

# PA197 Lab03

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## GNS3

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March 04, 2020

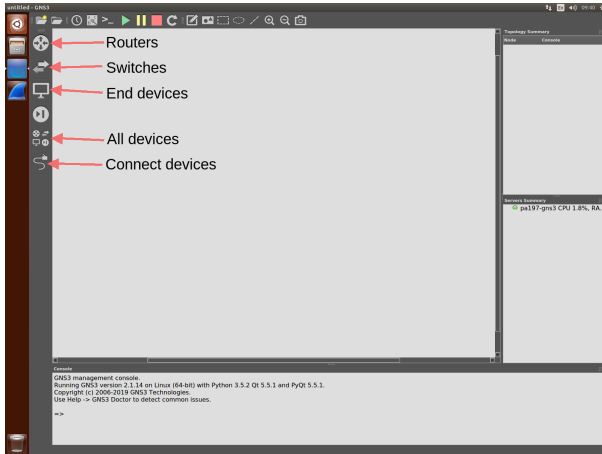
# Aims

- About GNS3
- Familiarising yourself with GNS3
- Campus network topology
- Task - example Campus network

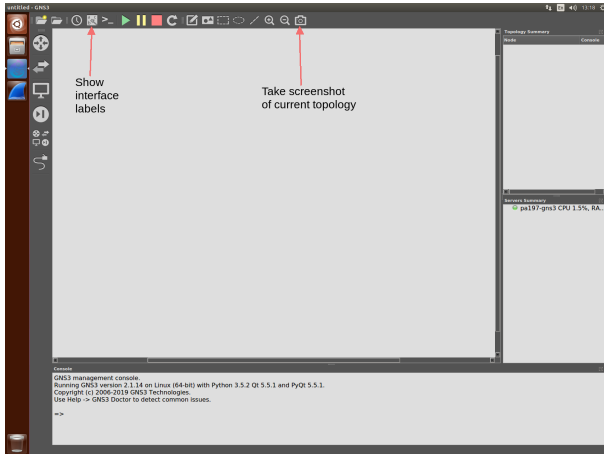
# GNS3

- Graphical Network Simulator 3
- Capable of simulating a computer network using a combination of physical, emulated (Dynamips) or software (Open vSwitch) devices
  - In contrast to Cisco's Packet Tracer, which doesn't provide full functionality - software reimplementations only, does not use IOS images, therefore not all commands are available
- Supports a wide variety of devices from different vendors
- Free-and-open-source software
  - Users have to provide their own device images due to licencing, Open vSwitch is included
- Consists of 2 components - GUI frontend and server
  - Server can be either run remotely or on the same device as the GUI
- Additional appliance templates can be obtained from the GNS3 Marketplace

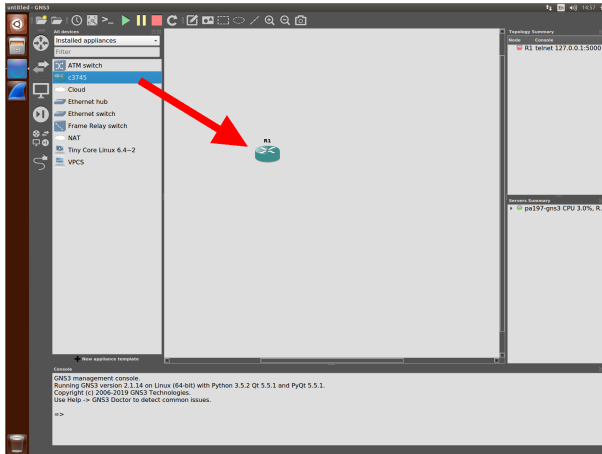
# Using GNS3 - crash course



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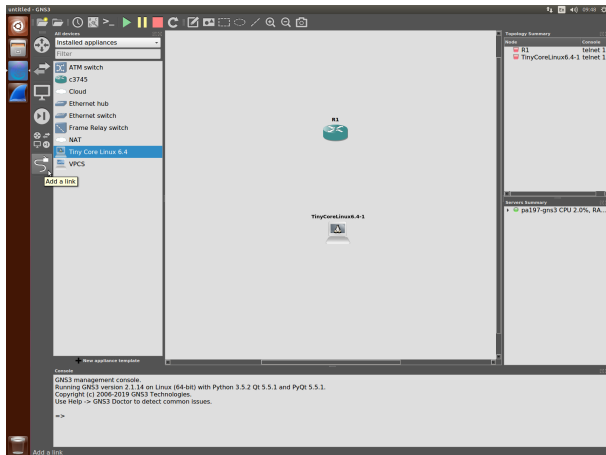


# Using GNS3 - crash course



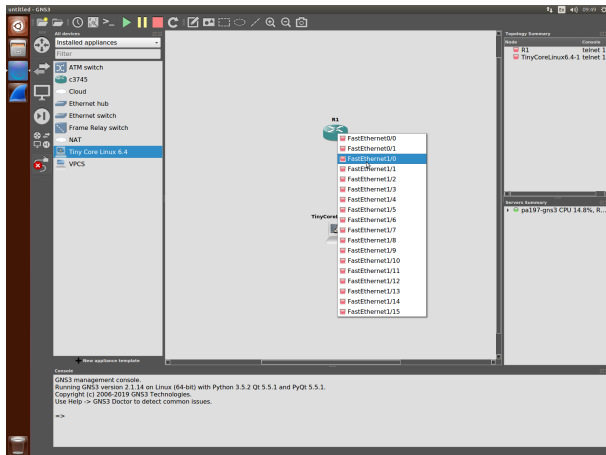
Drag and drop devices from the list to add them into your topology

# Using GNS3 - crash course



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  
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 0/x ports)

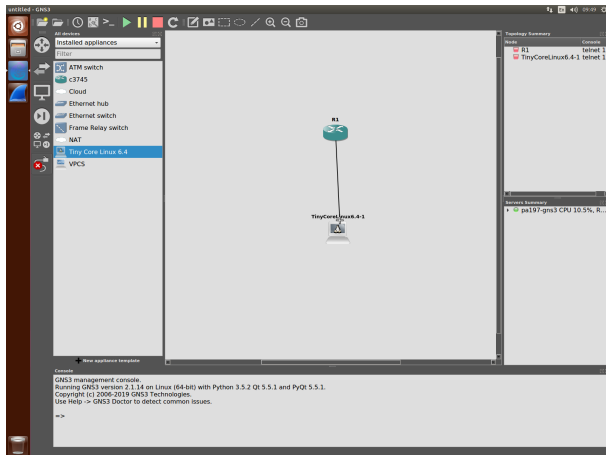
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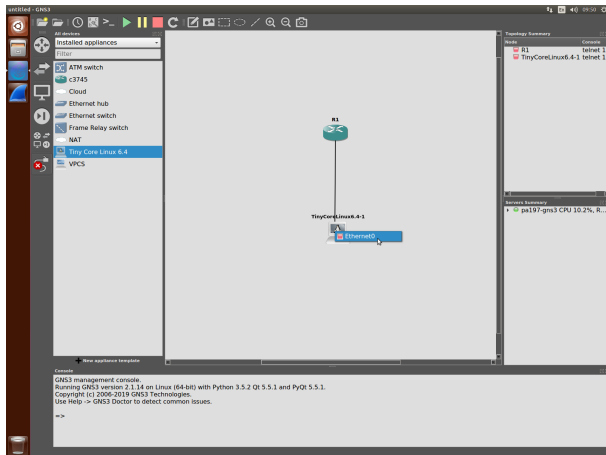


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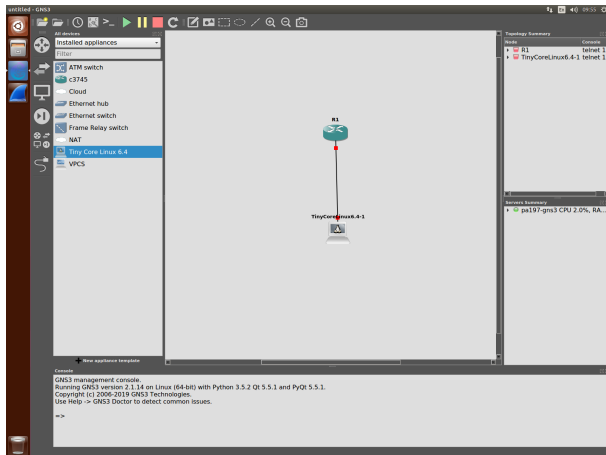
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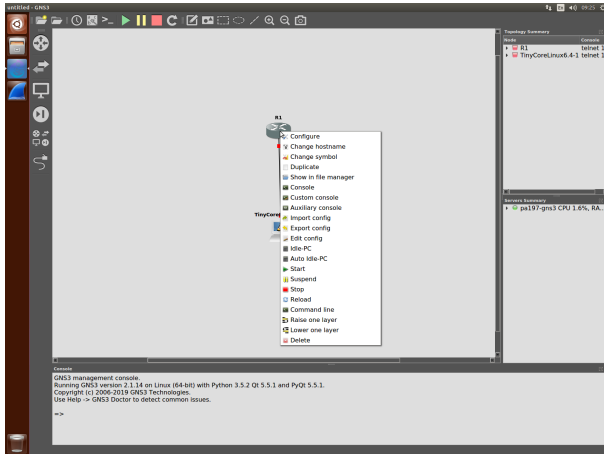
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# Using GNS3 - crash course



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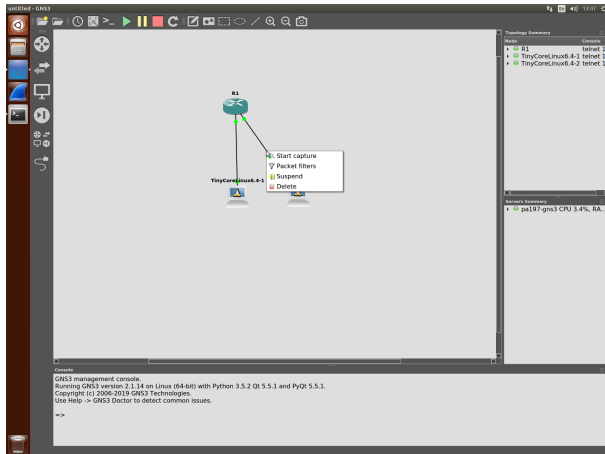
Use right-click to open up the drop-down menu with options for the selected node

# Using GNS3 - crash course

```
R1
*Mar 1 00:00:08.607: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet
et1/15, changed state to down
*Mar 1 00:00:08.611: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet
et1/14, changed state to down
*Mar 1 00:00:08.615: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet
et1/13, changed state to down
*Mar 1 00:00:08.615: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet
et1/12, changed state to down
*Mar 1 00:00:08.615: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet
et1/11, changed state to down
*Mar 1 00:00:08.619: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet
et1/10, changed state to down
*Mar 1 00:00:08.619: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet
et1/9, changed state to down
*Mar 1 00:00:08.619: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet
et1/8, changed state to down
*Mar 1 00:00:08.623: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet
et1/7, changed state to down
*Mar 1 00:00:08.623: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet
et1/6, changed state to down
R1#
*Mar 1 00:00:37.979: %LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan1, cha
nged state to up
R1#
```

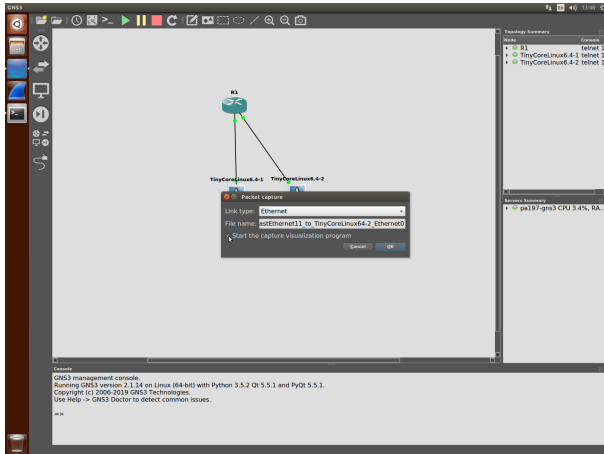
Use the  
"Console"  
option from the  
drop-down to  
open up a CLI  
to the selected  
node  
Note: the device  
must be started  
prior to  
attempting to  
connect to the  
console

# Using GNS3 - crash course



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)

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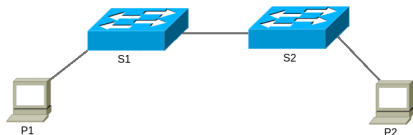
The screenshot shows a Wireshark capture window titled "Capturing from Standard Input [N1-Pa01Ethernet/1 to 192.168.1.2]". The interface includes a toolbar, a filter bar, and a main display area. The main display area shows a list of captured packets with columns for No., Time, Source, Destination, Protocol Length, and Info. The packets are ICMP Echo (ping) requests and replies. Below the list, the packet details pane shows the structure of the selected packet, including Ethernet II, Internet Protocol Version 4, and Internet Control Message Protocol. The packet bytes pane shows the raw hex and ASCII data of the selected packet.

No.	Time	Source	Destination	Protocol Length	Info
55	18.888769	192.168.1.1	192.168.1.2	ICMP 88	Echo (ping) request 18-0x2a99, seq=137/38956, ttl=64 (request in 54)
56	21.885117	192.168.1.2	192.168.1.1	ICMP 88	Echo (ping) reply 18-0x2a99, seq=137/38952, ttl=64 (reply in 57)
57	21.885776	192.168.1.1	192.168.1.2	ICMP 88	Echo (ping) request 18-0x2a99, seq=137/38952, ttl=64 (request in 58)
58	22.888643	192.168.1.2	192.168.1.1	ICMP 88	Echo (ping) reply 18-0x2a99, seq=137/38958, ttl=64 (reply in 59)
59	22.887776	192.168.1.1	192.168.1.2	ICMP 88	Echo (ping) request 18-0x2a99, seq=137/38958, ttl=64 (request in 60)
60	23.887153	192.168.1.2	192.168.1.1	ICMP 88	Echo (ping) reply 18-0x2a99, seq=137/38964, ttl=64 (reply in 61)
61	23.888196	192.168.1.1	192.168.1.2	ICMP 88	Echo (ping) request 18-0x2a99, seq=137/38964, ttl=64 (request in 62)
63	24.887934	192.168.1.1	192.168.1.2	ICMP 88	Echo (ping) request 18-0x2a99, seq=122/38978, ttl=64 (request in 64)
64	24.888511	192.168.1.2	192.168.1.1	ICMP 88	Echo (ping) reply 18-0x2a99, seq=122/38978, ttl=64 (reply in 63)
65	25.884456	192.168.1.1	192.168.1.2	ICMP 88	Echo (ping) request 18-0x2a99, seq=122/38976, ttl=64 (request in 65)
66	25.893513	192.168.1.2	192.168.1.2	ICMP 88	Echo (ping) reply 18-0x2a99, seq=122/38976, ttl=64 (request in 65)

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)



# Creating a simple network

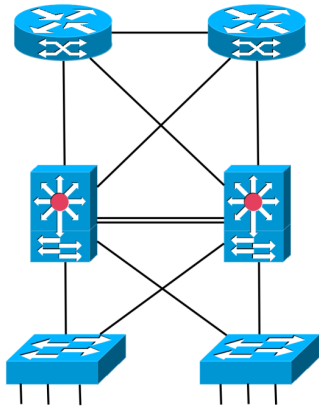


- create a simple network as shown on the diagram
  - you may choose from either the VPC or Linux VM and Cisco 3745 or Ethernet switch
- change the hostnames of the devices in GNS3 according to the diagram
- ping from P1 to P2
- using Wireshark, observe the ICMP echo packets being sent

# 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

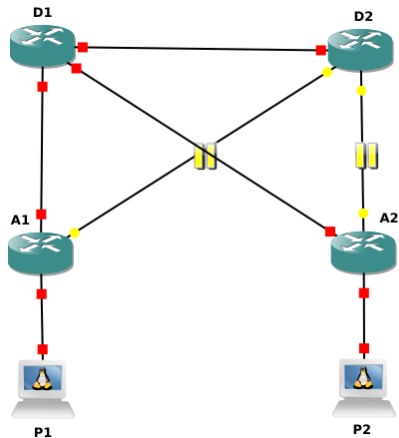
**Distribution layer:** aggregates access layer links and links them to the core layer, handles communication between devices on the access layer

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

# Spanning Tree Protocol

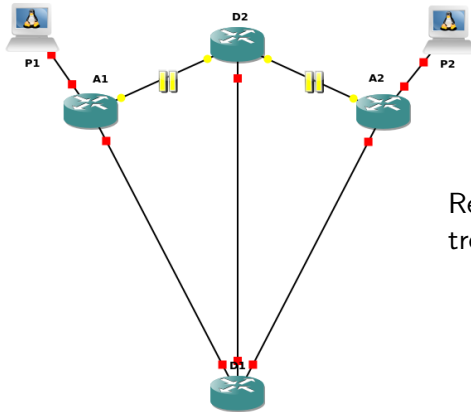
- Redundancy causes loops
- STP (logically) disconnects redundant links
- Tree-like design
- Root-focused
  - Root bridge forwards on all ports, all traffic goes through the root bridge

## Spanning Tree Protocol - diagram



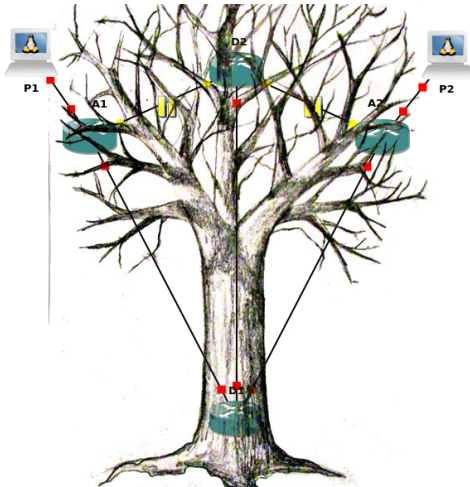
Where D1 is root bridge

# Spanning Tree Protocol - diagram

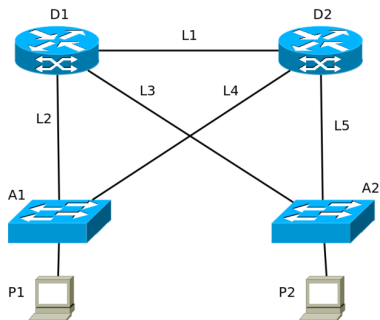


Re-arranged visually for a more tree-like structure

# Spanning Tree Protocol - diagram



## Example Campus network design



- use the c3745 router appliance provided
- 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, observe the recalculated path

Host	IP
P1	192.168.1.11/24
P2	192.168.1.12/24



# 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 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
```

# References & further reading

## ● GNS3

- <https://www.gns3.com/>
- <https://docs.gns3.com/>
- <https://www.gns3.com/marketplace/>

## ● Campus topology

- <http://www.ciscopress.com/articles/article.asp?p=2202410&seqNum=4>
- [http://www.mcmcse.com/cisco/guides/hierarchical\\_model.shtml](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>