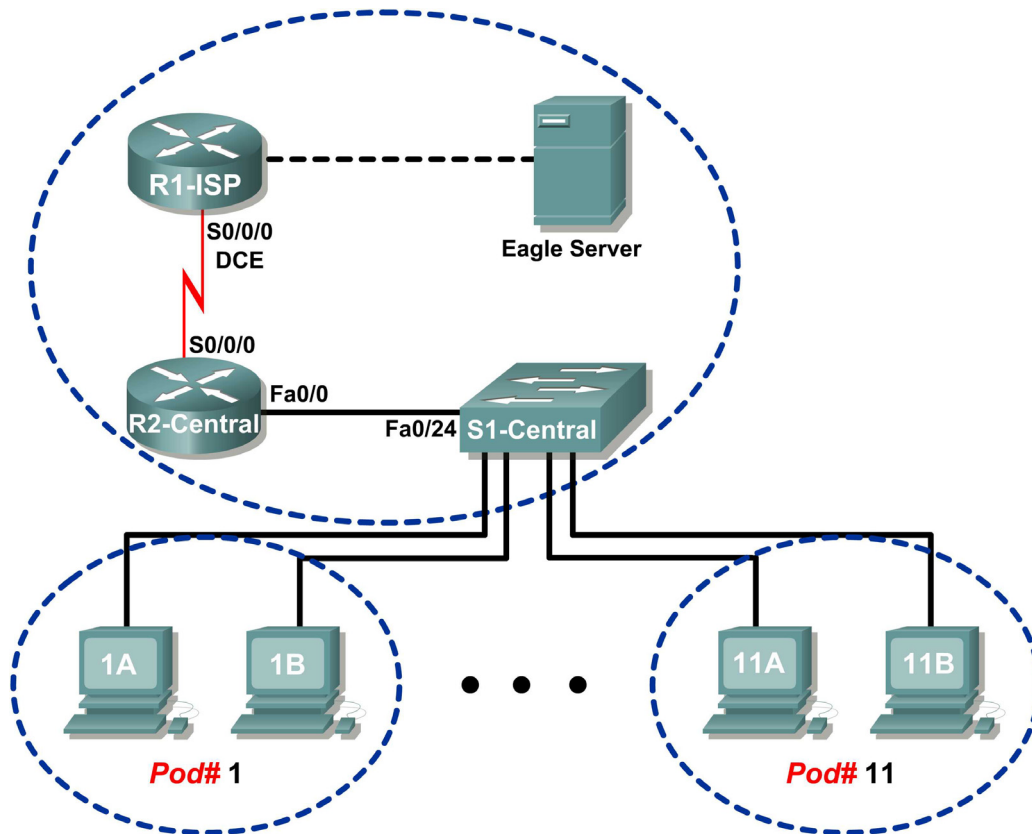


Lab 6.7.2: Examining ICMP Packets

Topology Diagram



Addressing Table

Device	Interface	IP Address	Subnet Mask	Default Gateway
R1-ISP	S0/0/0	10.10.10.6	255.255.255.252	N/A
	Fa0/0	192.168.254.253	255.255.255.0	N/A
R2-Central	S0/0/0	10.10.10.5	255.255.255.252	N/A
	Fa0/0	172.16.255.254	255.255.0.0	N/A
Eagle Server	N/A	192.168.254.254	255.255.255.0	192.168.254.253
	N/A	172.31.24.254	255.255.255.0	N/A
hostPod#A	N/A	172.16.Pod#.1	255.255.0.0	172.16.255.254
hostPod#B	N/A	172.16.Pod#.2	255.255.0.0	172.16.255.254
S1-Central	N/A	172.16.254.1	255.255.0.0	172.16.255.254

Learning Objectives

Upon completion of this lab, you will be able to:

- Understand the format of ICMP packets.
- Use Wireshark to capture and examine ICMP messages.

Background

The Internet Control Message Protocol (ICMP) was first defined in RFC 792, September, 1981. ICMP message types were later expanded in RFC 1700. ICMP operates at the TCP/IP Network layer and is used to exchange information between devices.

ICMP packets serve many uses in today's computer network. When a router cannot deliver a packet to a destination network or host, an informational message is returned to the source. Also, the `ping` and `tracert` commands send ICMP messages to destinations, and destinations respond with ICMP messages.

Scenario

Using the Eagle 1 Lab, Wireshark captures will be made of ICMP packets between network devices.

Task 1: Understand the Format of ICMP Packets.

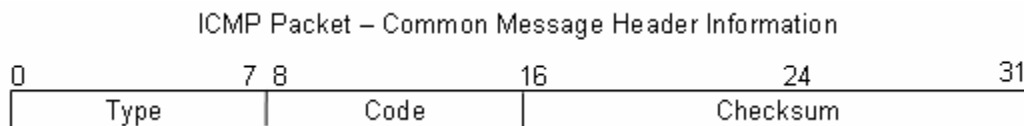


Figure 1. ICMP Message Header

Refer to Figure 1, the ICMP header fields common to all ICMP message types. Each ICMP message starts with an 8-bit Type field, an 8-bit Code field, and a computed 16-bit Checksum. The ICMP message type describes the remaining ICMP fields. The table in Figure 2 shows ICMP message types from RFC 792:

Value	Meaning
0	Echo Reply
3	Destination Unreachable
4	Source Quench
5	Redirect
8	Echo
11	Time Exceeded
12	Parameter Problem
13	Timestamp
14	Timestamp Reply
15	Information Request
16	Information Reply

Figure 2. ICMP Message Types

Codes provide additional information to the Type field. For example, if the Type field is 3, destination unreachable, additional information about the problem is returned in the Code field. The table in Figure 3 shows message codes for an ICMP Type 3 message, destination unreachable, from RFC 1700:

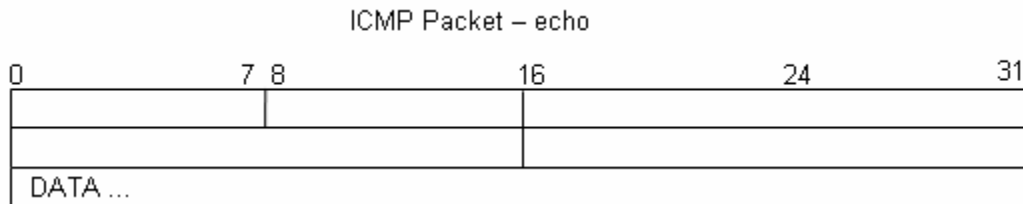
Code Value	Meaning
0	Net Unreachable
1	Host Unreachable
2	Protocol Unreachable
3	Port Unreachable
4	Fragmentation Needed and Don't Fragment was Set
5	Source Route Failed
6	Destination Network Unknown
7	Destination Host Unknown
8	Source Host Isolated
9	Communication with Destination Network is Administratively Prohibited
10	Communication with Destination Host is Administratively Prohibited
11	Destination Network Unreachable for Type of Service
12	Destination Host Unreachable for Type of Service

Figure 3. ICMP Type 3 Message Codes

Using ICMP message capture shown in Figure 4, fill in the fields for the ICMP packet echo request. Values beginning with 0x are hexadecimal numbers:

```
Internet Control Message Protocol
Type: 8 (Echo (ping) request)
Code: 0
Checksum: 0x365c [correct]
Identifier: 0x0200
Sequence number: 0x1500
Data (32 bytes)
```

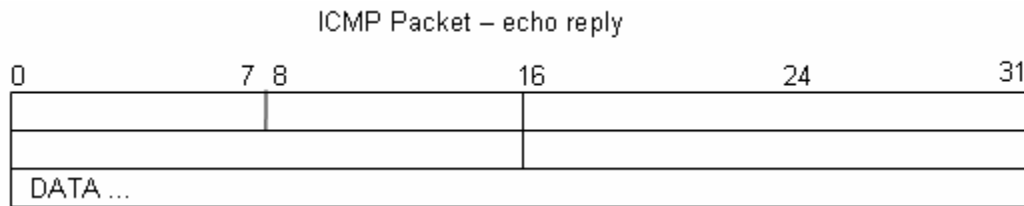
Figure 4. ICMP Packet Echo Request



Using the ICMP message capture shown in Figure 5, fill in the fields for the ICMP packet echo reply:

```
Internet Control Message Protocol
Type: 0 (Echo (ping) reply)
Code: 0
Checksum: 0x3e5c [correct]
Identifier: 0x0200
Sequence number: 0x1500
Data (32 bytes)
```

Figure 5. ICMP Packet Echo Reply



At the TCP/IP Network layer, communication between devices is not guaranteed. However, ICMP does provide minimal checks for a reply to match the request. From the information provided in the ICMP messages above, how does the sender know that the reply is to a specific echo?

Task 2: Use Wireshark to Capture and Examine ICMP Messages.

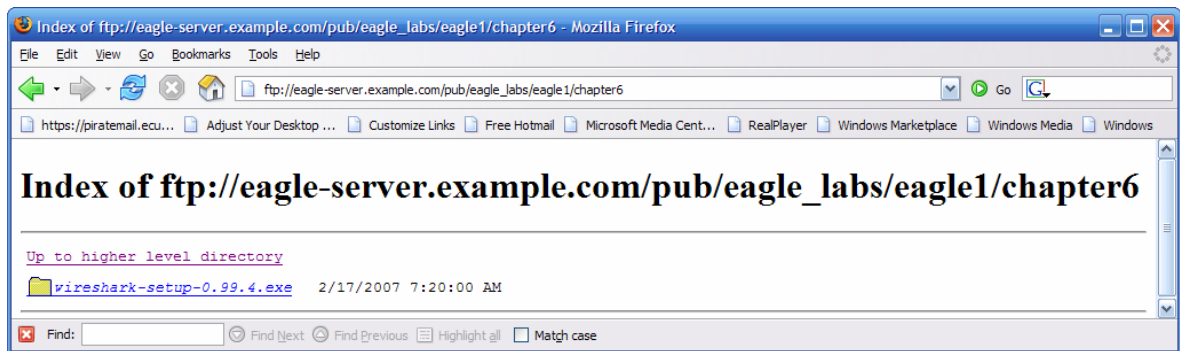


Figure 6. Wireshark Download Site

If Wireshark has not been loaded on the pod host computer, it can be downloaded from Eagle Server.

1. Open a web browser, URL [FTP://eagle-server.example.com/pub/eagle_labs/eagle1/chapter6](ftp://eagle-server.example.com/pub/eagle_labs/eagle1/chapter6), as shown in Figure 6.
2. Right-click the Wireshark filename, click **Save Link As**, and save the file to the pod host computer.
3. When the file has been downloaded, open and install Wireshark.

Step 1: Capture and evaluate ICMP echo messages to Eagle Server.

In this step, Wireshark will be used to examine ICMP echo messages.

1. Open a Windows terminal on the pod host computer.
2. When ready, start Wireshark capture.

```
C:\> ping eagle-server.example.com
Pinging eagle-server.example.com [192.168.254.254] with 32 bytes of
data:
Reply from 192.168.254.254: bytes=32 time<1ms TTL=63
Reply from 192.168.254.254: bytes=32 time<1ms TTL=63
Reply from 192.168.254.254: bytes=32 time<1ms TTL=63
Reply from 192.168.254.254: bytes=32 time<1ms TTL=63
Ping statistics for 192.168.254.254:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms
C:\>
```

Figure 7. Successful ping Replies from Eagle Server

3. From the Windows terminal, ping Eagle Server. Four successful replies should be received from Eagle Server, as shown in Figure 7.
4. Stop Wireshark capture. There should be a total of four ICMP echo requests and matching echo replies, similar to those shown in Figure 8.

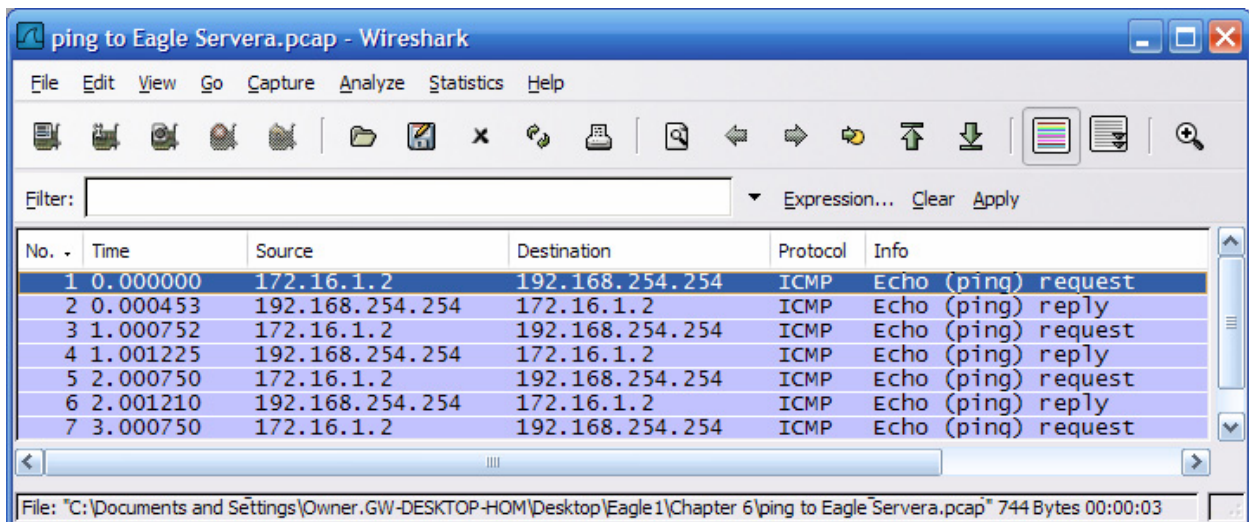


Figure 8. Wireshark Capture of ping Requests and Replies

Which network device responds to the ICMP echo request? _____

5. Expand the middle window in Wireshark, and expand the Internet Control Message Protocol record until all fields are visible. The bottom window will also be needed to examine the Data field.
6. Record information from the *first* echo request packet to Eagle Server:

Field	Value
Type	
Code	
Checksum	
Identifier	
Sequence number	
Data	

Are there 32 bytes of data? _____

7. Record information from the *first* echo reply packet from Eagle Server:

Field	Value
Type	
Code	
Checksum	
Identifier	
Sequence number	
Data	

Which fields, if any, changed from the echo request?

8. Continue to evaluate the remaining echo requests and replies. Fill in the following information from each new ping:

Packet	Checksum	Identifier	Sequence number
Request # 2			
Reply # 2			
Request # 3			
Reply # 3			
Request # 4			
Reply # 4			

Why did the Checksum values change with each new request?

Step 2: Capture and evaluate ICMP echo messages to 192.168.253.1.

In this step, pings will be sent to a fictitious network and host. The results from the Wireshark capture will be evaluated—and may be surprising.

Try to ping IP address 192.168.253.1.

C:\> ping 192.168.253.1

```

C:\> ping 192.168.253.1
Pinging 192.168.253.1 with 32 bytes of data:
Reply from 172.16.255.254: Destination host unreachable.
Reply from 172.16.255.254: Destination host unreachable.
Reply from 172.16.255.254: Destination host unreachable.
Reply from 172.16.255.254: Destination host unreachable.
Ping statistics for 192.168.253.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms
C:\>
    
```

Figure 9. Ping Results from a Fictitious Destination

See Figure 9. Instead of a request timeout, there is an echo response.

What network device responds to pings to a fictitious destination?

No. -	Time	Source	Destination	Protocol	Info
1	0.000000	172.16.1.2	192.168.253.1	ICMP	Echo (ping) request
2	0.000816	172.16.255.254	172.16.1.2	ICMP	Destination unreachable (Host unreachable)
3	1.000854	172.16.1.2	192.168.253.1	ICMP	Echo (ping) request
4	1.001686	172.16.255.254	172.16.1.2	ICMP	Destination unreachable (Host unreachable)
5	2.001815	172.16.1.2	192.168.253.1	ICMP	Echo (ping) request
6	2.002547	172.16.255.254	172.16.1.2	ICMP	Destination unreachable (Host unreachable)
7	3.002815	172.16.1.2	192.168.253.1	ICMP	Echo (ping) request
8	3.003588	172.16.255.254	172.16.1.2	ICMP	Destination unreachable (Host unreachable)

Figure 10. Wireshark Capture from a Fictitious Destination

Wireshark captures to a fictitious destination are shown in Figure 10. Expand the middle Wireshark window and the Internet Control Message Protocol record.

Which ICMP message type is used to return information to the sender?

What is the code associated with the message type?

Step 3: Capture and evaluate ICMP echo messages that exceed the TTL value.

In this step, pings will be sent with a low TTL value, simulating a destination that is unreachable. Ping Eagle Server, and set the TTL value to 1:

```
C:\> ping -i 1 192.168.254.254
```

```
C:\> ping -i 1 192.168.254.254
Pinging 192.168.254.254 with 32 bytes of data:
Reply from 172.16.255.254: TTL expired in transit.
Reply from 172.16.255.254: TTL expired in transit.
Reply from 172.16.255.254: TTL expired in transit.
Reply from 172.16.255.254: TTL expired in transit.
Ping statistics for 192.168.254.254:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms
C:\>
```

Figure 11. Ping Results for an Exceeded TTL

See Figure 11, which shows ping replies when the TTL value has been exceeded.

What network device responds to pings that exceed the TTL value?

No. -	Time	Source	Destination	Protocol	Info
1	0.000000	172.16.1.2	192.168.254.254	ICMP	Echo (ping) request
2	0.000701	172.16.255.254	172.16.1.2	ICMP	Time-to-live exceeded (Time to live exceeded in transit)
3	1.000003	172.16.1.2	192.168.254.254	ICMP	Echo (ping) request
4	1.000687	172.16.255.254	172.16.1.2	ICMP	Time-to-live exceeded (Time to live exceeded in transit)
5	1.999996	172.16.1.2	192.168.254.254	ICMP	Echo (ping) request
6	2.000761	172.16.255.254	172.16.1.2	ICMP	Time-to-live exceeded (Time to live exceeded in transit)
7	3.000970	172.16.1.2	192.168.254.254	ICMP	Echo (ping) request
8	3.001723	172.16.255.254	172.16.1.2	ICMP	Time-to-live exceeded (Time to live exceeded in transit)

Figure 12. Wireshark Capture of TTL Value Exceeded

Wireshark captures to a fictitious destination are shown in Figure 12. Expand the middle Wireshark window and the Internet Control Message Protocol record.

Which ICMP message type is used to return information to the sender?

What is the code associated with the message type?

Which network device is responsible for decrementing the TTL value?

Task 3: Challenge

Use Wireshark to capture a `tracert` session to Eagle Server and then to 192.168.254.251. Examine the ICMP TTL exceeded message. This will demonstrate how the `tracert` command traces the network path to the destination.

Task 4: Reflection

The ICMP protocol is very useful when troubleshooting network connectivity issues. Without ICMP messages, a sender has no way to tell why a destination connection failed. Using the `ping` command, different ICMP message type values were captured and evaluated.

Task 5: Clean Up

Wireshark may have been loaded on the pod host computer. If the program must be removed, click **Start > Control Panel > Add or Remove Programs**, and scroll down to Wireshark. Click the filename, click **Remove**, and follow uninstall instructions.

Remove any Wireshark pcap files that were created on the pod host computer.

Unless directed otherwise by the instructor, turn off power to the host computers. Remove anything that was brought into the lab, and leave the room ready for the next class.