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Interconnexion des réseaux - Lab 2

PART 1. Configuring a CISCO Router

Exercise 1(A). Switching Cisco IOS Command Modes

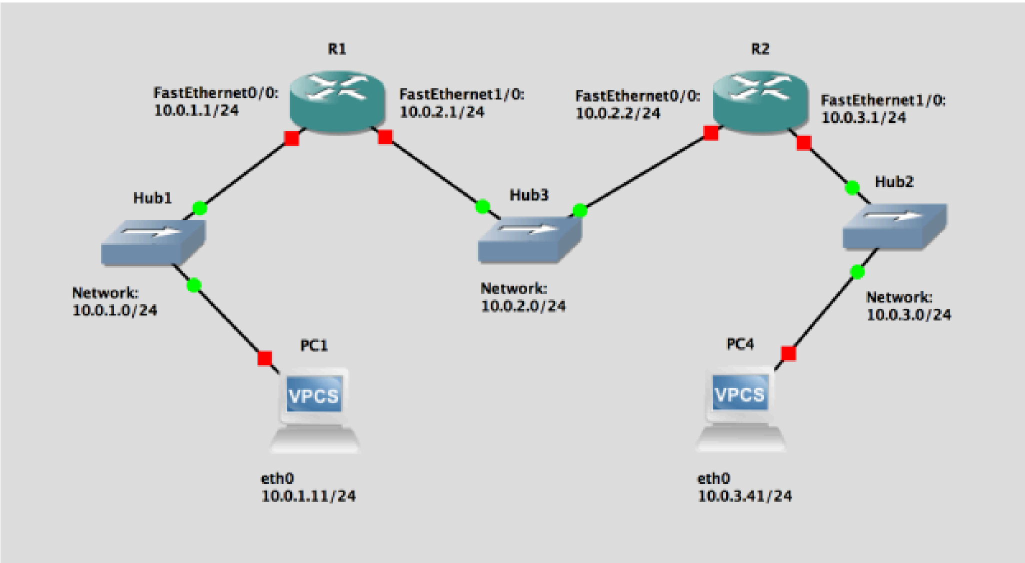

Figure 2.1 Network Topology for Parts 1-3

Virtual Machines	**eth0**	**eth1**
PC1	10.0.1.11 / 24	None / Disabled
PC4	10.0.3.41 / 24	None / Disabled
Cisco Router	**FastEthernet0/0**	**FastEthernet1/0**
R1	10.0.1.1 / 24	10.0.2.1 / 24
R2	10.0.2.2/24	10.0.3.1/24

Table 2.1 IP addresses for Parts 1-3

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We performed the following steps: First, we connected the Ethernet interfaces of the VPCs to the Cisco router as shown in the diagram. We did not power on the VPCs yet. Next, we started Router1 by right-clicking and selecting Start in GNS3, then opened the console to access the User EXEC mode (Router1>). After confirming the prompt appeared, we typed ? to view available commands. To access privileged settings, we entered enable to switch to Privileged EXEC mode (Router1#). We then disabled this mode using disable to return to User EXEC. To begin configuration, we entered global config mode with configure terminal (Router1(config)#), and accessed the interface configuration with interface FastEthernet0 (Router1(config-if)#). We used exit to move up one level or end to return directly to Privileged EXEC mode. Finally, we terminated the console session from User EXEC mode using logout or exit.

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Exercise 1(B). Configuring a Cisco Router via the console

```
R1
R1#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R1(config)#ip routing
R1(config)#interface Fast
R1(config)#interface FastEthernet 0/0
R1(config-if)#ip address 10.0.1.1 255.255.255.0
R1(config-if)#no shutdown
R1(config-if)#interface FastEthernet1/0
R1(config-if)#ip address 10.0.2.1 255.255.255.0
R1(config-if)#no shutdown
R1(config-if)#end
R1#
*Mar  1 00:08:51.899: %SYS-5-CONFIG_I: Configured from console by console
R1#
*Mar  1 00:08:52.063: %LINK-3-UPDOWN: Interface FastEthernet1/0, changed state t
o up
*Mar  1 00:08:53.063: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthern
et1/0, changed state to up
R1#
R1#
R1#
R1#
R1#
R1#
```

```
R1
     0 output buffer failures, 0 output buffers swapped out
FastEthernet1/0 is up, line protocol is up
  Hardware is AmdFE, address is cc01.1c6a.0010 (bia cc01.1c6a.0010)
  Internet address is 10.0.2.1/24
  MTU 1500 bytes, BW 100000 Kbit, DLY 100 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ARPA, loopback not set
  Keepalive set (10 sec)
  Full-duplex, 100Mb/s, 100BaseTX/FX
  ARP type: ARPA, ARP Timeout 04:00:00
  Last input never, output 00:00:04, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: fifo
  Output queue: 0/40 (size/max)
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     0 packets input, 0 bytes
     Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored
     0 watchdog
     0 input packets with dribble condition detected
     10 packets output, 1461 bytes, 0 underruns
     0 output errors, 0 collisions, 1 interface resets
```

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R1

```
R1#
R1#show running-config
Building configuration...

Current configuration : 964 bytes
!
version 12.4
service timestamps debug datetime msec
service timestamps log datetime msec
no service password-encryption
!
hostname R1
!
boot-start-marker
boot-end-marker
!
!
no aaa new-model
memory-size iomem 5
no ip icmp rate-limit unreachable
!
!
ip cef
no ip domain lookup
```

R2

```
R2#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R2(config)#ip routing
R2(config)#interface Fast
R2(config)#interface FastEthernet 0/0
R2(config-if)#ip address 10.0.2.2 255.255.255.0
R2(config-if)#no shutdown
R2(config-if)#interface
*Mar  1 00:01:53.899: %LINK-3-UPDOWN: Interface FastEthernet0/0, changed state t
o up
*Mar  1 00:01:54.899: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthern
et0/0, changed state to up
R2(config-if)#interface FastEthernet1/0
R2(config-if)#ip address 10.0.3.1 255.255.255.0
R2(config-if)#no shutdown
R2(config-if)#end
R2#
*Mar  1 00:02:33.395: %LINK-3-UPDOWN: Interface FastEthernet1/0, changed state t
o up
R2#
*Mar  1 00:02:33.423: %SYS-5-CONFIG_I: Configured from console by console
*Mar  1 00:02:34.395: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthern
et1/0, changed state to up
R2#
```

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The following steps were performed to configure Router1 and Router2: First, each router was started and accessed via console. In Privileged EXEC mode, we entered global configuration using configure terminal. IP routing was ensured enabled with ip routing. Then, each interface (FastEthernet0/0 and FastEthernet1/0) was configured with the appropriate IP addresses from Table 3.1 in interface configuration mode. The no shutdown command activated each interface. After configuration, we used end to return to Privileged EXEC mode and verified the settings with show interfaces and show running-config to display the current configuration. The same process was repeated for Router2 using its respective IP addresses.

Exercise 1(C). Setting static routing table entries on a Cisco router

```
R1
R1#show ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

     10.0.0.0/24 is subnetted, 2 subnets
C       10.0.2.0 is directly connected, FastEthernet1/0
C       10.0.1.0 is directly connected, FastEthernet0/0
R1#
R1#
R1#
R1#
R1#
R1#
R1#
R1#
R1#
R1#
```

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R1

```
R1#show ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

     10.0.0.0/24 is subnetted, 3 subnets
C       10.0.2.0 is directly connected, FastEthernet1/0
S       10.0.3.0 [1/0] via 10.0.2.2
C       10.0.1.0 is directly connected, FastEthernet0/0
```

R1

```
R1#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R1(config)#ip route 10.0.3.0 255.255.255.0 10.0.2.2
```

R2

```
R2#show ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

     10.0.0.0/24 is subnetted, 3 subnets
C       10.0.2.0 is directly connected, FastEthernet0/0
C       10.0.3.0 is directly connected, FastEthernet1/0
S       10.0.1.0 [1/0] via 10.0.2.1
```

R2

```
R2#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R2(config)#ip route 10.0.1.0 255.255.255.0 10.0.2.1
```

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Static routes were added to Router1 and Router2 to ensure proper communication according to the network topology. First, the current routing table was viewed using show ip route, displaying directly connected networks automatically added when interfaces were configured. Then, static routes were manually added in global configuration mode using the ip route command to reach remote networks (10.0.3.0/24 via next-hop IP or interface). For example:

```
ip route 10.0.3.0 255.255.255.0 10.0.2.22
```

This was repeated on both routers to ensure full connectivity. The routing table was displayed again to verify the new entries.

Lab Question: Explain the fields of the routing table entries on a Cisco router :

A Cisco routing table entry includes:

- Destination Network: The network address (10.0.1.0/24) the route applies to.
- Next Hop: The IP address of the next router (or interface) packets are forwarded to.
- Administrative Distance (AD): A value indicating the trustworthiness of the route source (lower is better; static routes = 1, directly connected = 0).
- Metric: A value used by dynamic protocols to determine the best path (lower is better).
- Route Source: Indicated by a code (C = connected, S = static, D = EIGRP, O = OSPF).
- Outgoing Interface: The local interface used to forward packets (FastEthernet0/0).

The router selects the best route based on longest prefix match (most specific), then lowest AD, and finally lowest metric.

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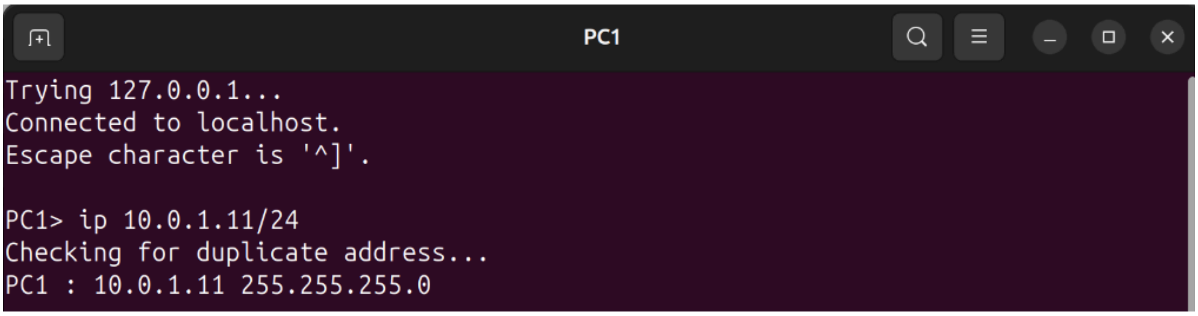
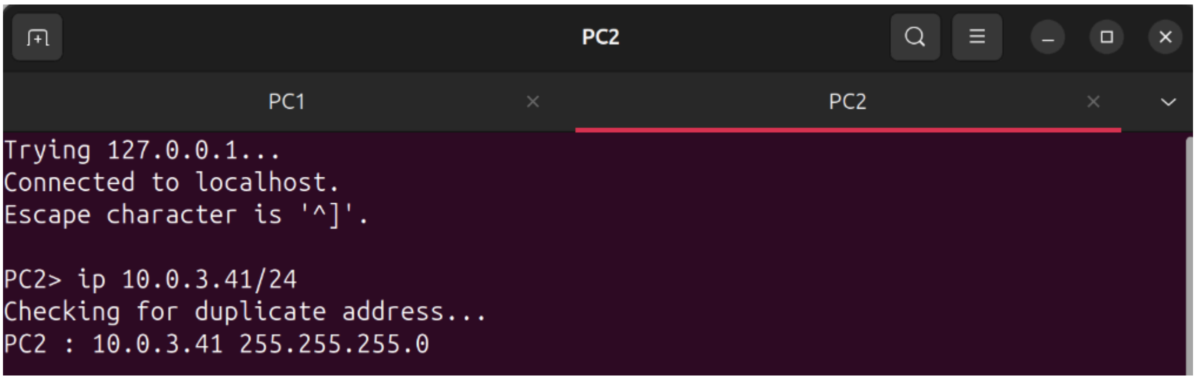
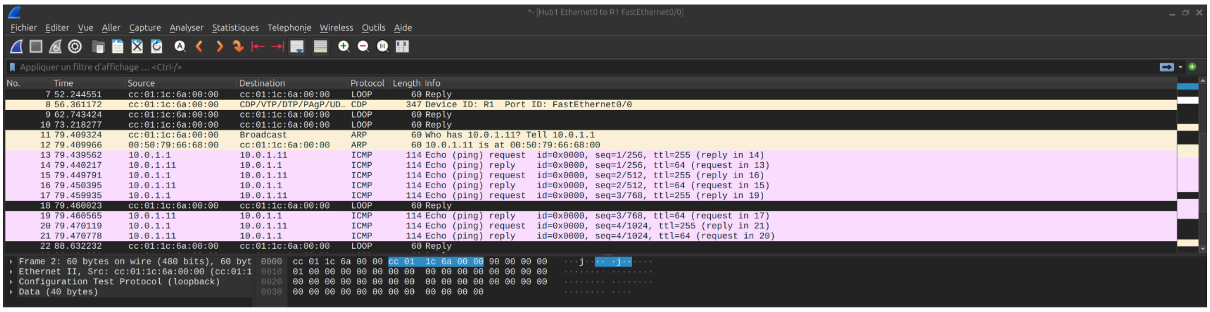
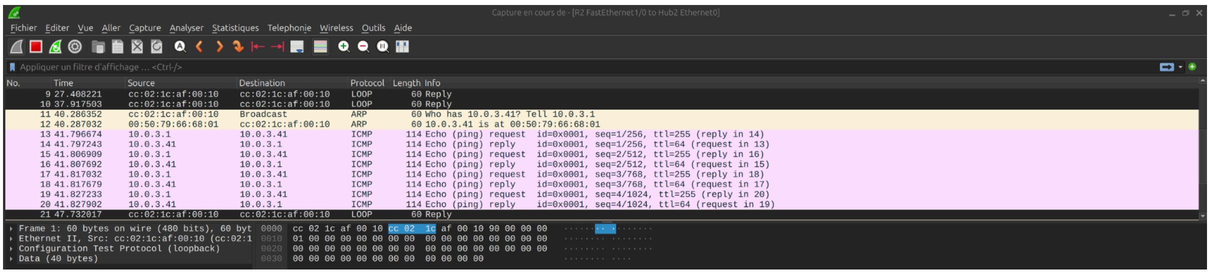
PART 2. More on Router Configuration

Exercise 2(A). Network setup









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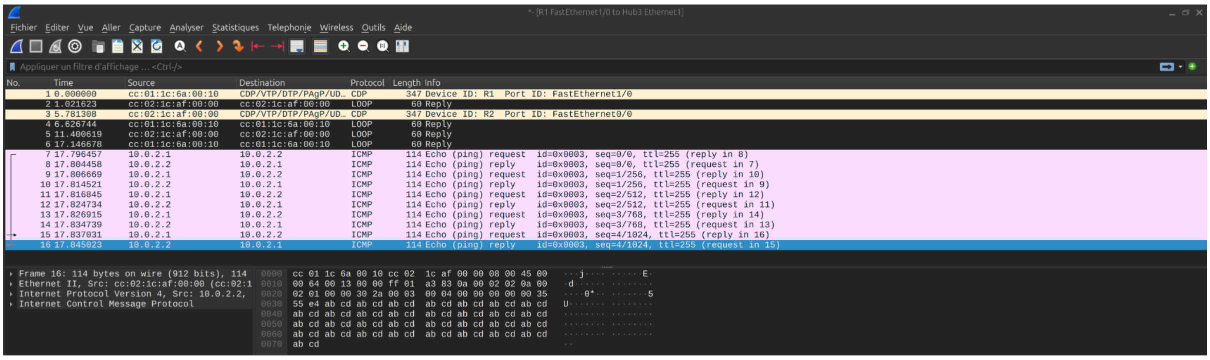
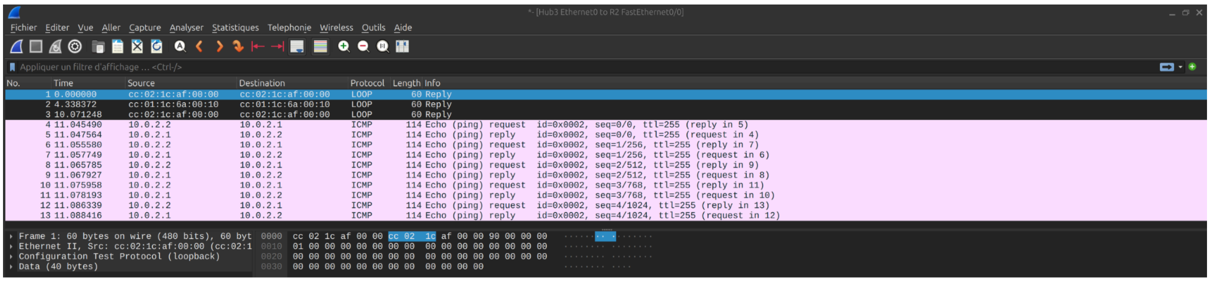




ICMP (Internet Control Message Protocol) is a network-layer protocol used to send error messages and operational information between devices on an IP network. It is essential for diagnosing connectivity issues and ensuring smooth data transmission. Unlike TCP or UDP, ICMP does not transfer data but supports tools like ping and traceroute.

When a ping command is issued, it sends an ICMP Echo Request to the target device, which replies with an ICMP Echo Reply if reachable. This confirms end-to-end connectivity. Wireshark captures these exchanges, along with ARP packets used to resolve MAC addresses on the local network.
ICMP also reports errors — for example:

- Destination Unreachable (Type 3): when a host or network can't be reached.
- Time Exceeded (Type 11): when TTL reaches zero, used in traceroute.

Lab Questions :

Use the saved data to answer the following questions:

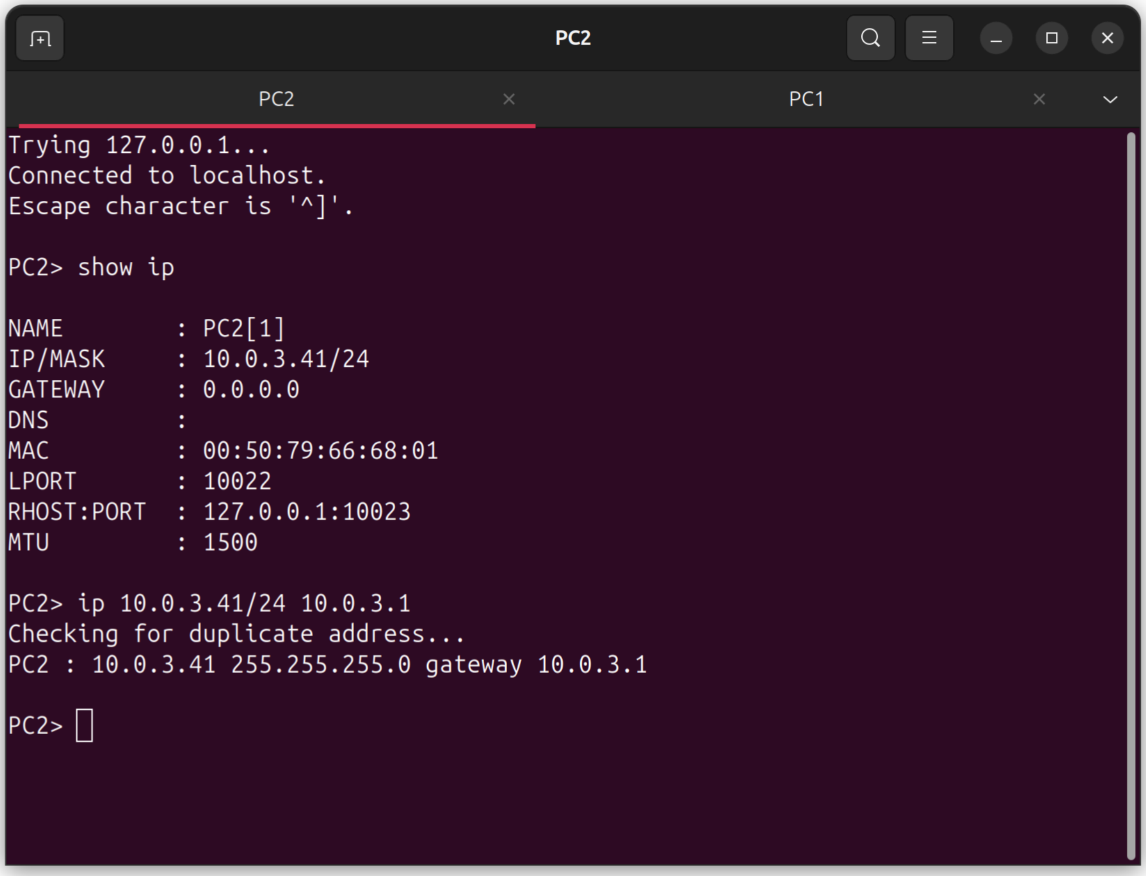
- • What is the output on Router1 when the ping commands are issued?
- • Which packets, if any, are captured by Wireshark?
- • Do you observe any ARP or ICMP packets? If so, what do they indicate?
- • Are some of the destinations not reachable? Why?

- The ping commands to PC1, Router2, and PC4 show "Success rate is 100 percent (5/5)" with normal round-trip times, indicating full connectivity
- Wireshark captures ICMP Echo Request and Echo Reply packets between Router1 and the destinations, confirming end-to-end communication.
- Yes, ARP packets appear when a device resolves the MAC address of another on the same subnet. ICMP packets indicate connectivity testing: Echo Request (ping)

and Echo Reply (response). ARP ensures Layer 2 reachability, while ICMP verifies Layer 3 connectivity.

- No, all destinations are reachable. If any were unreachable, possible causes would include missing static routes, incorrect IP configurations, disabled interfaces, or unresolved ARP ("encapsulation failed"). In this case, proper routing and configuration ensure success.

Exercise 2(B). Testing the network setup



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PC1

PC2 | PC1

```
Trying 127.0.0.1...
Connected to localhost.
Escape character is '^]'.

PC1> ip 10.0.1.11/24 10.0.1.1
Checking for duplicate address...
PC1 : 10.0.1.11 255.255.255.0 gateway 10.0.1.1

PC1>
```

R1

```
R1#trace 10.0.3.41

Type escape sequence to abort.
Tracing the route to 10.0.3.41

  1 10.0.2.2 1336 msec 1616 msec 1472 msec
  2 10.0.3.41 468 msec 28 msec 32 msec
```

PC1

```
Trying 127.0.0.1...
Connected to localhost.
Escape character is '^]'.

PC1> trace 10.0.3.41
trace to 10.0.3.41, 8 hops max, press Ctrl+C to stop
 1   10.0.1.1   9.090 ms  9.667 ms  9.406 ms
 2   10.0.2.2   19.781 ms  29.578 ms  20.214 ms
 3   *10.0.3.41   39.306 ms (ICMP type:3, code:3, Destination port unreachable)
```

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```
PC2
PC1 | PC2
Trying 127.0.0.1...
Connected to localhost.
Escape character is '^]'.

PC2> trace 10.0.1.11
trace to 10.0.1.11, 8 hops max, press Ctrl+C to stop
 1   10.0.3.1   4.245 ms  9.845 ms  9.795 ms
 2   10.0.2.1   20.486 ms  19.476 ms  19.034 ms
 3   *10.0.1.11   29.661 ms (ICMP type:3, code:3, Destination port unreachable)
```

"Port unreachable" because VPCS devices do not have traceroute; they cannot respond, but the packets do pass through all routers correctly.

```
R1#show arp
Protocol  Address          Age (min)  Hardware Addr   Type   Interface
Internet  10.0.2.1                -   cc01.1c6a.0010  ARPA   FastEthernet1/0
Internet  10.0.1.1                -   cc01.1c6a.0000  ARPA   FastEthernet0/0
```

```
R2#show arp
Protocol  Address          Age (min)  Hardware Addr   Type   Interface
Internet  10.0.3.1                -   cc02.1caf.0010  ARPA   FastEthernet1/0
Internet  10.0.2.2                -   cc02.1caf.0000  ARPA   FastEthernet0/0
```

Interfaces are never deleted, they remain available even after reboot. Only their configuration can be changed or reset.

```
PC1> arp

cc:01:1c:6a:00:00  10.0.1.1 expires in 76 seconds
```

```
PC2> arp

cc:02:1c:af:00:10  10.0.3.1 expires in 113 seconds
```

```
R1#show arp
Protocol  Address          Age (min)  Hardware Addr   Type   Interface
Internet  10.0.1.11               0   0050.7966.6800  ARPA   FastEthernet0/0
Internet  10.0.2.1                -   cc01.1c6a.0010  ARPA   FastEthernet1/0
Internet  10.0.2.2                0   cc02.1caf.0000  ARPA   FastEthernet1/0
Internet  10.0.1.1                -   cc01.1c6a.0000  ARPA   FastEthernet0/0
```

```
R2#show arp
Protocol  Address          Age (min)  Hardware Addr   Type   Interface
Internet  10.0.3.1                -   cc02.1caf.0010  ARPA   FastEthernet1/0
Internet  10.0.2.1                0   cc01.1c6a.0010  ARPA   FastEthernet0/0
Internet  10.0.2.2                -   cc02.1caf.0000  ARPA   FastEthernet0/0
Internet  10.0.3.41               0   0050.7966.6801  ARPA   FastEthernet1/0
```

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Lab Question :

- Explain the operation of trace command
- Determine the source and destination addresses in the Ethernet and IP packets for PC1, R1, R2 and PC2.
- Use your answers above to explain how the source and destination Ethernet and IP addresses are changed when a datagram is forwarded by a router.

- The traceroute command traces the path packets take from the source to a destination across an IP network. It works by sending probe packets (ICMP on Windows, UDP on Unix-like systems) with increasing Time-to-Live (TTL) values, starting at 1. Each router along the path decrements the TTL and, when it reaches 0, sends back an ICMP "Time Exceeded" message. This reveals the router's IP address and response time. By incrementing the TTL for each subsequent probe, traceroute maps each hop until the destination is reached, which responds with an ICMP Echo Reply (or "Port Unreachable" for UDP). The output shows the list of routers (hops), their IP addresses, and round-trip times, helping diagnose network latency, routing issues, or failures.

- If PC1 sends a packet to PC2, the path is:

  👉 PC1 → Router 1 → Router 2 → PC2

- When a datagram is forwarded by a router, the IP addresses stay the same, but the Ethernet (MAC) addresses change at every hop. The source IP and destination IP remain those of the original sender (PC1) and final receiver (PC2). However, each time the datagram moves from one network segment to the next, the router removes the old Ethernet header and creates a new one. This new frame uses the router's outgoing interface MAC as the source MAC, and the next hop's MAC (another router or the final PC) as the destination MAC.
  Thus, for a path like PC1 → Router1 → Router2 → PC2:

  PC1 sends the frame with PC1 MAC → Router1 MAC.
  Router1 forwards it with Router1 MAC → Router2 MAC.
  Router2 forwards it with Router2 MAC → PC2 MAC.

  Throughout this process, the IP addresses never change, but the Ethernet source and destination MAC addresses are rewritten at every hop by each router.

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Exercise 2(B). Observe MAC addresses at a router

```
PC1> ping 10.0.10.110 -c 5

*10.0.1.1 icmp_seq=1 ttl=255 time=10.947 ms (ICMP type:3, code:1, Destination ho
st unreachable)
*10.0.1.1 icmp_seq=2 ttl=255 time=4.598 ms (ICMP type:3, code:1, Destination hos
t unreachable)
*10.0.1.1 icmp_seq=3 ttl=255 time=4.123 ms (ICMP type:3, code:1, Destination hos
t unreachable)
*10.0.1.1 icmp_seq=4 ttl=255 time=2.813 ms (ICMP type:3, code:1, Destination hos
t unreachable)
*10.0.1.1 icmp_seq=5 ttl=255 time=5.638 ms (ICMP type:3, code:1, Destination hos
t unreachable)
```

Lab Questions

• What is the output on PC1, when the ping command is issued?
• How far do you think the ICMP Echo Request message travels?
• Which, if any, ICMP Echo Reply message do you think returns to PC1?

- Destination host unreachable
- The Echo Request travels only as far as the default gateway (Router1).
  Router1 checks its routing table, does not find any route to 10.0.10.0/24, and therefore drops the packet. It does not forward the packet any further.
  So the packet stops at Router1.
- No ICMP Echo Reply returns, because the destination does not exist.
  Instead, Router1 may return an ICMP Destination Unreachable message back to PC1, telling it that the network is unreachable.

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PART 3. Proxy ARP

```
PC2> clear arp

PC2> arp

arp table is empty

PC2> clear ip
IPv4 address/mask, gateway, DNS, and DHCP cleared

PC2> show ip

NAME        : PC2[1]
IP/MASK     : 0.0.0.0/0
GATEWAY     : 0.0.0.0
DNS         :
MAC         : 00:50:79:66:68:01
LPORT       : 10022
RHOST:PORT  : 127.0.0.1:10023
MTU         : 1500
```

```
PC2> ip 10.0.3.41/8
Checking for duplicate address...
PC2 : 10.0.3.41 255.0.0.0

PC2> ping 10.0.1.11

84 bytes from 10.0.1.11 icmp_seq=1 ttl=62 time=39.653 ms
84 bytes from 10.0.1.11 icmp_seq=2 ttl=62 time=36.331 ms
84 bytes from 10.0.1.11 icmp_seq=3 ttl=62 time=35.983 ms
84 bytes from 10.0.1.11 icmp_seq=4 ttl=62 time=34.735 ms
84 bytes from 10.0.1.11 icmp_seq=5 ttl=62 time=34.877 ms
```

```
PC2> arp

cc:02:1c:af:00:10  10.0.1.11 expires in 73 seconds
```

```
R1(config)#interface Fa
R1(config)#interface FastEthernet 0/0
R1(config-if)#no ip proxy-arp
R1(config-if)#exit
R1(config)#interface FastEthernet 1/0
R1(config-if)#no proxy-arp
                   ^
% Invalid input detected at '^' marker.

R1(config-if)#no ipproxy-arp
                   ^
% Invalid input detected at '^' marker.

R1(config-if)#no ip proxy-arp
R1(config-if)#
```

```
R2#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R2(config)#inter
R2(config)#interface fas
R2(config)#interface fastEthernet 0/0
R2(config-if)#no ip proxy-arp
R2(config-if)#exit
R2(config)#interface fastEthernet 1/0
R2(config-if)#no ip proxy-arp
R2(config-if)#exit
R2(config)#
```

```
PC2> ping 10.0.1.11

host (10.0.1.11) not reachable

PC2> ip 10.0.3.41/24
Checking for duplicate address...
PC2 : 10.0.3.41 255.255.255.0
```

```
R2(config)#interface fastEthernet 1/0
R2(config-if)#ip proxy-arp
R2(config-if)#interface fastEthernet 0/0
R2(config-if)#ip proxy-arp
R2(config-if)#exit
R2(config)#exit
R2#
```

Lab Questions

• Explain the outcome of the exercise.
• Explain how Proxy ARP allowed PC4 to communicate with PC1.

- When PC4’s subnet mask was changed to 255.0.0.0, it assumed that all 10.x.x.x addresses were on the same local network. Normally, this would prevent PC4 from reaching PC1 without a proper route, because PC1 is actually on a different subnet. However, with Proxy ARP enabled on Router2, PC4 was still able to successfully ping PC1. When Proxy ARP was disabled, the ping failed because PC4 could no longer resolve the MAC address for PC1.

- Proxy ARP works by allowing a router to answer ARP requests on behalf of hosts that are on other subnets. In this case:
    1. PC4 broadcasts an ARP request for PC1's IP.
    2. Router2 responds with its own MAC address, pretending to be PC1.
    3. PC4 sends the packet to Router2, thinking it is the destination.
    4. Router2 then forwards the packet to the actual PC1.

So, even though PC4 had no route to PC1, Proxy ARP enabled it to reach the router, which then delivered the packet to the correct destination.

PART 4. Network Prefixes and Routing

```
PC1> ip 10.0.1.10 255.255.255.0 10.0.1.1
Checking for duplicate address...
PC1 : 10.0.1.10 255.255.255.0 gateway 10.0.1.1
```

```
PC2> ip 10.0.2.10 255.255.255.0 10.0.2.138
Checking for duplicate address...
PC2 : 10.0.2.10 255.255.255.0 gateway 10.0.2.138
```

```
PC3> ip 10.0.2.137 255.255.255.248 10.0.2.138
Checking for duplicate address...
PC3 : 10.0.2.137 255.255.255.248 gateway 10.0.2.138
```

```
PC4> ip 10.0.2.139 255.255.255.0 10.0.2.138
Checking for duplicate address...
PC4 : 10.0.2.139 255.255.255.0 gateway 10.0.2.138
```

```
PC1> ping 10.0.2.137 -c 2

host (10.0.1.1) not reachable
```

```
PC1> ping 10.0.2.137 -c 2

10.0.2.137 icmp_seq=1 timeout
10.0.2.137 icmp_seq=2 timeout
```

No shutdown and ip proxy-arp on both interfaces to make the ping work.

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```
PC1> arp

cc:01:6b:6b:00:00  10.0.1.1 expires in 66 seconds
```

```
PC2> arp

00:50:79:66:68:02  10.0.2.137 expires in 52 seconds
```

```
PC3> arp

cc:01:6b:6b:00:10  10.0.2.138 expires in 43 seconds
```

```
PC4> arp

00:50:79:66:68:02  10.0.2.137 expires in 37 seconds
```

```
R1#show arp
Protocol  Address          Age (min)  Hardware Addr   Type   Interface
Internet  10.0.1.10               1   0050.7966.6800  ARPA   FastEthernet0/0
Internet  10.0.1.1                -   cc01.6b6b.0000  ARPA   FastEthernet0/0
Internet  10.0.2.137              1   0050.7966.6802  ARPA   FastEthernet1/0
Internet  10.0.2.138              -   cc01.6b6b.0010  ARPA   FastEthernet1/0
```

```
PC1> show ip

NAME        : PC1[1]
IP/MASK     : 10.0.1.10/24
GATEWAY     : 10.0.1.1
DNS         :
MAC         : 00:50:79:66:68:00
LPORT       : 10016
RHOST:PORT  : 127.0.0.1:10017
MTU         : 1500
```

```
PC2> show ip

NAME        : PC2[1]
IP/MASK     : 10.0.2.10/24
GATEWAY     : 10.0.2.138
DNS         :
MAC         : 00:50:79:66:68:01
LPORT       : 10018
RHOST:PORT  : 127.0.0.1:10019
MTU         : 1500
```

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```
PC3> show ip

NAME        : PC3[1]
IP/MASK     : 10.0.2.137/29
GATEWAY     : 10.0.2.138
DNS         :
MAC         : 00:50:79:66:68:02
LPORT       : 10020
RHOST:PORT  : 127.0.0.1:10021
MTU         : 1500
```

```
PC4> show ip

NAME        : PC4[1]
IP/MASK     : 10.0.2.139/24
GATEWAY     : 10.0.2.138
DNS         :
MAC         : 00:50:79:66:68:03
LPORT       : 10022
RHOST:PORT  : 127.0.0.1:10023
MTU         : 1500
```

```
PC3> ping 10.0.2.139 -c 3

84 bytes from 10.0.2.139 icmp_seq=1 ttl=64 time=0.916 ms
84 bytes from 10.0.2.139 icmp_seq=2 ttl=64 time=1.035 ms
84 bytes from 10.0.2.139 icmp_seq=3 ttl=64 time=1.368 ms
```

```
PC3> arp

00:50:79:66:68:03  10.0.2.139 expires in 60 seconds
```

```
PC3> ping 10.0.2.10 -c 3

84 bytes from 10.0.2.10 icmp_seq=1 ttl=63 time=12.426 ms
84 bytes from 10.0.2.10 icmp_seq=2 ttl=63 time=12.306 ms
84 bytes from 10.0.2.10 icmp_seq=3 ttl=63 time=11.537 ms
```

```
PC3> arp

cc:01:6b:6b:00:10  10.0.2.138 expires in 76 seconds
```

```
PC2> arp

cc:01:6b:6b:00:10  10.0.2.138 expires in 56 seconds
```

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Lab Questions

• Explain what you observed in steps 3, 4 and 5. Use the saved data to support your answers. Provide explanations of the observations.

Step 3: PC3 successfully pinged PC4. ARP shows PC3 learned PC4's MAC directly.
This works because both hosts share the same Ethernet segment, and ARP on a local link does not depend on subnet masks.

Step 4: The ping succeeds, but PC3's ARP table contains the MAC of 10.0.2.138 (Router1). Because of PC3's /29 mask, it considers 10.0.2.10 "outside" its subnet and sends traffic to its default gateway. The router then forwards the packets to PC2.

Step 5: Multiple hosts show ARP entries pointing to the router (10.0.2.138).
This confirms that traffic from PC3 to other subnets, or to hosts outside its /29, goes through the gateway.

• If PC3 had no default entry in its table, would you have seen the same results? Explain for each of the pings above what would have been different.

No. Results would be different.

- **PC3 → PC4:**
  Still works. They are on the same Ethernet segment, so ARP resolves directly.
- **PC3 → PC2:**
  Would fail. PC3 believes PC2 is outside its /29 subnet and, without a default gateway, it has no route for that destination.
- **PC3 → PC1:**
  Would also fail. Without a default route, PC3 cannot reach any other network.