RV College of Engineering®

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IV SEMESTER B.E

Computer Network- *Experiential Learning*

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Scenario 1
Peer to Peer Networks

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1. Introduction to Cisco packet tracer

Cisco Packet Tracer is a cross-platform visual simulation tool designed by Cisco Systems that allows users to create network topologies and imitate modern computer networks. The software allows users to simulate the configuration of Cisco routers and switches using a simulated command line interface. Packet Tracer makes use of a drag and drop user interface, allowing users to add and remove simulated network devices as they see fit. The software is mainly focused towards Certified Cisco Network Associate Academy students as an educational tool for helping them learn fundamental CCNA concepts.

Packet Tracer allows users to create simulated network topologies by dragging and dropping routers, switches and various other types of network devices. A physical connection between devices is represented by a 'cable' item. Packet Tracer supports an array of simulated Application Layer protocols, as well as basic routing with RIP, OSPF, EIGRP, BGP, to the extents required by the current CCNA curriculum. As of version 5.3, Packet Tracer also supports the Border Gateway Protocol.

In addition to simulating certain aspects of computer networks, Packet Tracer can also be used for collaboration. As of Packet Tracer 5.0, Packet Tracer supports a multi-user system that enables multiple users to connect multiple topologies together over a computer network. Packet Tracer also allows instructors to create activities that students have to complete. Packet Tracer is often used in educational settings as a learning aid.

Packet Tracer allows students to design complex and large networks, which is often not feasible with physical hardware, due to costs. Packet Tracer is commonly used by CCNA Academy students, since it is available to them for free. However, due to functional limitations, it is intended by CISCO to be used only as a learning aid, not a replacement for Cisco routers and switches. The application itself only has a small number of features found within the actual hardware running a current Cisco IOS version. Thus, Packet Tracer is unsuitable for modelling production networks. It has a limited command set, meaning it is not possible to practice all of the IOS commands that might be required. Packet Tracer can be useful for understanding abstract networking concepts, such as the Enhanced Interior Gateway Routing Protocol by animating these elements in a visual form. Packet Tracer is also useful in education by providing additional components, including an authoring system, network protocol simulation and improving knowledge an assessment system

Cisco registered a new PTTP URI scheme with IANA to extend Packet Tracer 7.2.2 capabilities and make it interact with Cisco CSR virtual routers. Cisco CSR routers are cloud based IOX-XE routers deployed on x86 virtual machines.

Cisco Packet Tracer provides two operating modes to visualize the behavior of a network—real-time mode and simulation mode. In real-time mode the network behaves as real devices do, with immediate real-time response for all network activities. The real-time mode gives students a viable alternative to real equipment and allows them to gain configuration practice before working with real equipment. In simulation mode the user can see and control time intervals, the inner workings of data transfer, and the propagation of data across a network. This helps students understand the fundamental concepts behind network operations. A solid understanding of network fundamentals can help accelerate learning about related concepts.

2. Introduction to Peer to Peer Networks

Peer-to-peer (P2P) computing or networking is a distributed application architecture that partitions tasks or workloads between peers. Peers are equally privileged, equipotent participants in the application. They are said to form a peer-to-peer network of nodes.

Peers make a portion of their resources, such as processing power, disk storage or network bandwidth, directly available to other network participants, without the need for central coordination by servers or stable hosts. Peers are both suppliers and consumers of resources, in contrast to the traditional client-server model in which the consumption and supply of resources is divided. Emerging collaborative P2P systems are going beyond the era of peers doing similar things while sharing resources, and are looking for diverse peers that can bring in unique resources and capabilities to a virtual community thereby empowering it to engage in greater tasks beyond those that can be accomplished by individual peers, yet that are beneficial to all the peers.

In our experiment, we use two types of devices- switch and router.

<u>I) A network switch</u> (also called switching hub, bridging hub, officially MAC bridge) is networking hardware that connects devices on a computer network by using packet switching to receive and forward data to the destination device.

A network switch is a multiport network bridge that uses MAC addresses to forward data at the data link layer (layer 2) of the OSI model. Some switches can also forward data at the network layer (layer 3) by additionally incorporating routing functionality. Such switches are commonly known as layer-3 switches or multilayer switches.

Switches for Ethernet are the most common form of network switch. The first Ethernet switch was introduced by Kalpana in 1990. Switches also exist for other types of networks including Fibre Channel, Asynchronous Transfer Mode, and InfiniBand.

Unlike less advanced repeater hubs, which broadcast the same data out of each of its ports and let the devices decide what data they need, a network switch forwards data only to the devices that need to receive it.

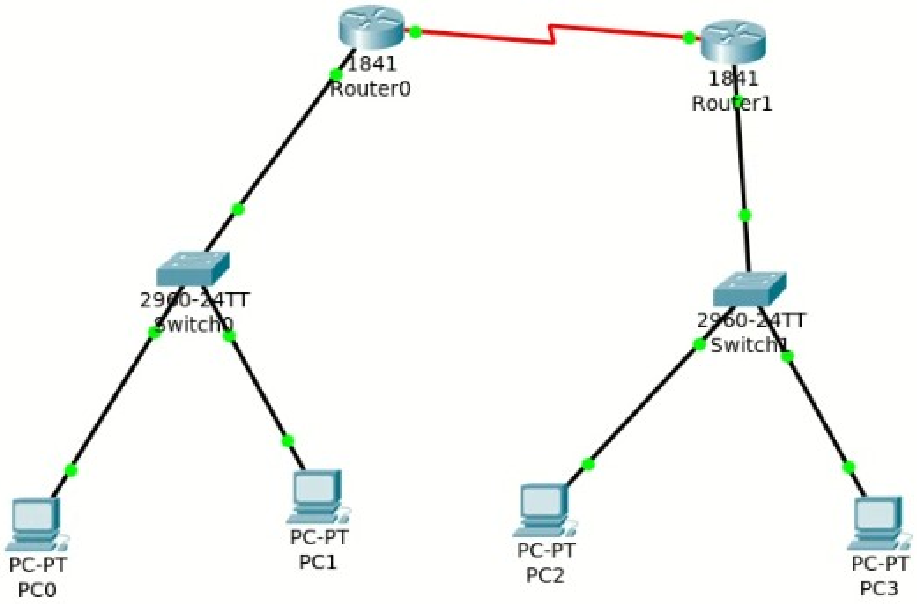
II) A router is a networking device that forwards data packets between computer networks. Routers perform the traffic directing functions on the Internet. Data sent through the internet, such as a web page or email, is in the form of data packets. A packet is typically forwarded from one router to another router through the networks that constitute an internetwork (e.g. the Internet) until it reaches its destination node.

A router is connected to two or more data lines from different IP networks. When a data packet comes in on one of the lines, the router reads the network address information in the packet header to determine the ultimate destination. Then, using information in its routing table or routing policy, it directs the packet to the next network on its journey.

The most familiar type of IP routers are home and small office routers that simply forward IP packets between the home computers and the Internet. An example of a router would be the owner's cable or DSL router, which connects to the Internet through an Internet service provider (ISP). More sophisticated routers, such as enterprise routers, connect large business or ISP networks up to the powerful core routers that forward data at high speed along the optical fiber lines of the Internet backbone.

3. Implementation details

a) Topology



The above configuration shows two networks connected together via the routers using a serial cable. The two networks may be located anywhere such as Bangalore and Chennai. PCs in each network are connected using a switch (via Fast Ethernet Cables) which uses the router as a gateway. Using routing(as seen in the next section), we can communicate between any two PCs without using a server system.

b) Commands used and their purpose.

Firstly, we make the connections as shown. For each PC we assign an IP address, subnet mask and a default gateway respectively in Desktop→IP Configuration. A default gateway is the node in a computer network using the internet protocol suite that serves as the forwarding host (router) to other networks when no other route specification matches the destination IP address of a packet.

PC	IP Address	Subnet Mask	Default Gateway
PC0	192.168.2.2	255.255.255.0	192.168.2.1
PC1	192.168.2.3	255.255.255.0	192.168.2.1
PC2	192.168.3.2	255.255.255.0	192.168.3.1
PC3	192.168.3.3	255.255.255.0	192.168.3.1

Now we need to set up the IP address of each interface in each router. We will use the CLI for this.

Router0

Command	Explanation
enable	Enters privileged EXEC mode
show ip int brief	Shows configured interfaces
configure terminal	Enters global configuration mode
interface s0/0/0	Enters interface for serial connection 0/0/0
ip address 192.168.4.1 255.255.255.0	Configures ip address and subnet mask of router for serial connection
no shutdown	Enables the interface, changing its state from administratively down to administratively up.
exit	Exits configuration mode for the interface and returns to global configuration mode.
interface FastEthernet0/0	Enters interface for Fast Ethernet connection 0/0
ip address 192.168.2.1 255.255.255.0	Configures ip address and subnet mask of router for ethernet connection (to switch), equal to gateway address of PC0 and PC1
no shutdown	Enables the interface, changing its state from administratively down to administratively up.
exit	Exits configuration mode for the interface and returns to global configuration mode.

Router1

Command	Explanation
enable	Enters privileged EXEC mode
show ip int brief	Shows configured interfaces
configure terminal	Enters global configuration mode
interface s0/0/0	Enters interface for serial connection 0/0/0
ip address **192.168.4.2** 255.255.255.0	Configures ip address and subnet mask of router for serial connection
no shutdown	Enables the interface, changing its state from administratively down to administratively up.
exit	Exits configuration mode for the interface and returns to global configuration mode.
interface FastEthernet0/0	Enters interface for Fast Ethernet connection 0/0
ip address **192.168.3.1** 255.255.255.0	Configures ip address and subnet mask of router for ethernet connection (to switch), equal to gateway address of PC2 and PC3
no shutdown	Enables the interface, changing its state from administratively down to administratively up.
exit	Exits configuration mode for the interface and returns to global configuration mode.

At this stage we notice that we can send packets from PC0 to PC1 and from 2 to 3 but not between networks. This is because we need to set up **routing.** Routing is the process of selecting a path for traffic in a network or between or across multiple networks.

Syntax: ip route network_address_destination subnet_mask ip_address_next_hop

Routing command for Router0

ip route 192.168.3.0 255.255.255.0 192.168.4.2

In this case router0 destination is the ‘3 network’, i.e PC2, PC3 and their gateway addresses, when ANDed with subnet mask 255.255.255.0 yield network address 192.168.3.0.

Next hop is the serially connected Router1 whose address is 192.168.4.2.

Routing command for Router1

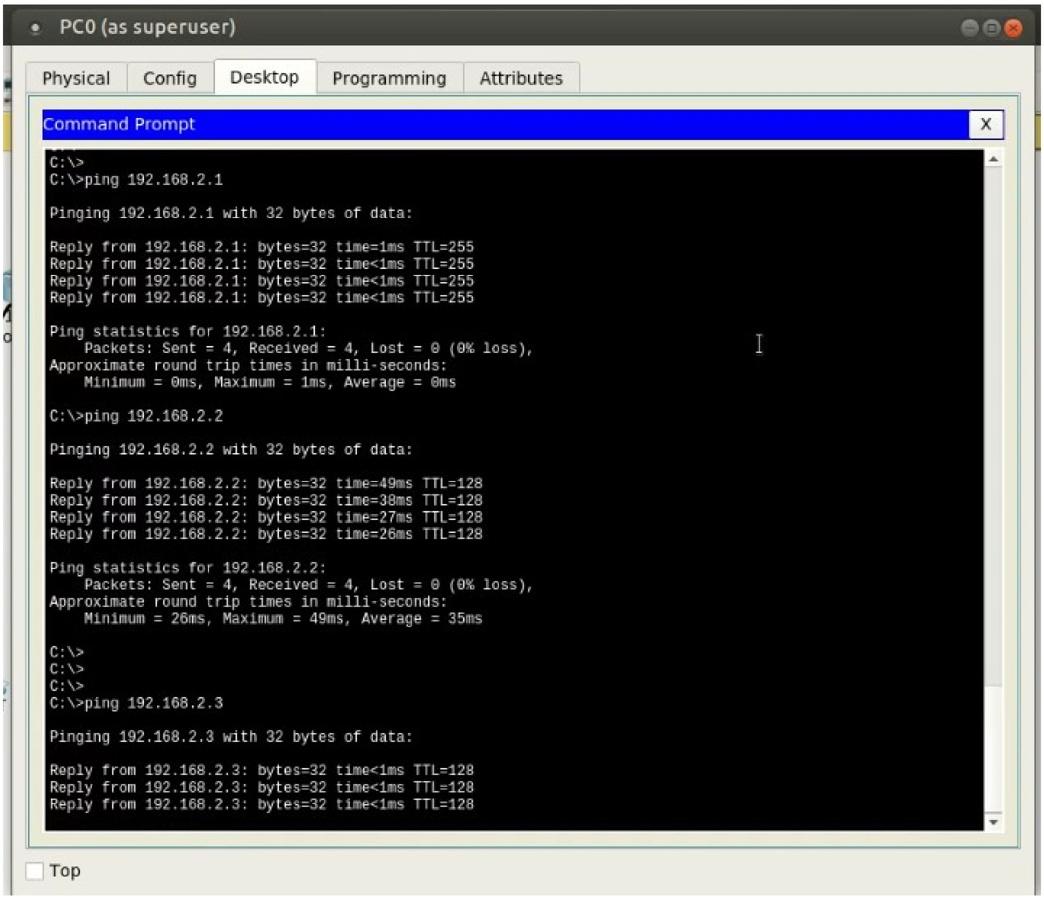
ip route 192.168.2.0 255.255.255.0 192.168.4.1

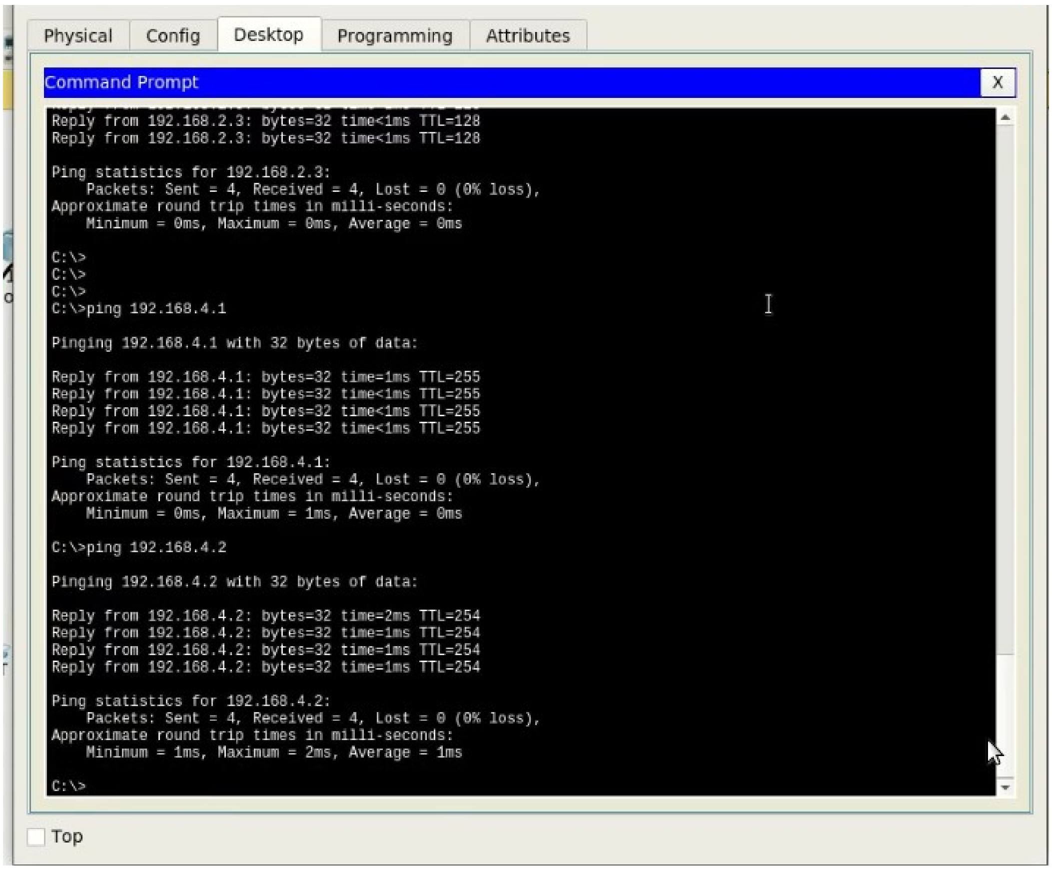
In this case router1 destination is the ‘2 network’, i.e PC0, PC1and their gateway addresses, when ANDed with subnet mask 255.255.255.0 yield network address 192.168.2.0.

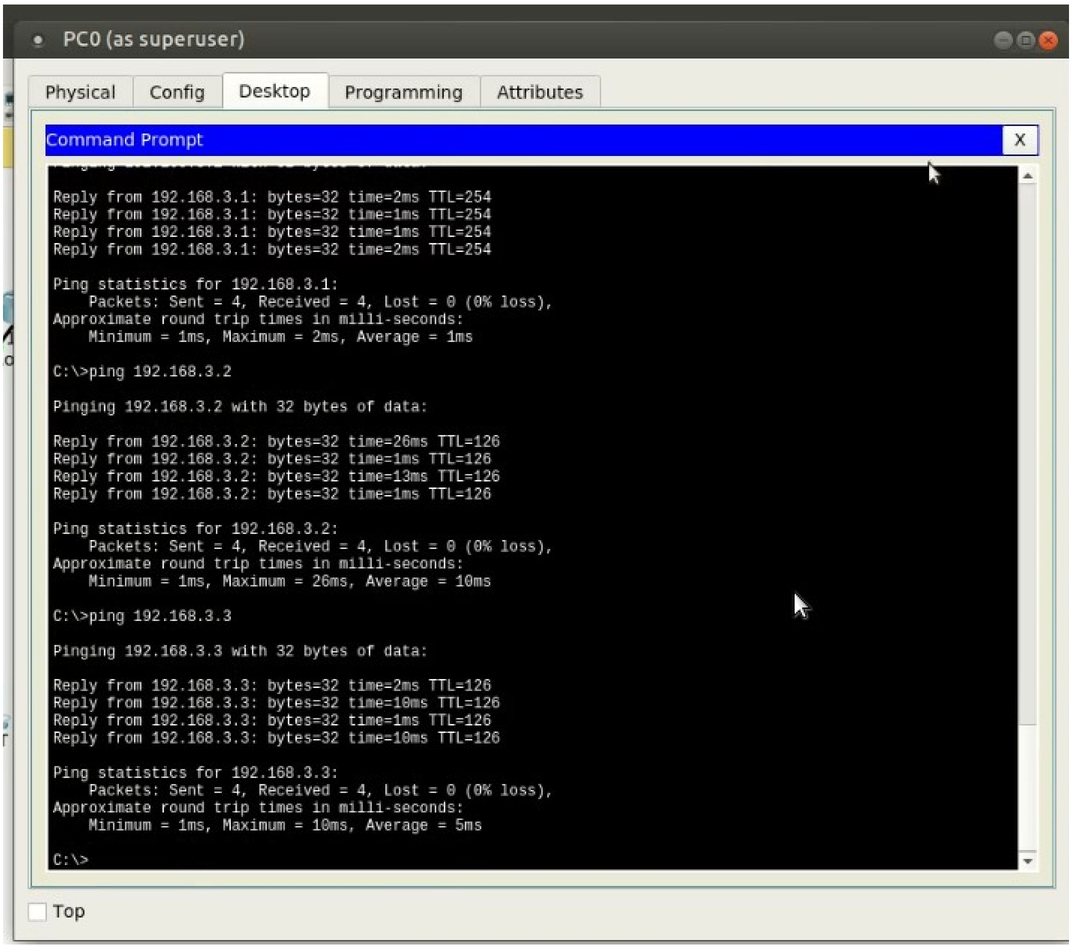
Next hop is the serially connected Router0 whose address is 192.168.4.1.

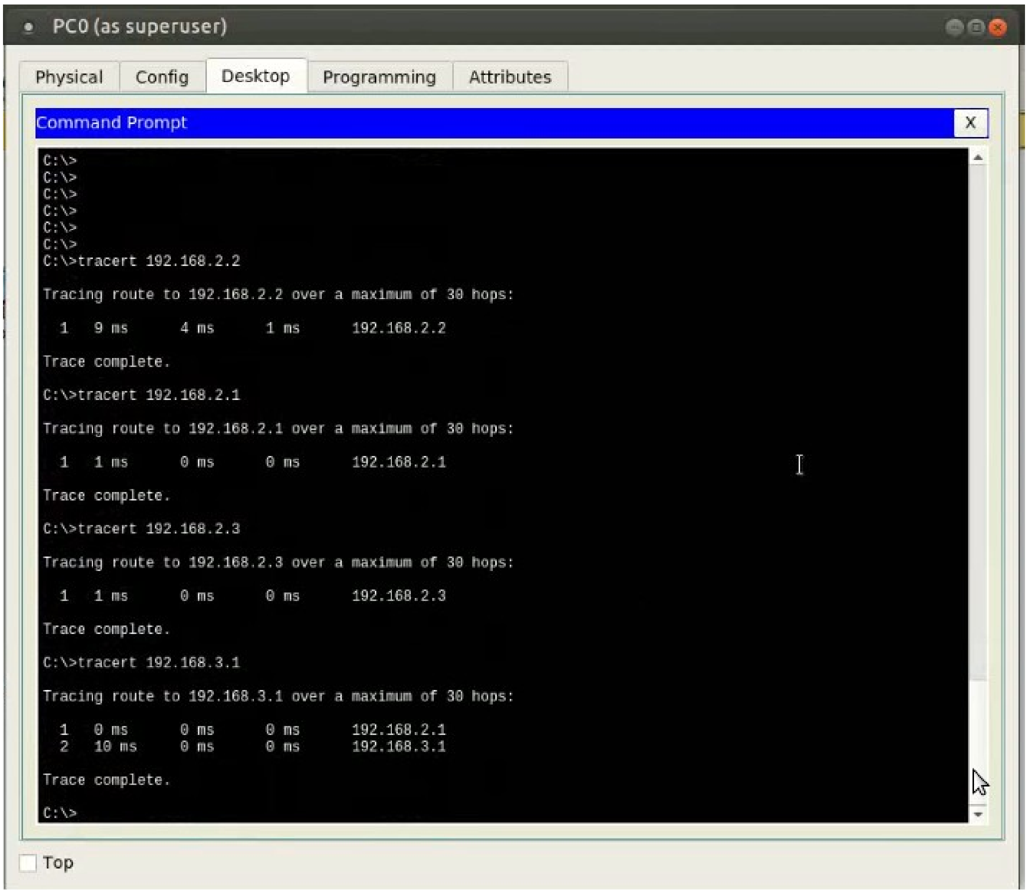
The network has been setup and we will try ping and traceroute commands, as seen in the next section.

4. Results and Screenshots






PC0 (as superuser)
Physical
Config
Desktop
Programming
Attributes
Command Prompt
X
Reply from 192.168.3.1: bytes=32 time=2ms TTL=254
Reply from 192.168.3.1: bytes=32 time=1ms TTL=254
Reply from 192.168.3.1: bytes=32 time=1ms TTL=254
Reply from 192.168.3.1: bytes=32 time=2ms TTL=254
Ping statistics for 192.168.3.1:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 1ms, Maximum = 2ms, Average = 1ms
C:\>ping 192.168.3.2
Pinging 192.168.3.2 with 32 bytes of data:
Reply from 192.168.3.2: bytes=32 time=26ms TTL=126
Reply from 192.168.3.2: bytes=32 time=1ms TTL=126
Reply from 192.168.3.2: bytes=32 time=13ms TTL=126
Reply from 192.168.3.2: bytes=32 time=1ms TTL=126
Ping statistics for 192.168.3.2:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 1ms, Maximum = 26ms, Average = 10ms
C:\>ping 192.168.3.3
Pinging 192.168.3.3 with 32 bytes of data:
Reply from 192.168.3.3: bytes=32 time=2ms TTL=126
Reply from 192.168.3.3: bytes=32 time=10ms TTL=126
Reply from 192.168.3.3: bytes=32 time=1ms TTL=126
Reply from 192.168.3.3: bytes=32 time=10ms TTL=126
Ping statistics for 192.168.3.3:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 1ms, Maximum = 10ms, Average = 5ms
C:\>
Top


PC0 (as superuser)
Physical
Config
Desktop
Programming
Attributes
Command Prompt
X
C:\>
C:\>
C:\>
C:\>
C:\>
C:\>
C:\>tracert 192.168.2.2
Tracing route to 192.168.2.2 over a maximum of 30 hops:
1 9 ms 4 ms 1 ms 192.168.2.2
Trace complete.
C:\>tracert 192.168.2.1
Tracing route to 192.168.2.1 over a maximum of 30 hops:
1 1 ms 0 ms 0 ms 192.168.2.1
Trace complete.
C:\>tracert 192.168.2.3
Tracing route to 192.168.2.3 over a maximum of 30 hops:
1 1 ms 0 ms 0 ms 192.168.2.3
Trace complete.
C:\>tracert 192.168.3.1
Tracing route to 192.168.3.1 over a maximum of 30 hops:
1 0 ms 0 ms 0 ms 192.168.2.1
2 10 ms 0 ms 0 ms 192.168.3.1
Trace complete.
C:\>
Top

5. Conclusion

- 2 hops needed to access PC in another network but only one hop needed to access PC in same network.
- Communication between 2 PCs on same switch is very quick because switch just intelligently forwards packets.
- A simple P2P communication has been setup between two networks wherein one PC may communicate with another without the use of servers.