

# Routing through Hub and Switch

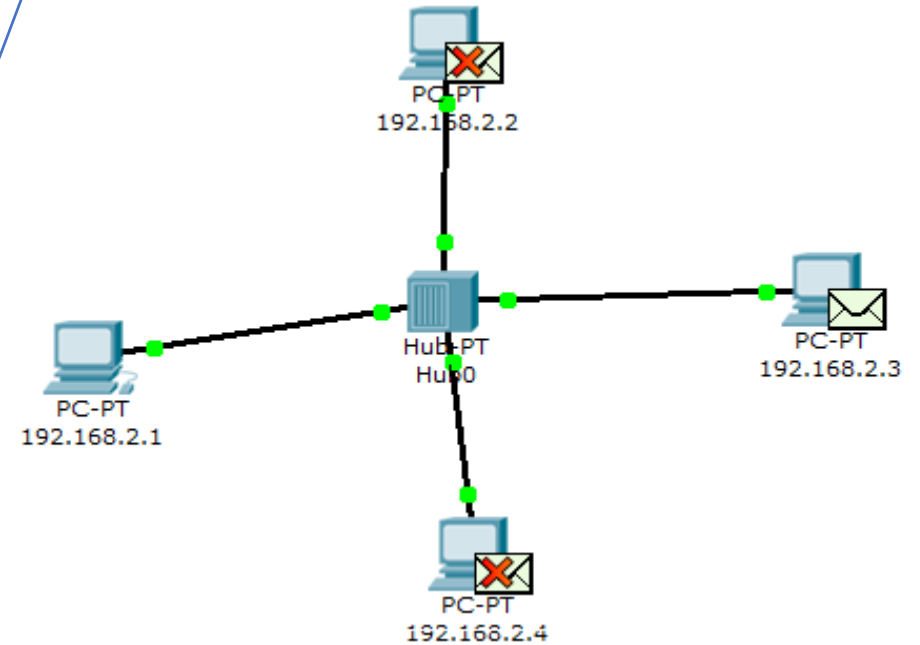
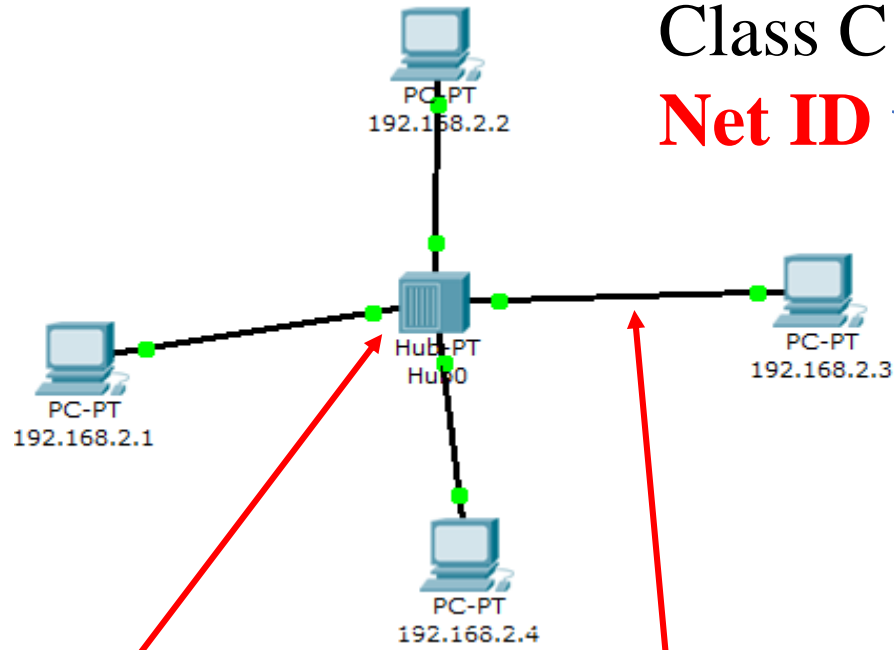
IP address in dotted decimal X.Y.Z.Q

Class C address **X.Y.Z.Q**

**Net ID** **user ID**

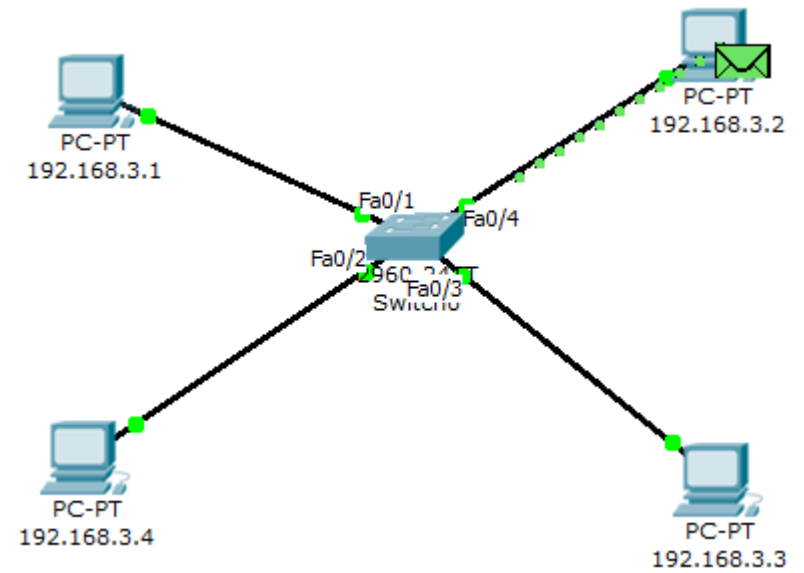
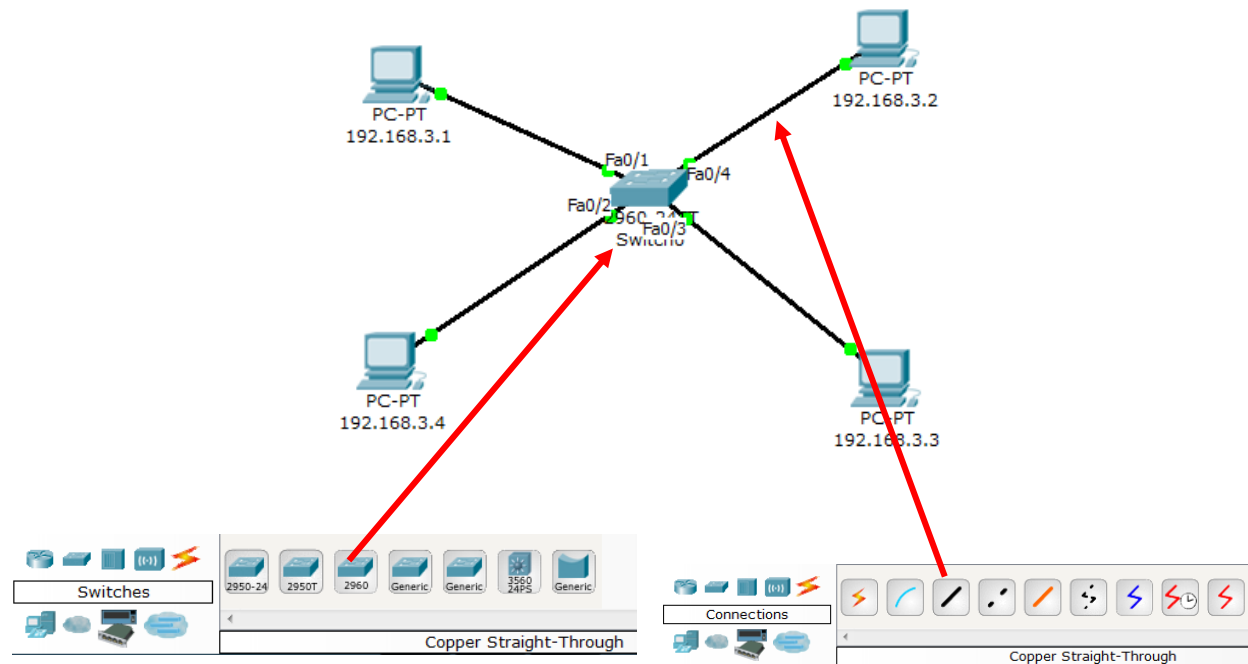
192.168.25.37

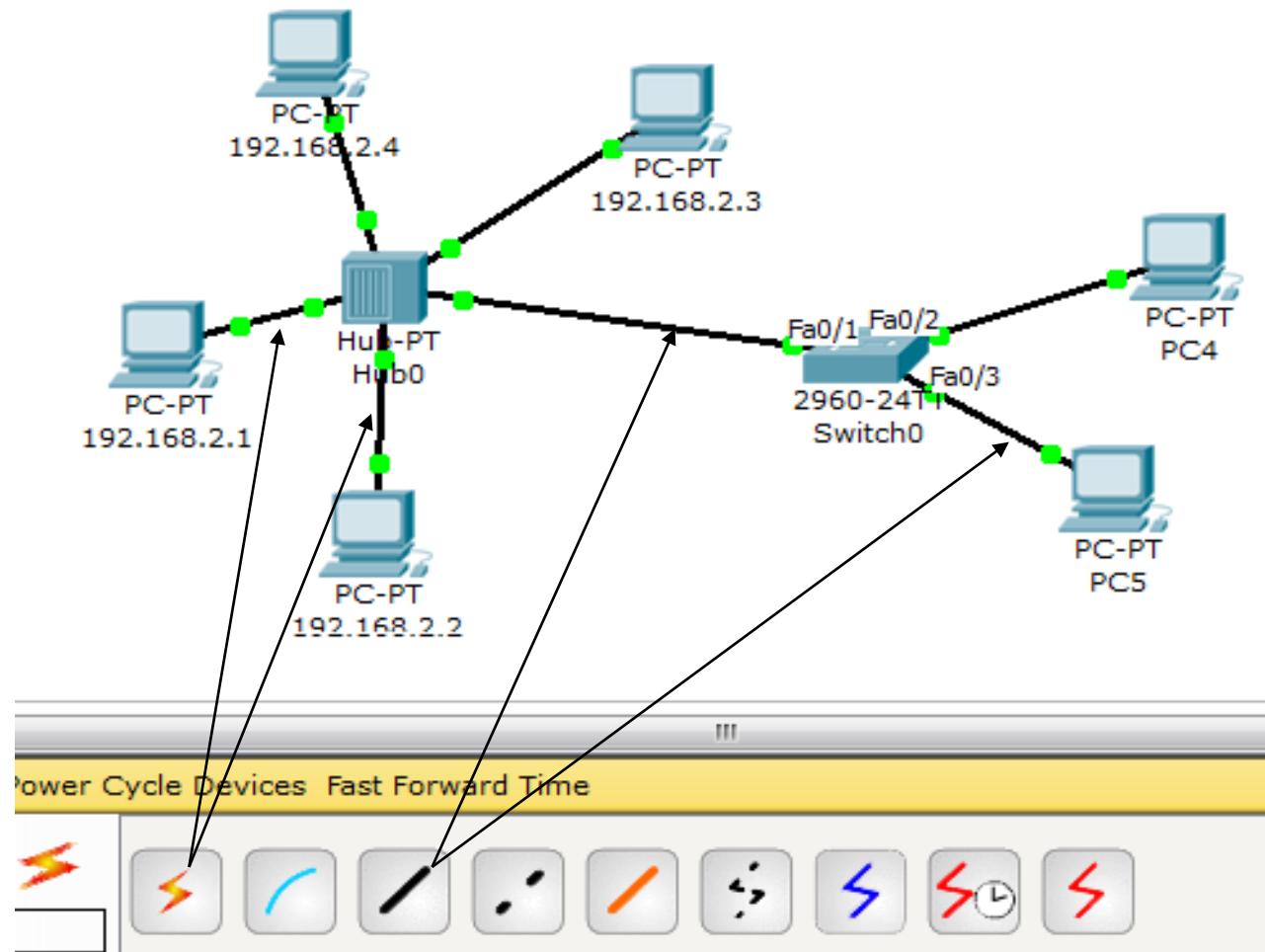
0-255



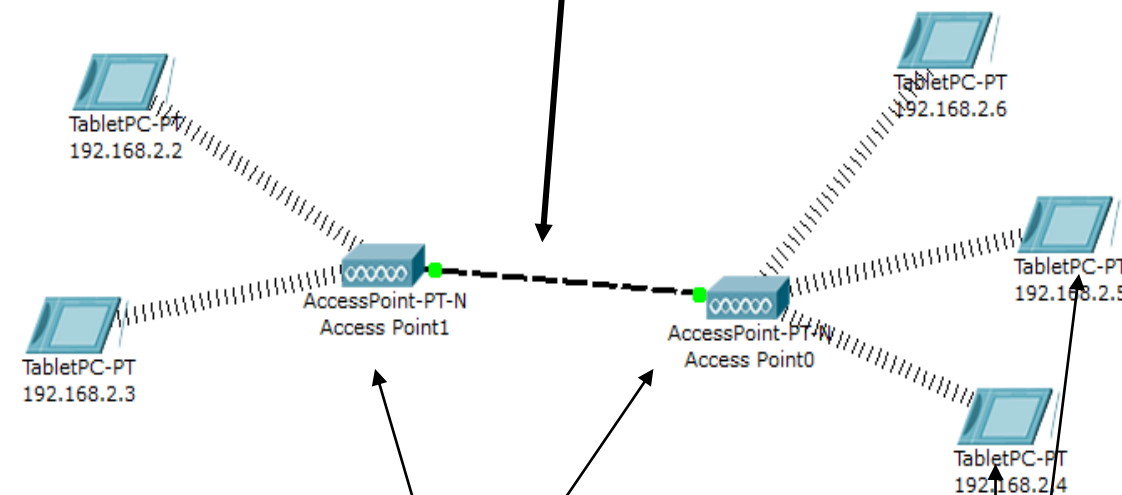
ping IP address

ICMP → Internet Control Message protocol






Connections

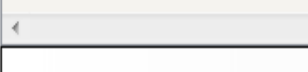


Time: 00:09:30 | Power Cycle Devices Fast Forward Time


Wireless Devices



Copper Cross-Over

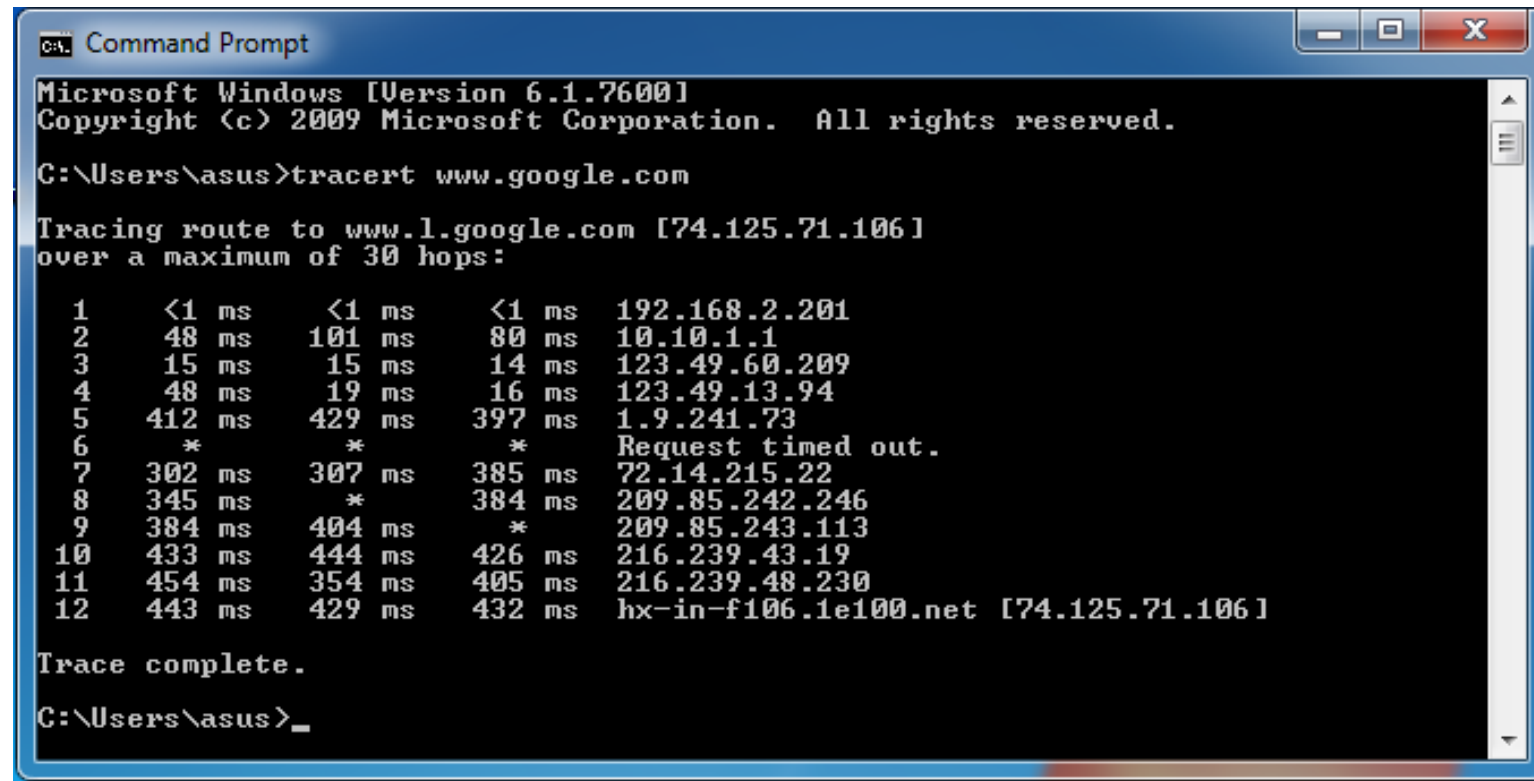


End Devices



# Verification of Some Fundamental Command of Network Connections

Using the command '*tracert IP address/DNS name*' on DOS prompt of a machine we can send an ICMP echo packet to the named host. Each hop is tested 3 times (by default) and the corresponding reply time is shown on the DOS prompt of the sender. Figure below shows the time table to reach [www.google.com](http://www.google.com).



```
Command Prompt
Microsoft Windows [Version 6.1.7600]
Copyright (c) 2009 Microsoft Corporation. All rights reserved.

C:\Users\asus>tracert www.google.com

Tracing route to www.l.google.com [74.125.71.106]
over a maximum of 30 hops:

  1  <1 ms    <1 ms    <1 ms    192.168.2.201
  2  48 ms    101 ms   80 ms    10.10.1.1
  3  15 ms    15 ms    14 ms    123.49.60.209
  4  48 ms    19 ms    16 ms    123.49.13.94
  5  412 ms   429 ms   397 ms    1.9.241.73
  6  *         *        *        Request timed out.
  7  302 ms   307 ms   385 ms    72.14.215.22
  8  345 ms   *        384 ms    209.85.242.246
  9  384 ms   404 ms   *        209.85.243.113
 10  433 ms   444 ms   426 ms    216.239.43.19
 11  454 ms   354 ms   405 ms    216.239.48.230
 12  443 ms   429 ms   432 ms    hx-in-f106.1e100.net [74.125.71.106]

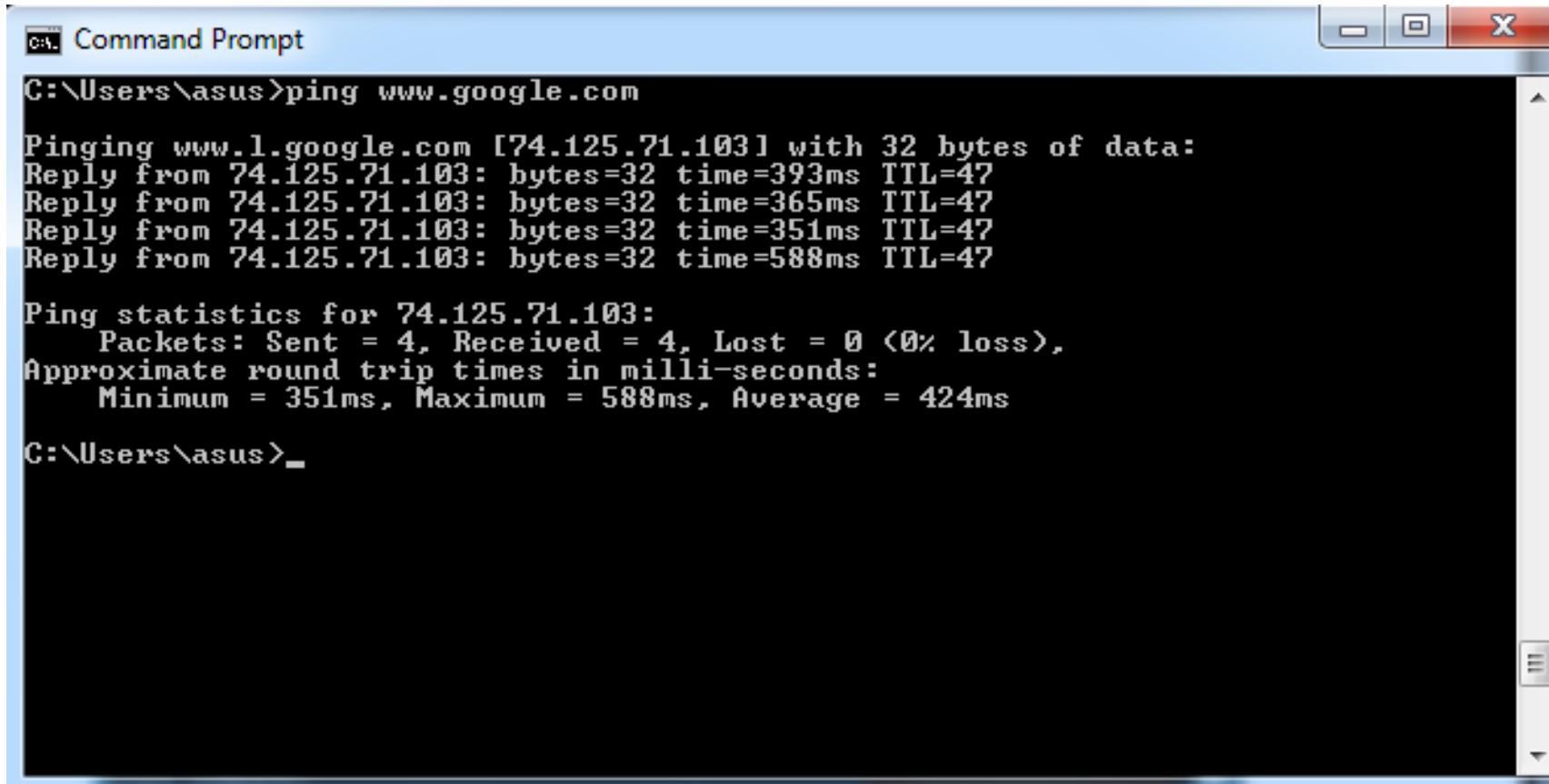
Trace complete.

C:\Users\asus>
```

Let us observe the line 2 as an example where the first attempt took 48ms, the second one took 101 ms, and the third one took 80ms. This variation depends on traffic condition of the link. Some time timeout may occur for a certain router, for example the line 6 of above case. In this case alternate router is selected (72.14.215.22) visualized from line 7. To get details about the command we can use '*tracert /?*'

To test the connection between two nodes of a network we can use *ping* command. The details of the command are shown below. Four test packets each of 32 bytes are sent. Ping provides results as the amount of time spent (in milliseconds) between the sending of test packets and receipt of responses. The statistics of time and success rate are also mention at the bottom of the time table.

The result of ping [www.google.com](http://www.google.com) is shown below.

A screenshot of a Windows Command Prompt window. The title bar is blue and says "Command Prompt". The window has standard Windows window controls (minimize, maximize, close) in the top right. The command prompt shows the command "C:\Users\asus>ping www.google.com" and its output. The output shows four successful replies from 74.125.71.103 with varying times (393ms, 365ms, 351ms, 588ms) and a TTL of 47. Below the replies, it shows ping statistics for 74.125.71.103: 4 packets sent, 4 received, 0% loss, with minimum, maximum, and average round trip times. The prompt ends with "C:\Users\asus>\_".

```
C:\Users\asus>ping www.google.com

Pinging www.l.google.com [74.125.71.103] with 32 bytes of data:
Reply from 74.125.71.103: bytes=32 time=393ms TTL=47
Reply from 74.125.71.103: bytes=32 time=365ms TTL=47
Reply from 74.125.71.103: bytes=32 time=351ms TTL=47
Reply from 74.125.71.103: bytes=32 time=588ms TTL=47

Ping statistics for 74.125.71.103:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 351ms, Maximum = 588ms, Average = 424ms

C:\Users\asus>_
```

# HUB, Bridge Switch and Router

## Hub

- ✓ A hub is the simplest of these devices. Any data packet coming from one port is sent to all other ports. It is then up to the receiving computer to decide if the packet is for it or not.
- ✓ The biggest problem with hubs is their simplicity. Since every packet is sent out to every computer on the network, there is a lot of wasted transmission. This means that the network can easily become flooded. Hubs are typically used on small networks where the amount of data going across the network is never very high.



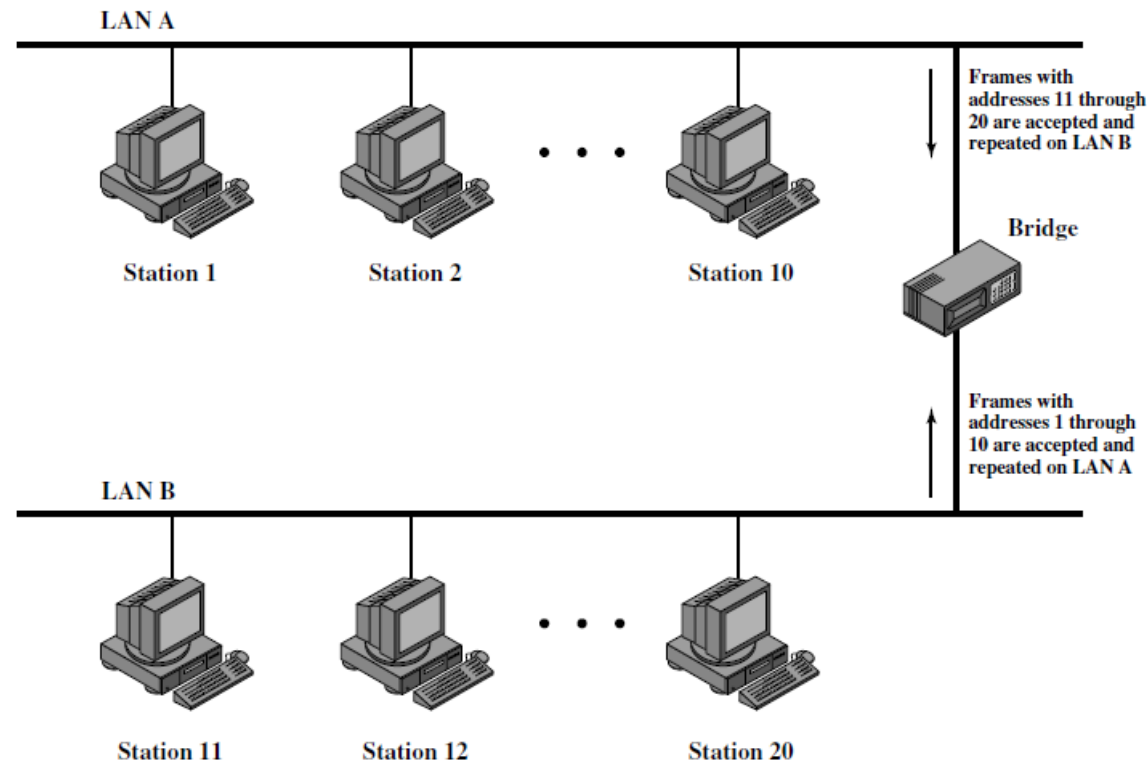
There are mainly two types of hubs:

1. Passive: The signal is forwarded as it is (so it doesn't need power supply).
2. Active: The signal is amplified, so they work as repeaters. In fact they have been called multiport repeaters (use power supply). Hubs can be connected to other hubs using an uplink port to extend the network.

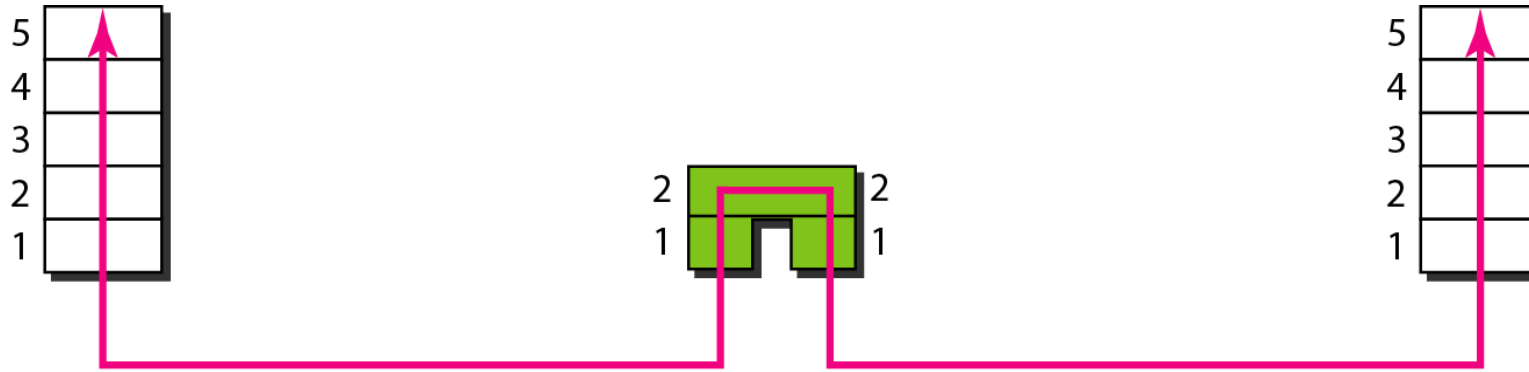
OSI Model: Active Hubs work on the physical layer (lowest layer). That's the reason they can't deal with addressing or data filtering. The passive Hub is at layer 0.

# Bridge

A bridge goes one step up on a hub in that it looks at the destination of the packet before sending. If the destination address is not on the other side of the bridge it will not transmit the data. It uses MAC address of 48 bits.

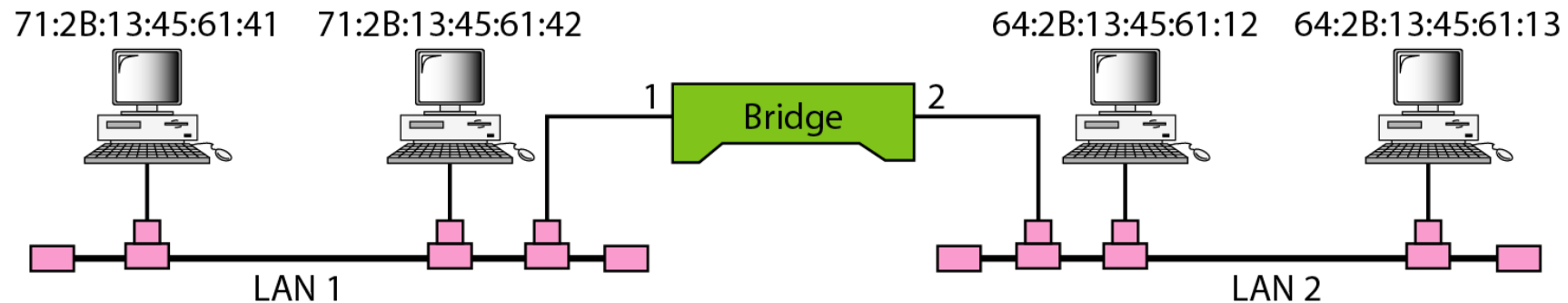


## *A bridge connecting two LANs*



Address	Port
71:2B:13:45:61:41	1
71:2B:13:45:61:42	1
64:2B:13:45:61:12	2
64:2B:13:45:61:13	2

Bridge Table



# Switch

Instead of broadcasting the frames everywhere, a switch actually checks for the destination MAC address and forward it to the relevant port to reach that computer only.



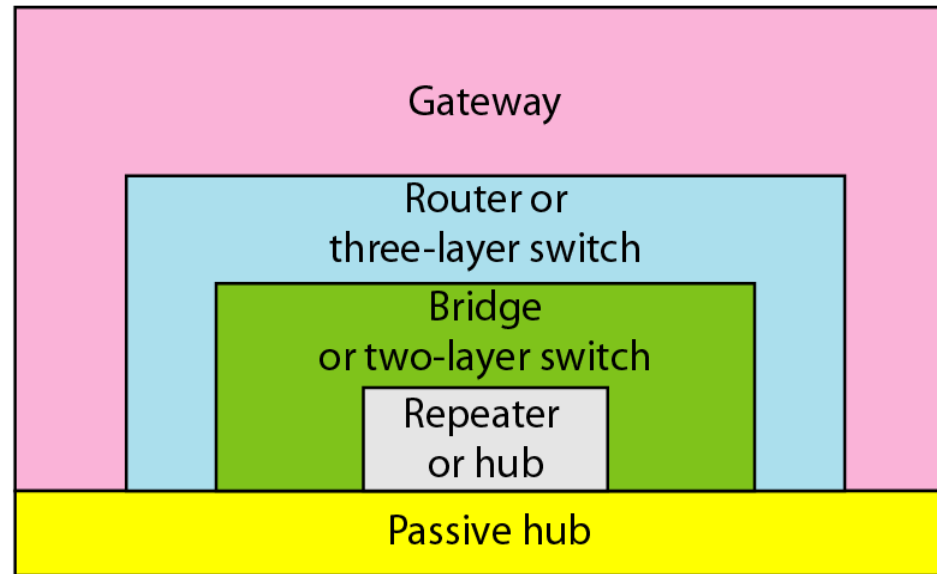
## **Router**

A router is similar in a switch in that it forwards packets based on address. But, instead of the MAC address that a switch uses, a router can use the IP address. This allows the network to send packet among different network ID.

## **Gateway**

**Gateways** are very intelligent devices or else can be a computer running the appropriate software to connect and translate data between networks with different protocols or architecture, so their work is much more complex than a normal router. For instance, allowing communication between TCP/IP clients and IPX/SPX or AppleTalk.

Application
Transport
Network
Data link
Physical



Application
Transport
Network
Data link
Physical

Five categories of connecting devices