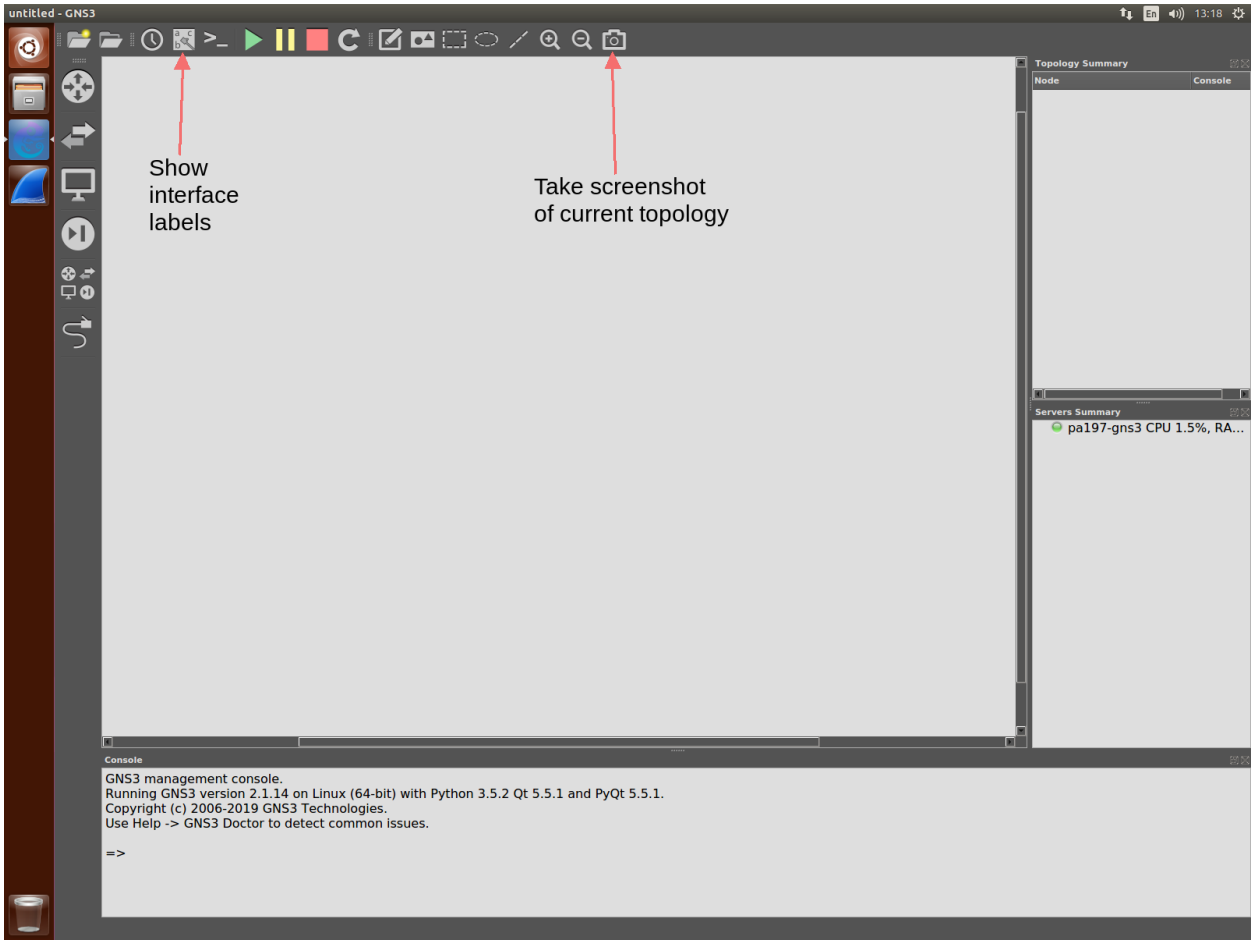
GNS3

- Graphical Network Simulator 3
- Simulates a computer network using a combination of physical, emulated or "dummy" devices
- Supports a wide variety of devices from different vendors, used mostly for Cisco IOS devices
- Free-and-open-source software
  - User has to provide her own device images for emulation due to licensing constraints, included are only dummy devices

Using GNS3


untitled - GNS3
Routers
Switches
End devices
All devices
Connect devices
Topology Summary
Node
Console
Servers Summary
pa197-gns3 CPU 1.8%, RA...
Console
GNS3 management console.
Running GNS3 version 2.1.14 on Linux (64-bit) with Python 3.5.2 Qt 5.5.1 and PyQt 5.5.1.
Copyright (c) 2006-2019 GNS3 Technologies.
Use Help -> GNS3 Doctor to detect common issues.
=>

Using GNS3


untitled - GNS3
Show interface labels
Take screenshot of current topology
Topology Summary
Node
Console
Servers Summary
pa197-gns3 CPU 1.5%, RA...
Console
GNS3 management console.
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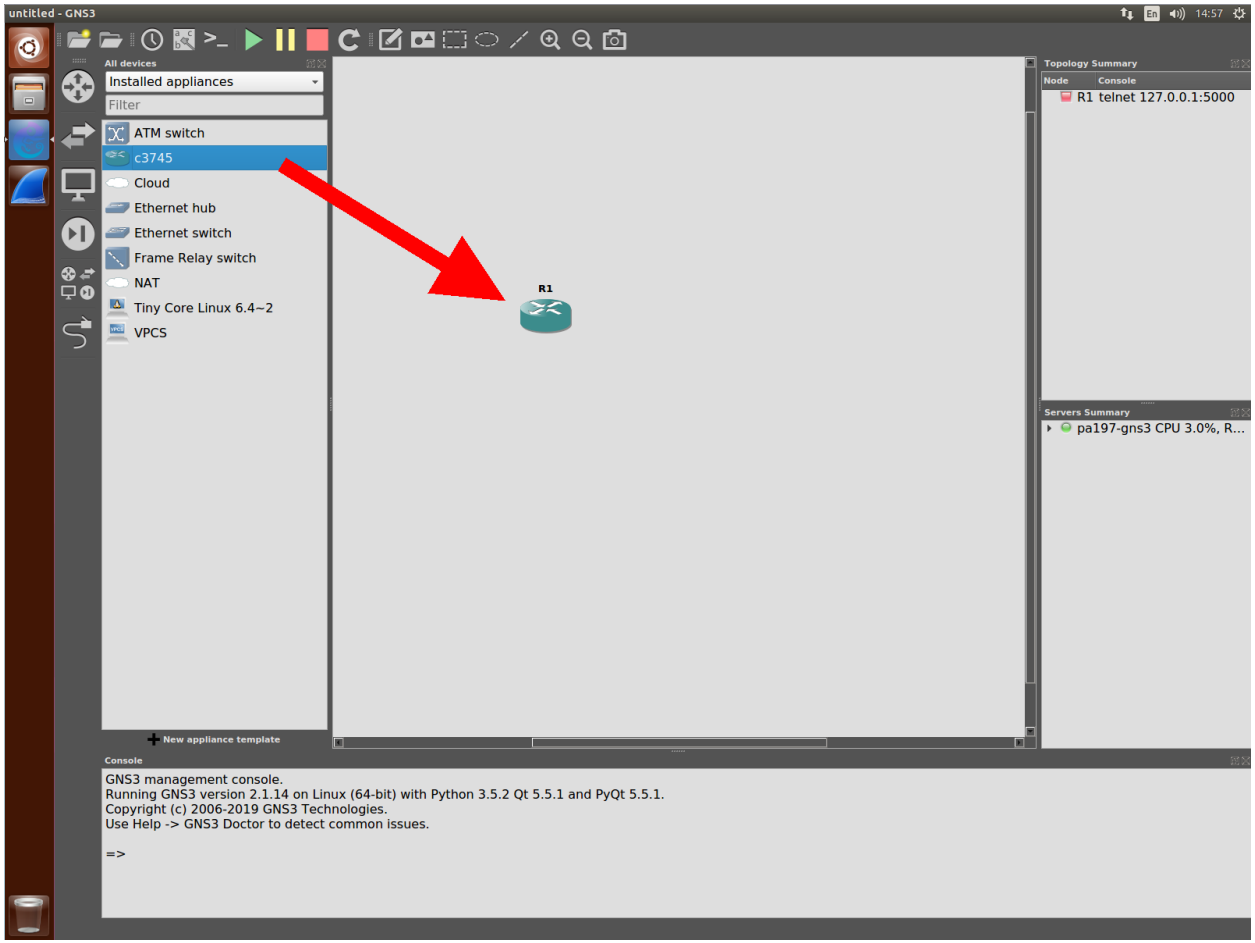
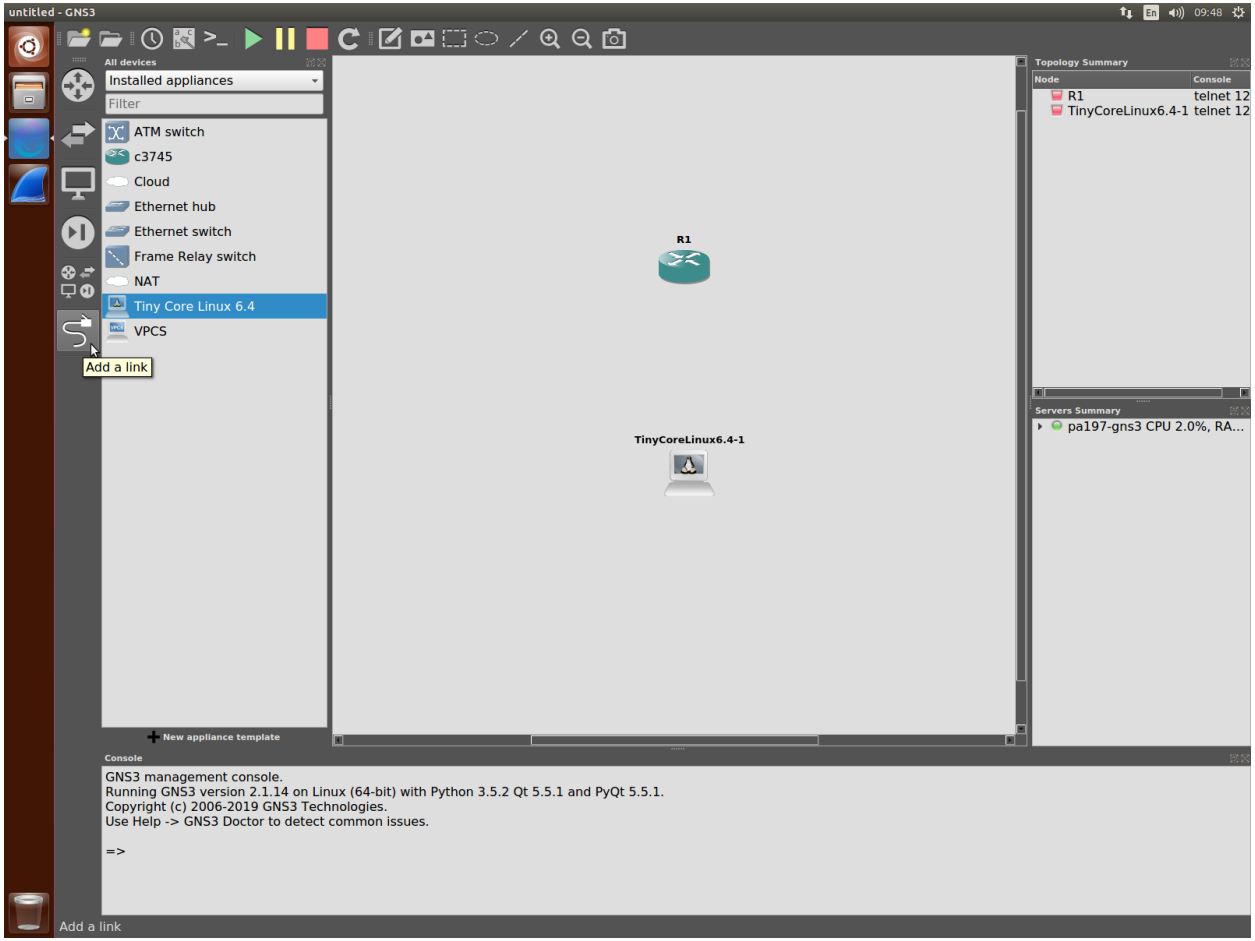
Using GNS3



Drag and drop devices from the list to add them into your topology

Using GNS3



To link devices: left-click on a node you wish to connect, choose an interface, choose another node to connect it to and choose its interface (don't use the built-in management FastEthernet 0/x ports)

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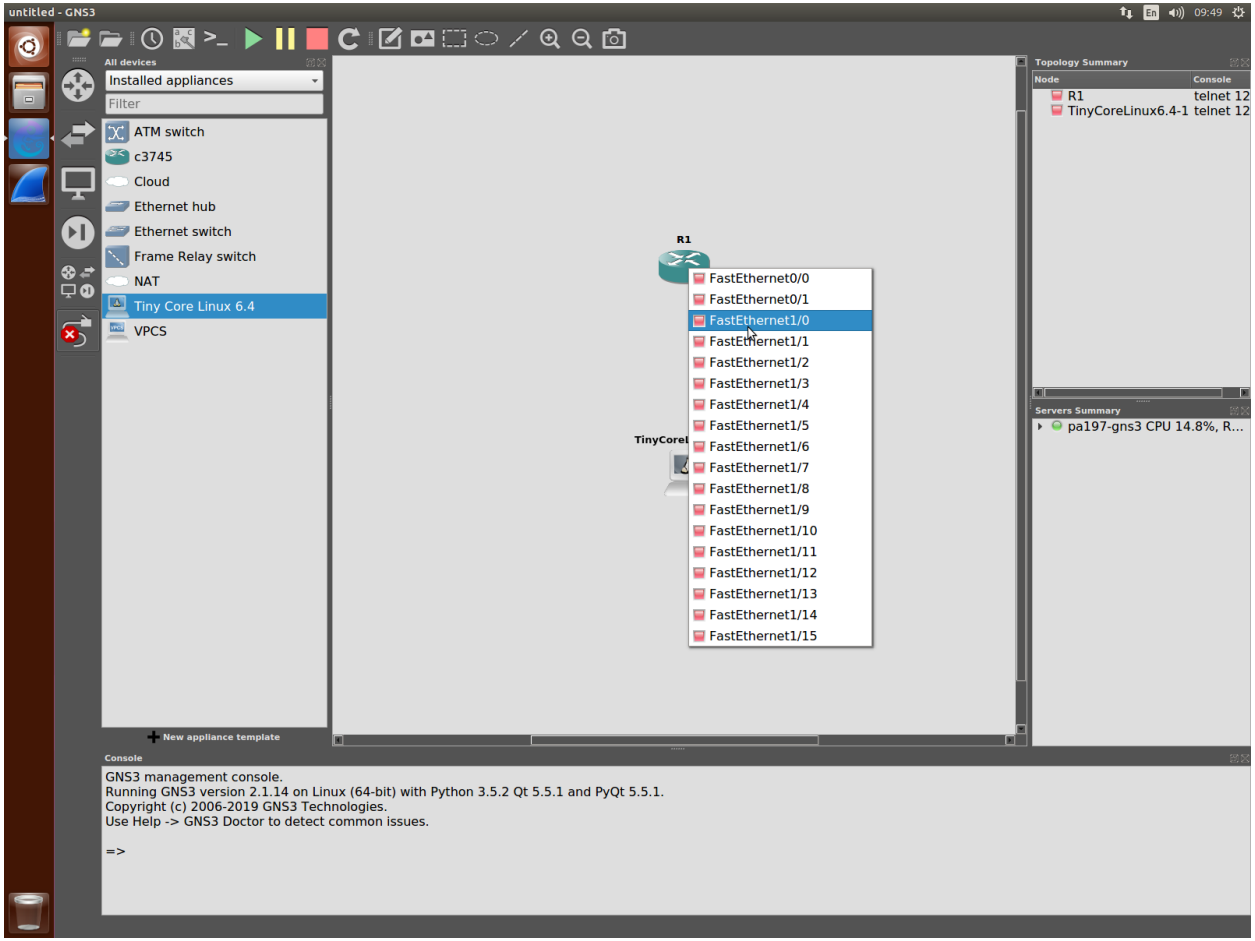

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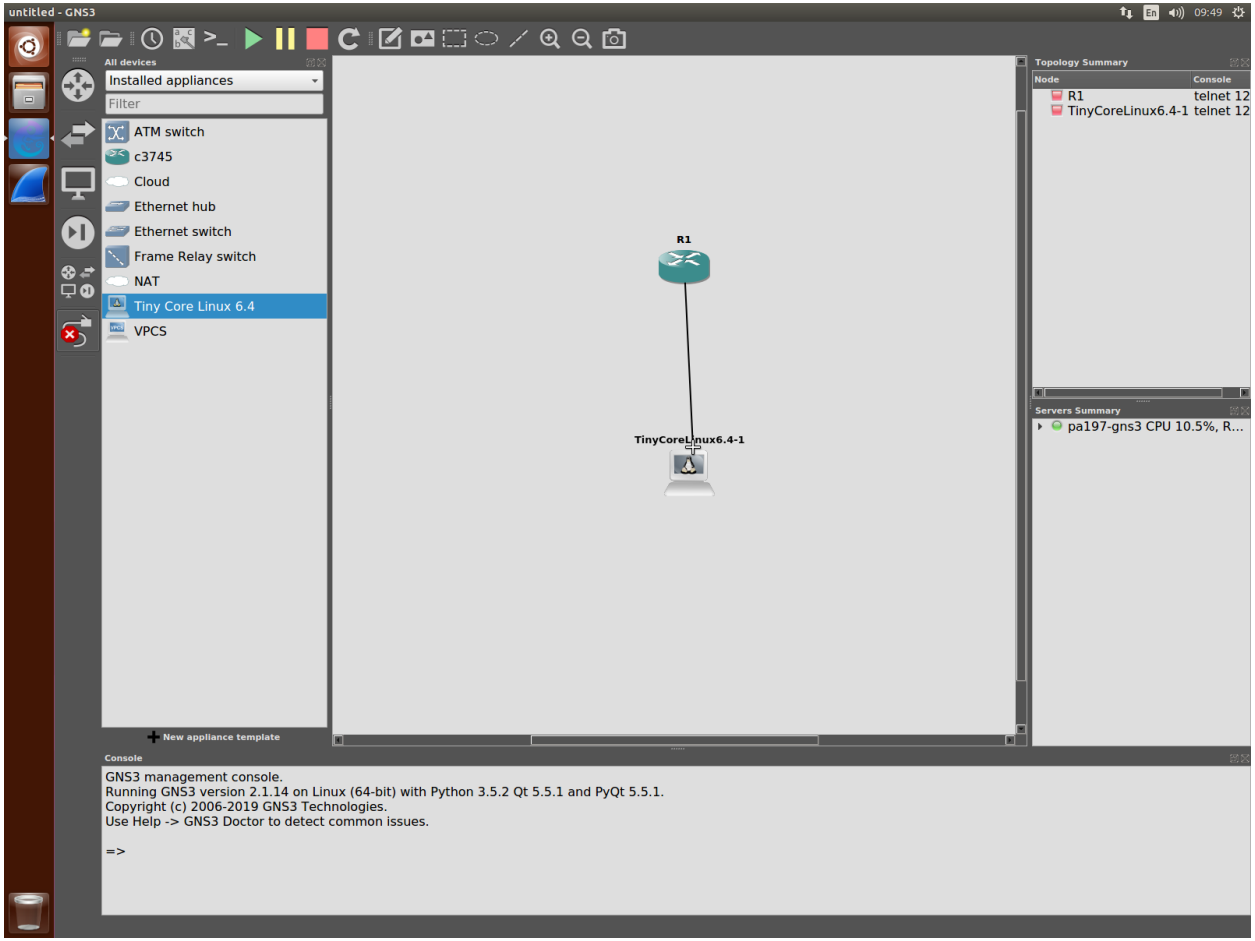

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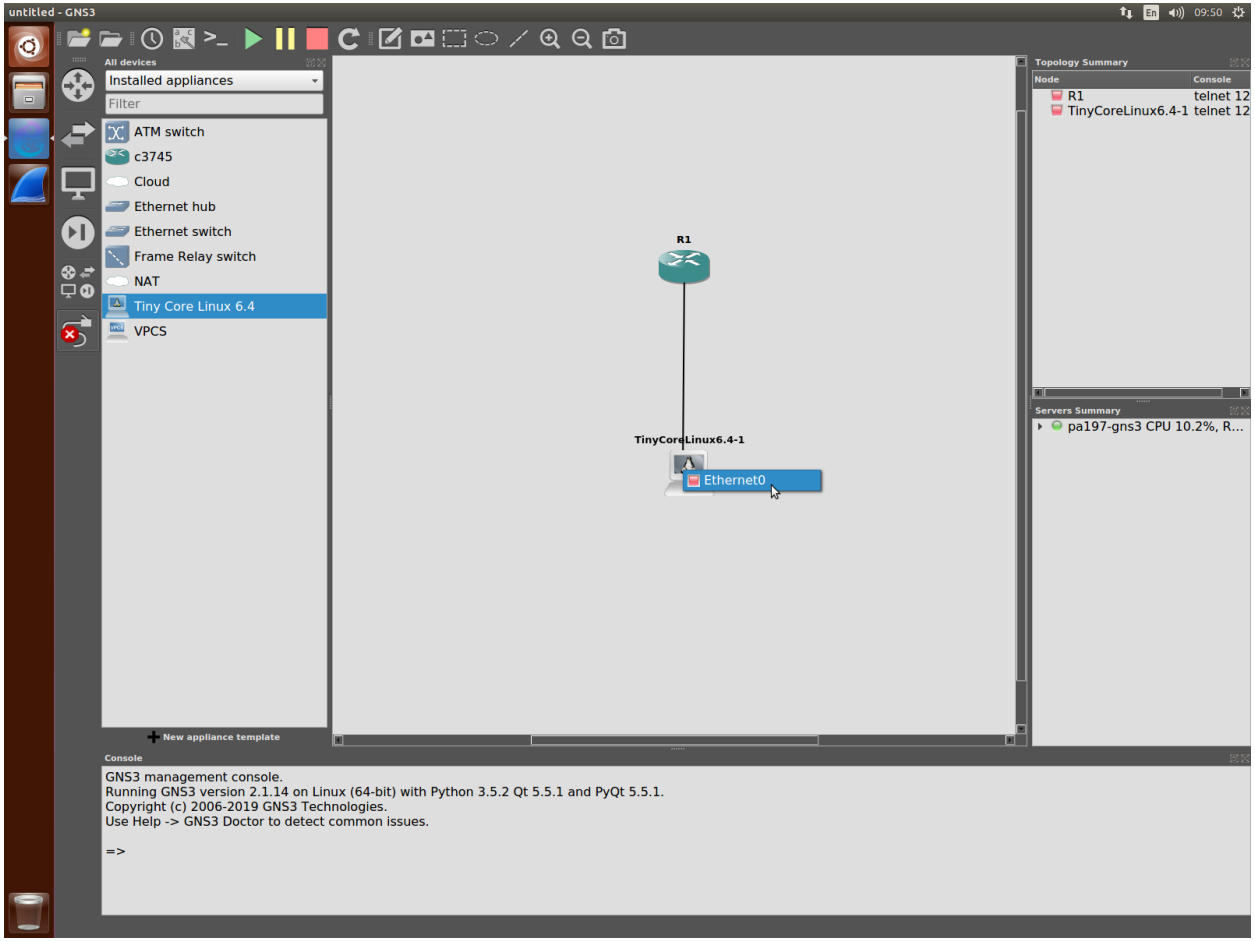

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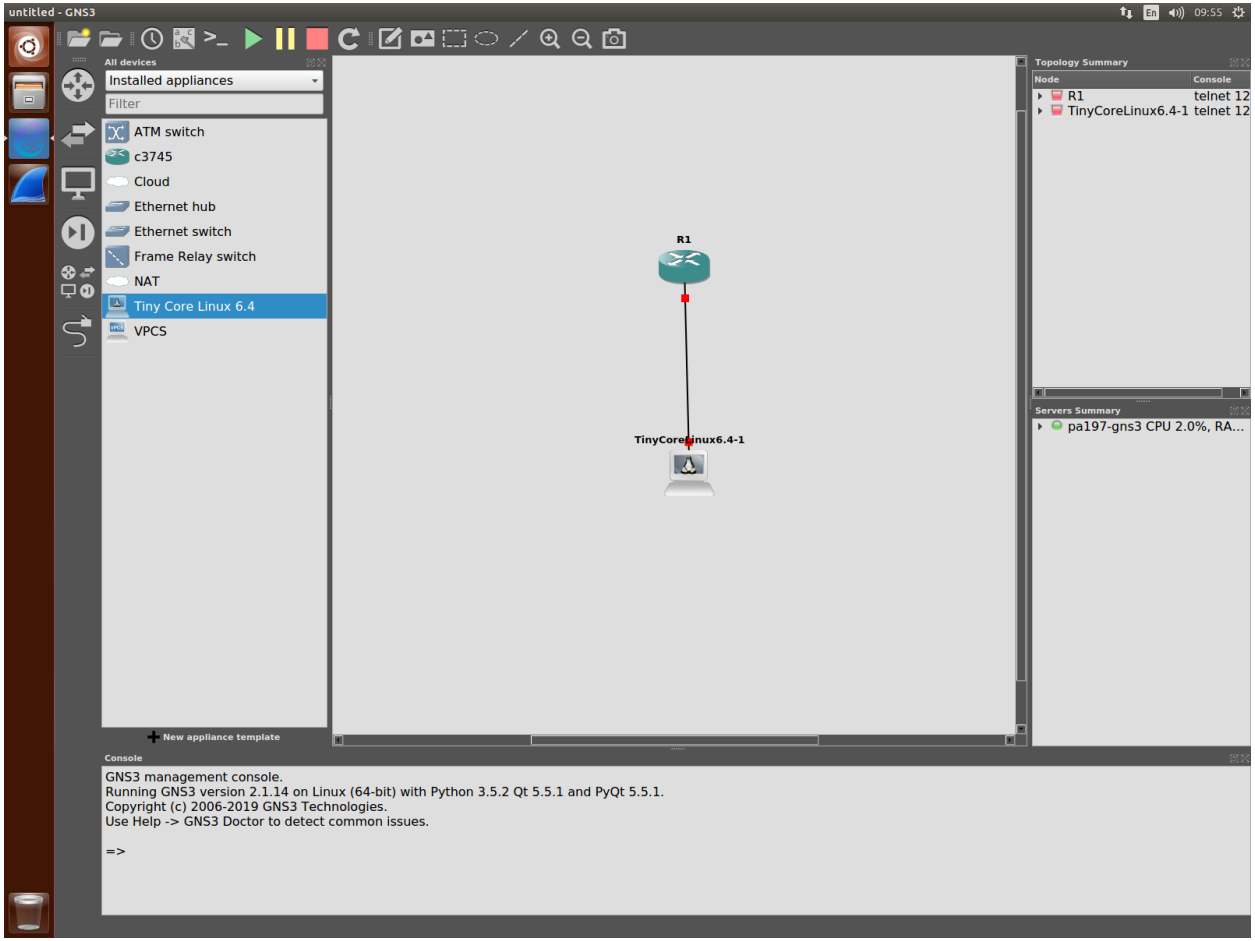

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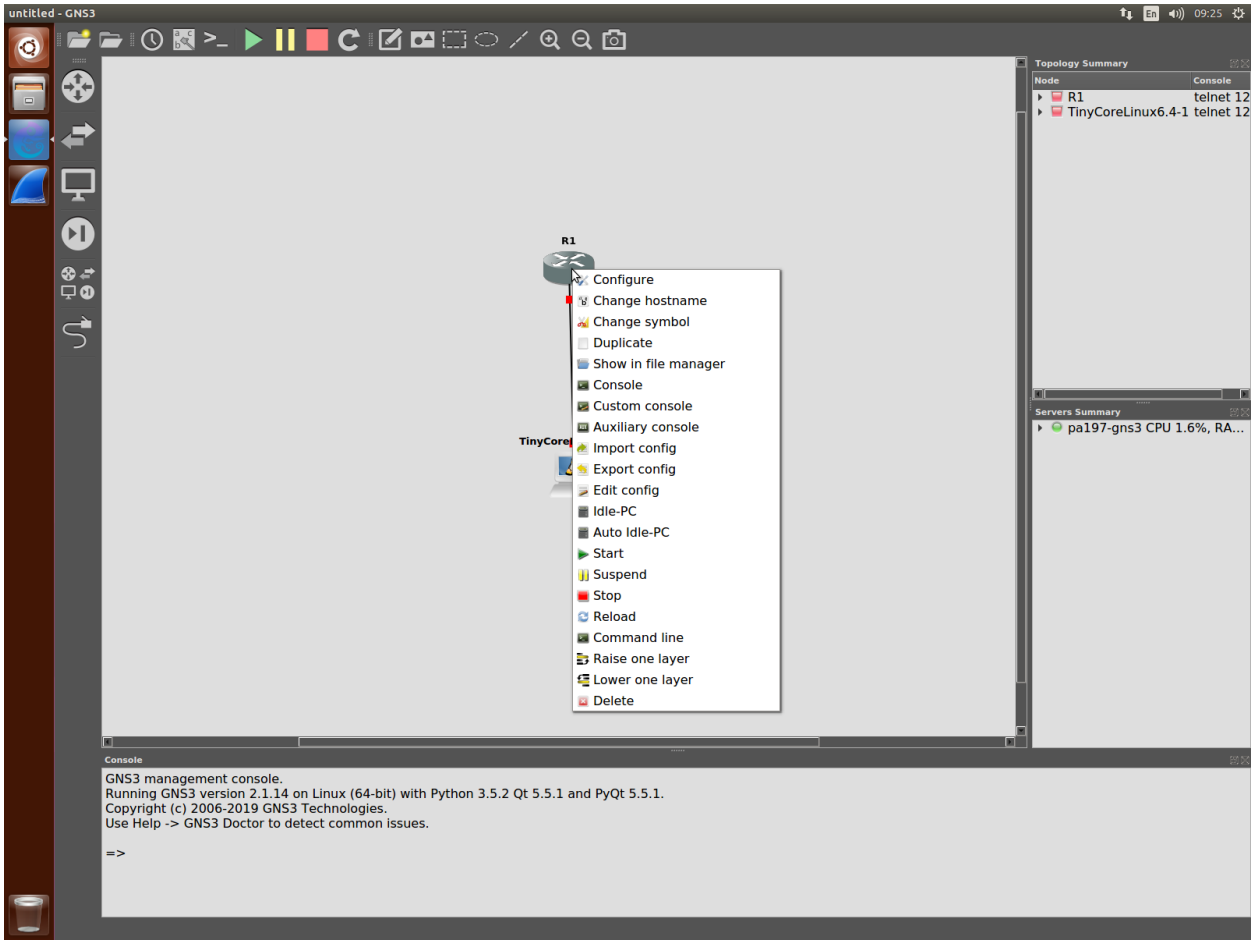
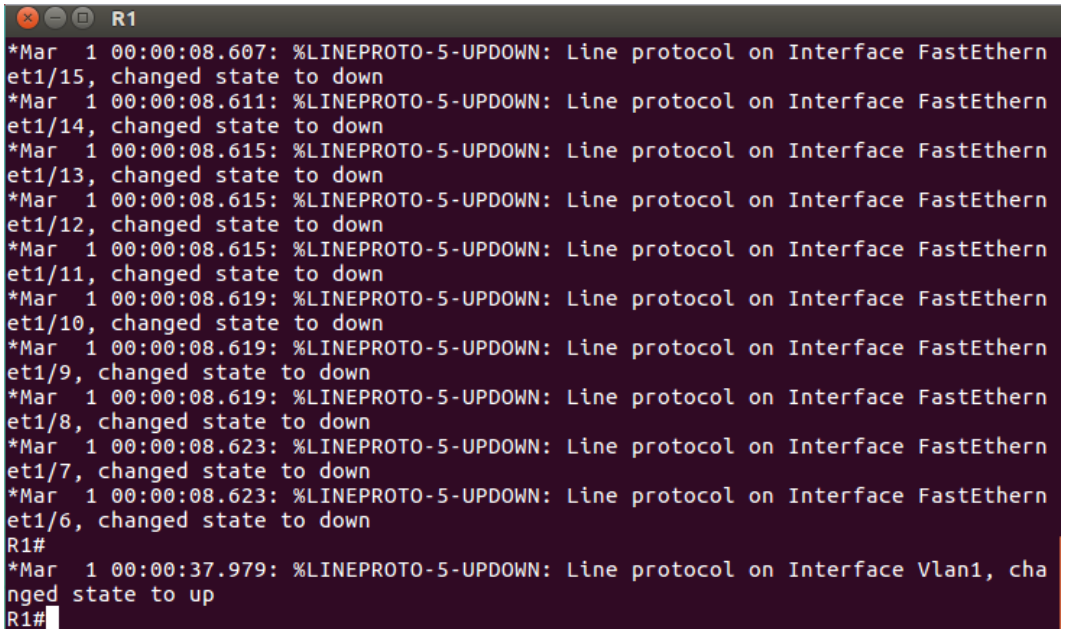


Use right-click to open up the drop-down menu with options for the selected node

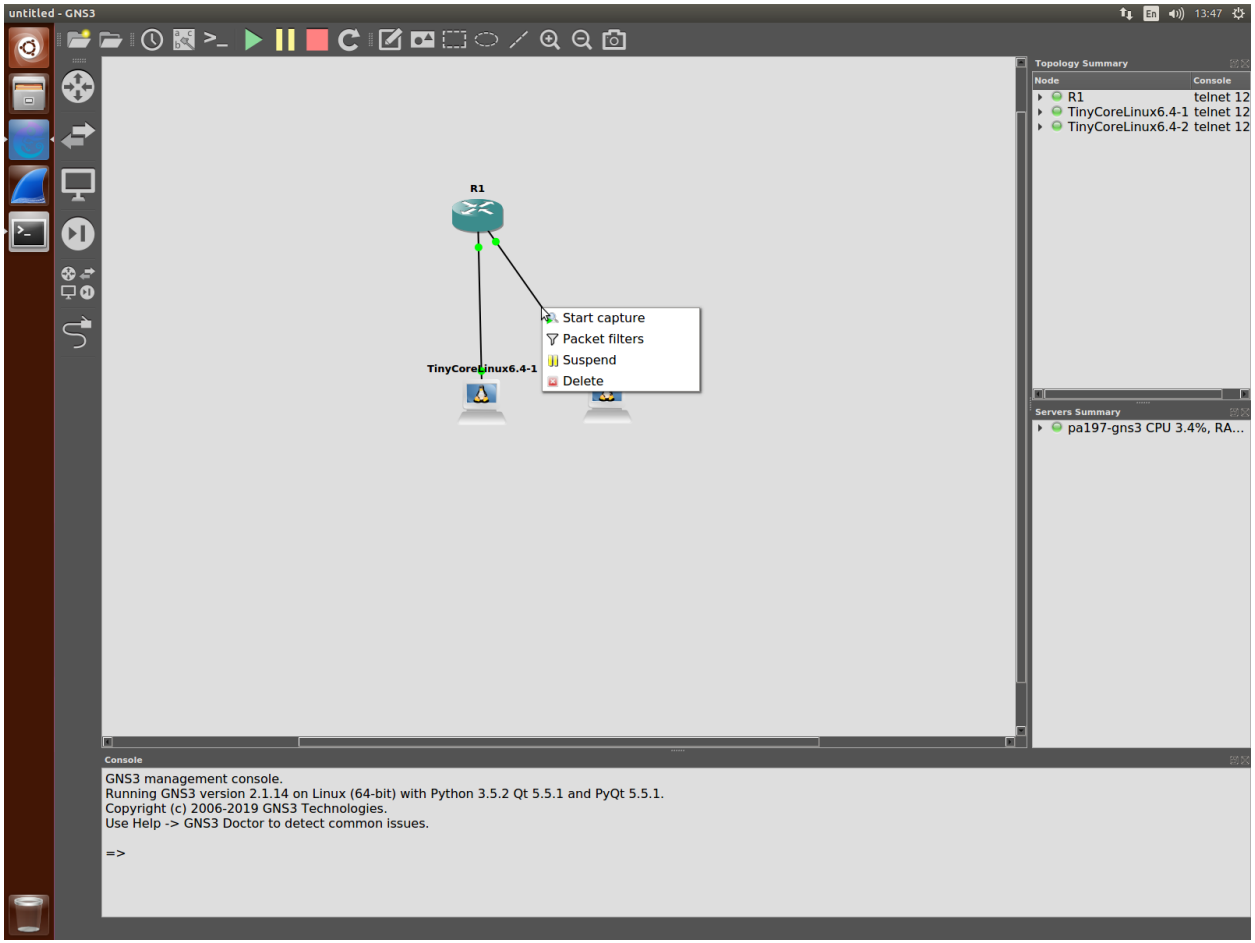
Using GNS3



Use the "Console" option from the drop-down to open up a CLI to the selected node

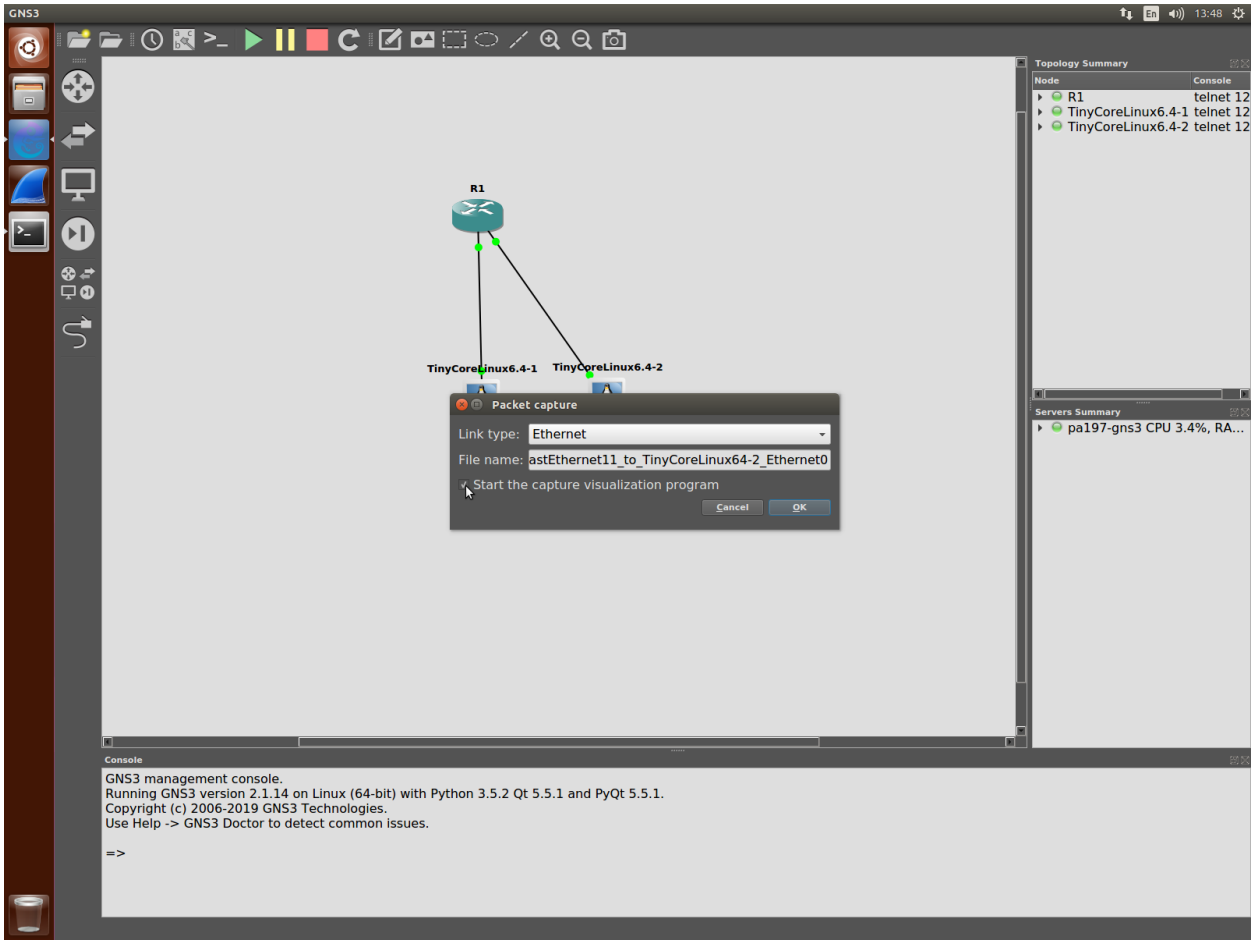
Note: the device must be started prior to attempting to connect to the console

Using GNS3



You can capture packets sent through a link and view them using Wireshark by right-clicking a link and selecting "Start capture" (make sure you have checked the "Start the capture visualization program" box)

Using GNS3



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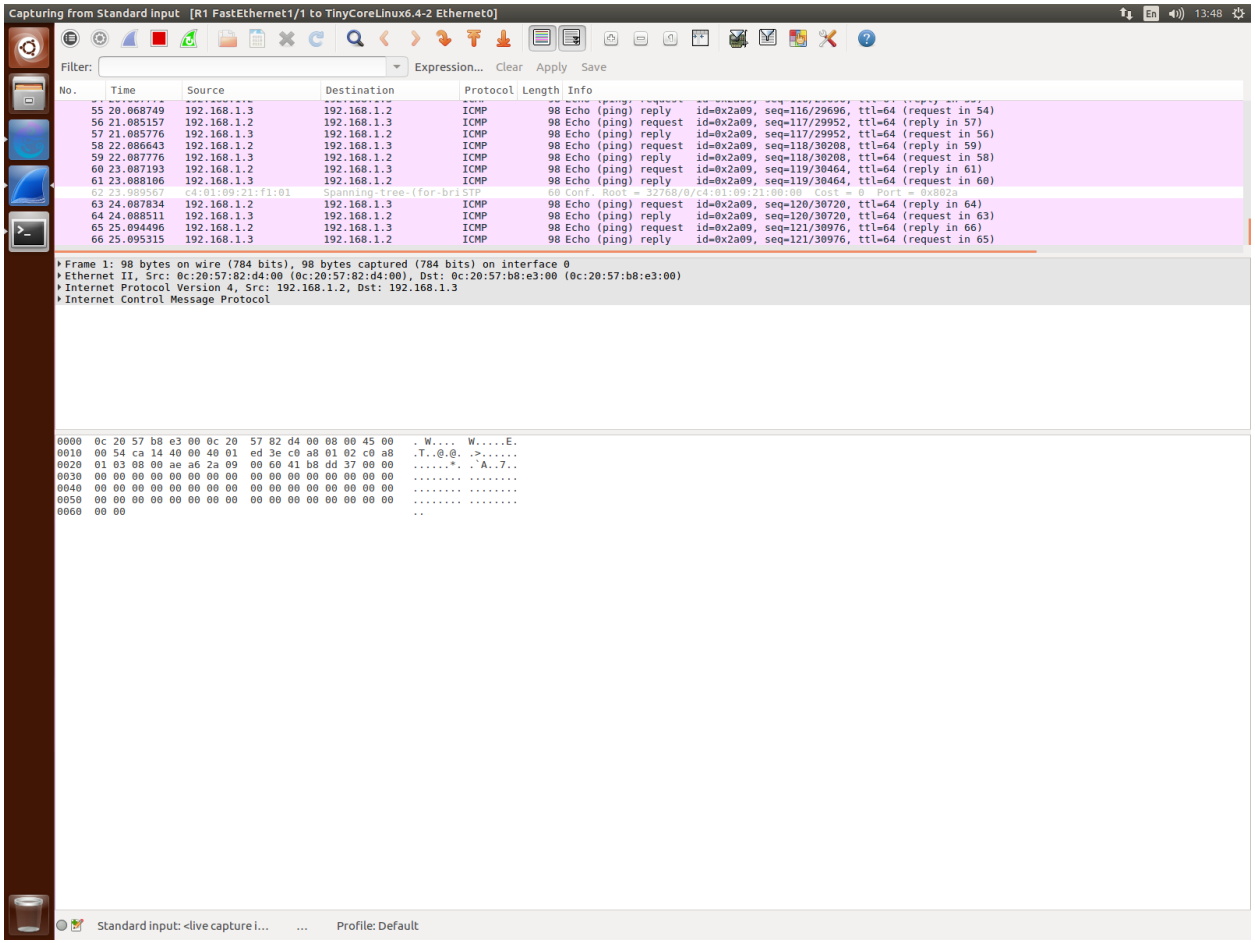

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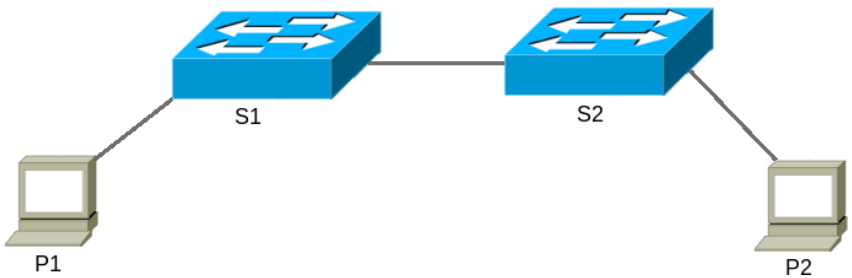
Creating a simple network

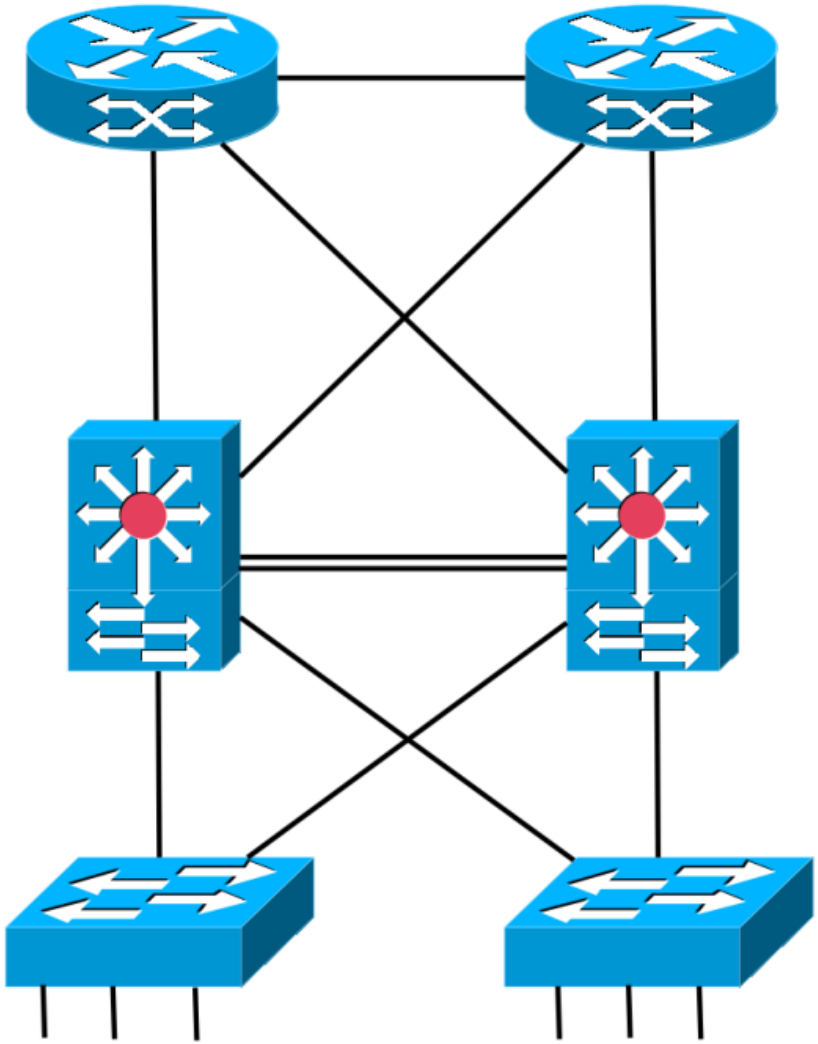


- create a network topology as shown using the "c3745" as the switch and "Tiny Core Linux 6.4" as the end device
- change the hostnames of the devices in GNS3 according to the diagram
- ping from P1 to P2 (set an IPv4 to make this easier)
  - `gns3@box:~$ sudo ifconfig eth0 192.168.1.2 netmask 255.255.255.0`
- see the PING packets being sent over the lines using Wireshark

Campus topology

- Three-layered topology
  - Core
  - Distribution
  - Access
- Modular
- Scalable
- High-availability

Campus topology - diagram



Core layer: backbone, connection to the "outside world" – fast, reliable, efficient

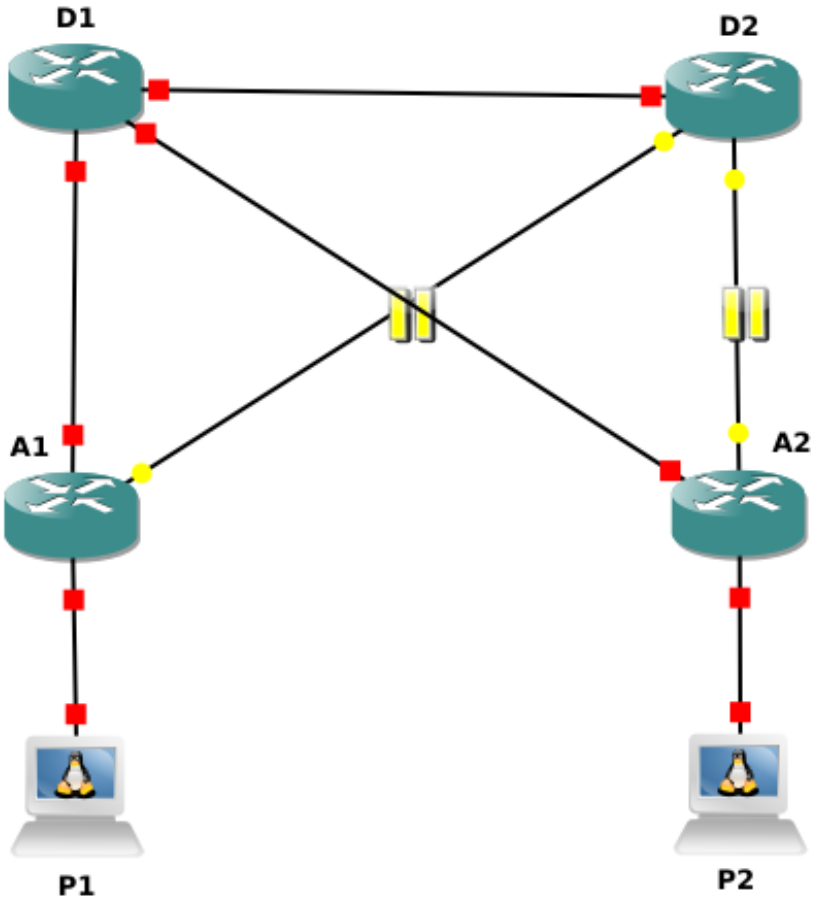
Distribution layer: aggregates access layer links and links them to the core layer, handles communication between devices on the access layer

Access layer: connects end devices (clients and servers alike) to network

Spanning Tree Protocol

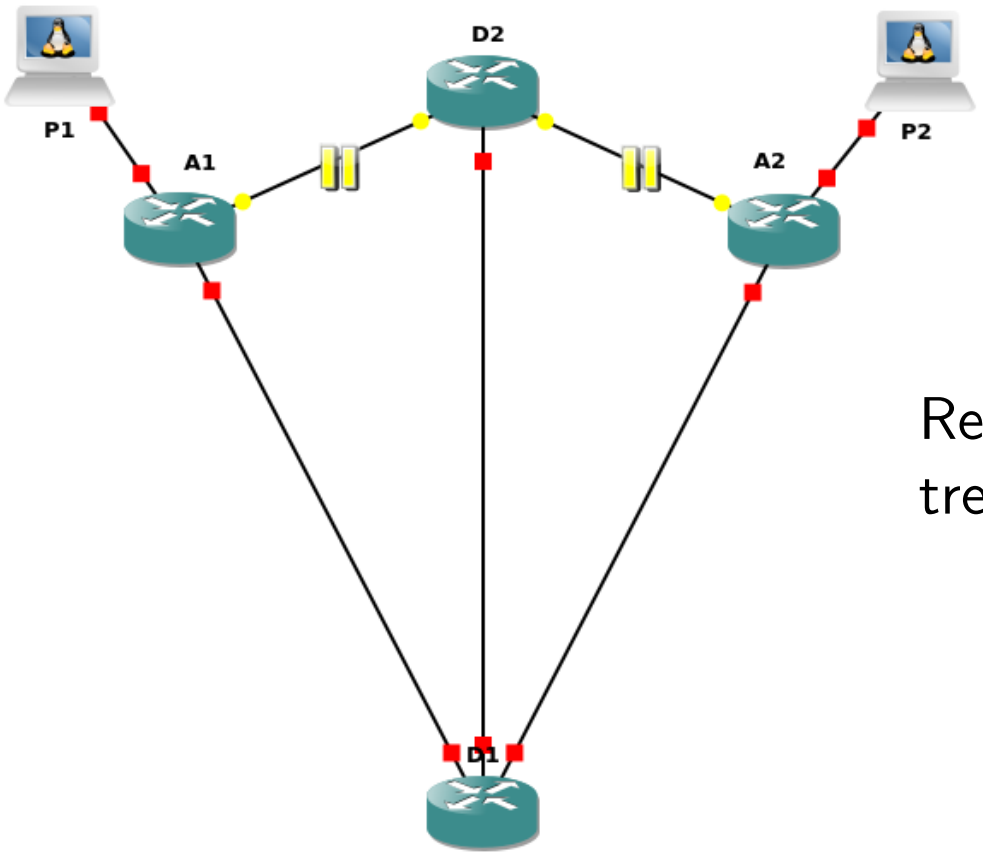
- Redundancy causes loops
- STP (logically) disconnects redundant links
- Tree-like design
- Root-focused
  - Root bridge forwards on all ports, all traffic goes through the root bridge

Spanning Tree Protocol - diagram



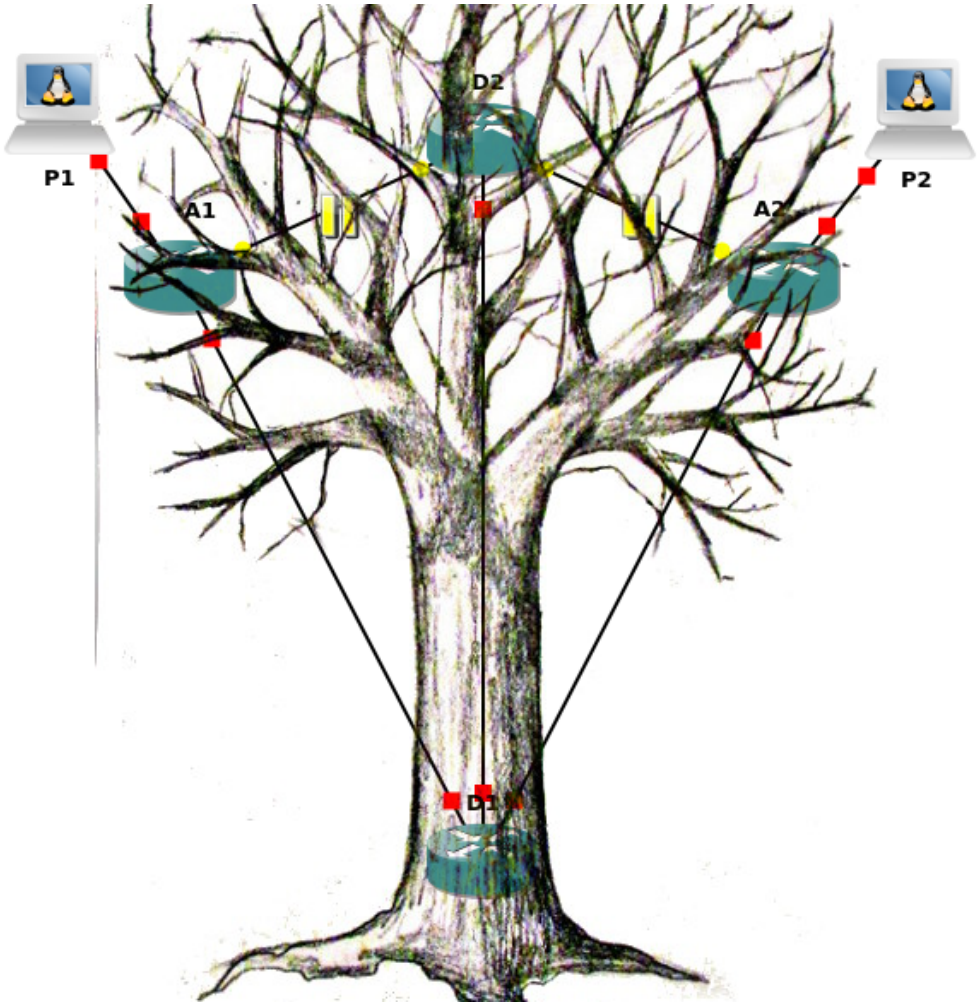
Where D1 is root bridge

Spanning Tree Protocol - diagram



Re-arranged visually for a more tree-like structure

Spanning Tree Protocol - diagram



Configuring Cisco IOS device

Incomplete (but unambiguous) commands allowed, tab-completing is recommended, type "?" for help

Show currently running configuration (change to `startup-config` to show the configuration loaded at startup)

```
Switch#show running-config
```

Save the currently running config for next boot

```
Switch#copy running-config startup-config
```

List interfaces along with with their status (connected, notconnected, disabled)

```
Switch#show interfaces status
```

Show to which interface packets destined for the specified MAC address will be forwarded to. Only accepts in quadruples separated by a ".", i.e. 9c:5c:8e:85:09:1f has to be 9c5c.8e85.091f

```
Switch#show mac-address address H.H.H
```

Show information on device's spanning tree priority and status of ports (blocked, forwarded et al.)

```
Switch#show spanning-tree brief
```

Enter global configuration mode, indicated by the "(config)" after the device's hostname

```
Switch#configure terminal
```

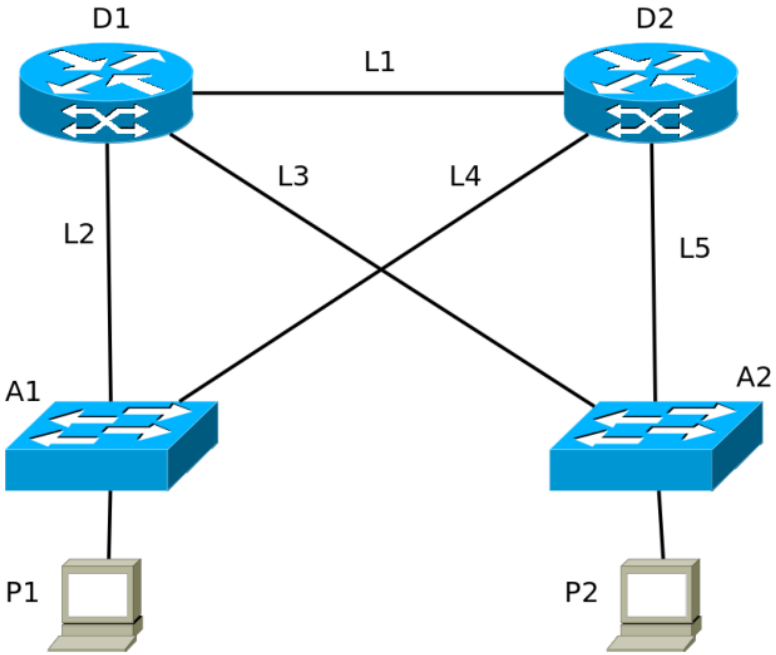
From the global configuration mode, enter the configuration for a specific interface, x/y is a number such as 1/0, see `show interfaces status`

```
Switch(config)#interface fastEthernet x/y
```

Set the device to be the primary root bridge in the spanning tree topology (replace `primary` with `secondary` to set as secondary root)

```
Switch(config)#spanning-tree vlan 1 root primary
```

Example Campus network design



Host	IP
P1	192.168.1.11/24
P2	192.168.1.12/24

- make D1 root bridge in the spanning tree topology
- make D2 secondary root (in case the primary root, D1, becomes unavailable, D2 will take over as the root bridge)
- find out which ports are blocked by STP
- find out the path of PING and PING REPLY packets
- disconnect line L2 (shut down the interface to which L2 in connected to on A1), observe the recalculated path of PING packets

References & further reading

- **GNS3**
  - https://www.gns3.com/
  - https://docs.gns3.com/
- **Campus topology**
  - http://www.ciscopress.com/articles/article.asp?p=2202410&seqNum=4
  - http://www.mcmcse.com/cisco/guides/hierarchical_model.shtml
  - https://www.cisco.com/c/en/us/solutions/design-zone/networking-design-guides/campus-wired-wireless.html
  - https://networklessons.com/spanning-tree/introduction-to-spanning-tree