

## **CHƯƠNG 8**

# **ICMP & PING, TRACERT**

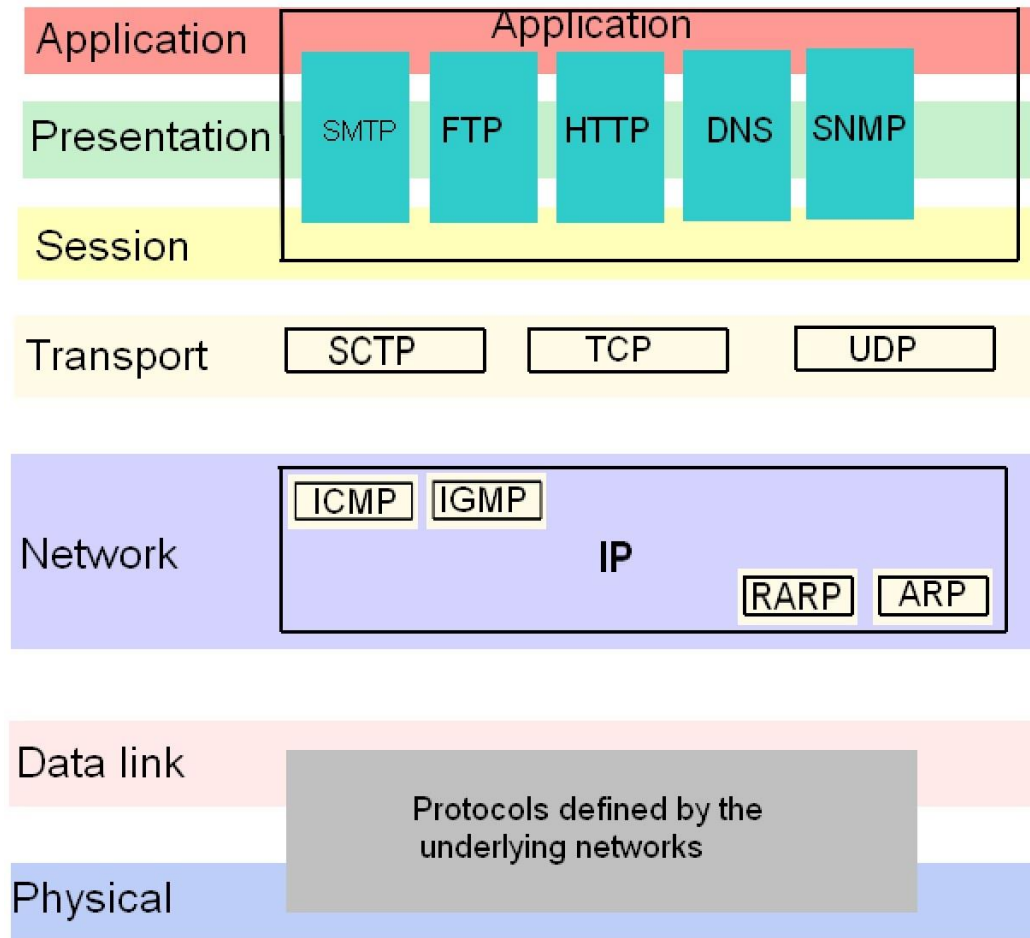
**LẬP TRÌNH MẠNG CĂN BẢN**



# NỘI DUNG

- Giới thiệu
- ICMP Protocol
- Ứng dụng Ping trong C#
- Ứng dụng Tracert Route trong C#

# ICMP



TCP/IP model

# ICMP

<u>Loại</u>	<u>mã</u>	<u>Mô tả</u>
0	0	echo reply (ping)
3	0	dest. network unreachable
3	1	dest host unreachable
3	2	dest protocol unreachable
3	3	dest port unreachable
3	6	dest network unknown
3	7	dest host unknown
4	0	source quench (congestion control - not used)
8	0	echo request (ping)
9	0	route advertisement
10	0	router discovery
11	0	TTL expired
12	0	bad IP header

# ICMP

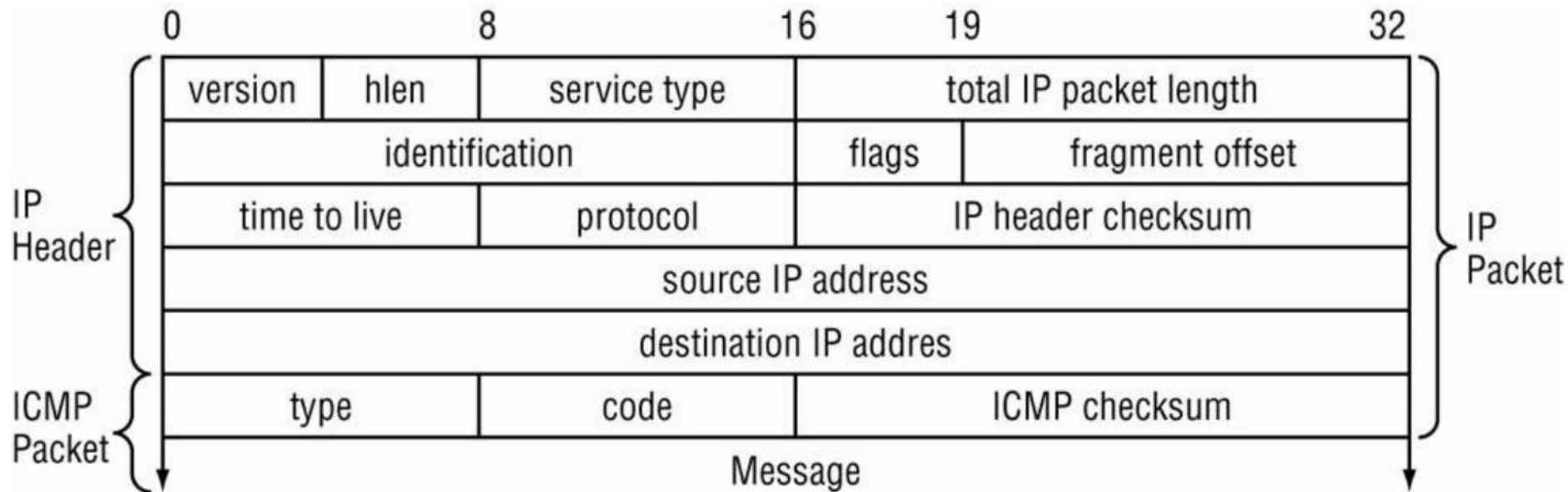
Các loại ICMP thường thấy là:

- ICMP echo
- ICMP Destination Unreachable
- ICMP Parameter Problem
- ICMP Redirect/ Change Request
- ICMP Timestamp request
- ICMP Information Request and Reply
- ICMP Address Mask Request
- ICMP Router Discovery
- ICMP Source Quench

# ICMP ECHO

- Đây là loại thường nhất và chúng rất quan trọng.
- Có hai loại ICMP echo là echo request và echo reply.
  - Type = 0 -> echo reply, code = 0
  - Type = 8 -> echo request, code = 0

# ĐỊNH DẠNG GÓI TIN ICMP



- **TYPE (8bit)**: là một số nguyên 8bit để xác định thông điệp.
- **CODE (8bit)**: cung cấp thêm thông tin về kiểu thông điệp.
- **CHECKSUM(16bit)** : ICMP sử dụng thuật checksum như IP, nhưng ICMP checksum chỉ tính đến thông điệp ICMP.

# ICMP (VD BẮT GÓI TIN WIRESHARK)

Source	Destination	Protocol	Length	Info
10.45.137.114	216.58.200.14	ICMP	74	Echo (ping) request
216.58.200.14	10.45.137.114	ICMP	74	Echo (ping) reply

- ▷ Frame 420: 74 bytes on wire (592 bits), 74 bytes captured (592 bits)
- ▷ Ethernet II, Src: Azurewav\_6a:f9:8b (28:c2:dd:6a:f9:8b), Dst: Junipe
- ▷ Internet Protocol Version 4, Src: 10.45.137.114, Dst: 216.58.200.14
- ◀ Internet Control Message Protocol

Type: 8 (Echo (ping) request)

Code: 0

Checksum: 0xe1a9 [correct]

[Checksum Status: Good]

Identifier (BE): 1 (0x0001)

Identifier (LE): 256 (0x0100)

Sequence number (BE): 63 (0x003f)

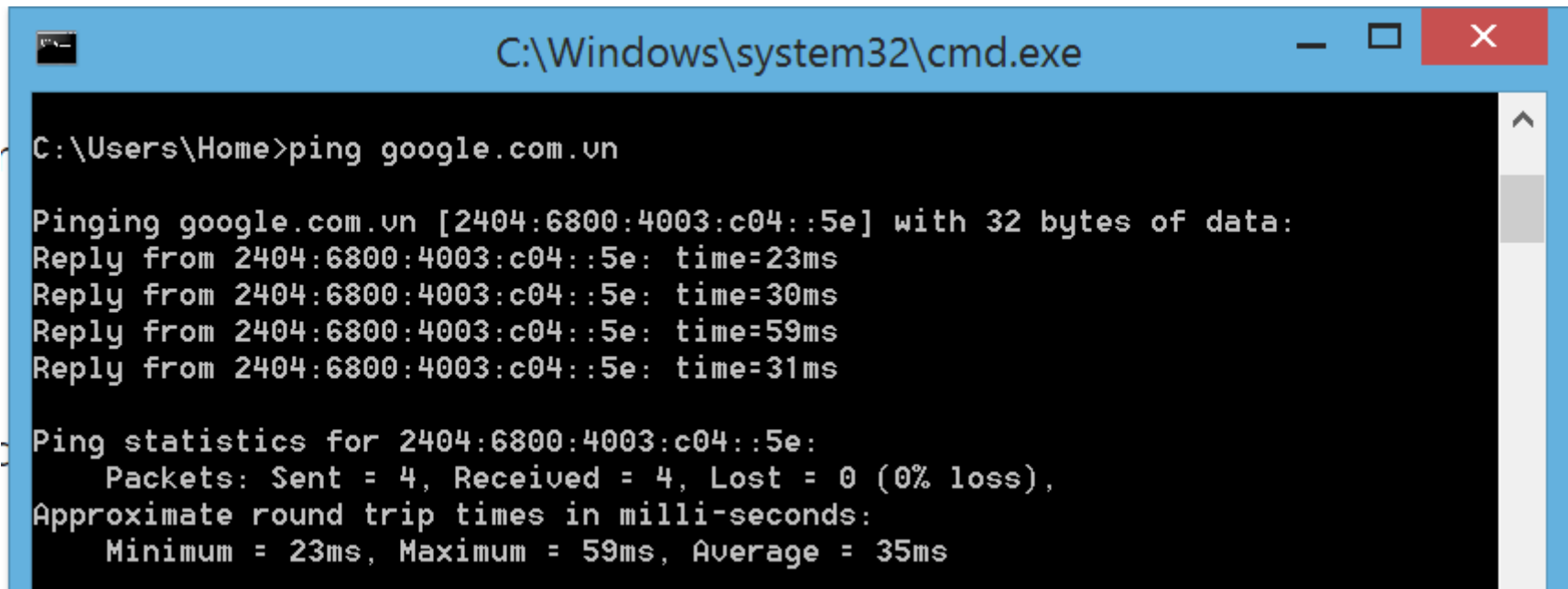
Sequence number (LE): 16128 (0x3f00)

[\[Response frame: 421\]](#)

- ▷ Data (32 bytes)



# ICMP (PING CMD)



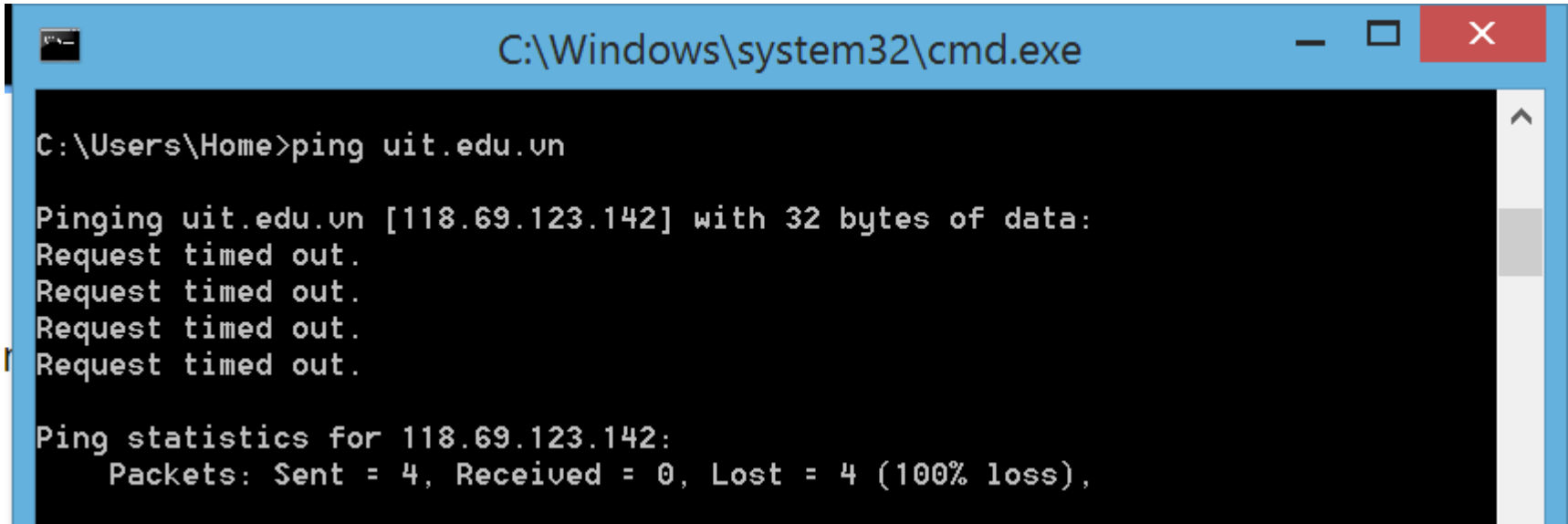
A screenshot of a Windows Command Prompt window. The title bar is blue and contains the text 'C:\Windows\system32\cmd.exe' along with standard window controls (minimize, maximize, close). The command prompt itself has a black background with white text. The user has entered the command 'ping google.com.vn'. The output shows four successful replies from the IP address 2404:6800:4003:c04::5e with round-trip times of 23ms, 30ms, 59ms, and 31ms. Below the replies, the ping statistics are displayed, showing 4 packets sent, 4 received, 0 lost (0% loss), and approximate round-trip times of 23ms (minimum), 59ms (maximum), and 35ms (average).

```
C:\Users\Home>ping google.com.vn

Pinging google.com.vn [2404:6800:4003:c04::5e] with 32 bytes of data:
Reply from 2404:6800:4003:c04::5e: time=23ms
Reply from 2404:6800:4003:c04::5e: time=30ms
Reply from 2404:6800:4003:c04::5e: time=59ms
Reply from 2404:6800:4003:c04::5e: time=31ms

Ping statistics for 2404:6800:4003:c04::5e:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 23ms, Maximum = 59ms, Average = 35ms
```

# ICMP (PING CMD)



A screenshot of a Windows Command Prompt window. The title bar is blue and contains the text 'C:\Windows\system32\cmd.exe' along with standard window controls. The command prompt itself has a black background with white text. The user has entered the command 'ping uit.edu.vn'. The output shows four 'Request timed out.' messages. Below this, the 'Ping statistics for 118.69.123.142:' are displayed, showing 'Packets: Sent = 4, Received = 0, Lost = 4 (100% loss)'.

```
C:\Users\Home>ping uit.edu.vn

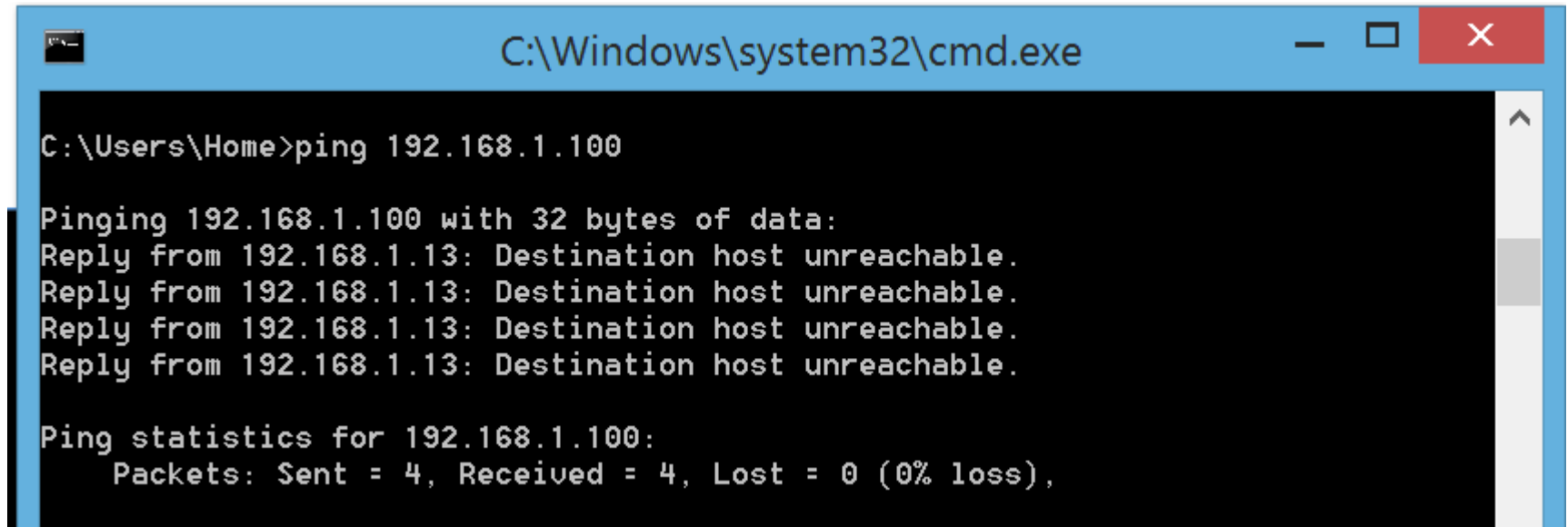
Pinging uit.edu.vn [118.69.123.142] with 32 bytes of data:
Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 118.69.123.142:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
```

## •Nguyên nhân:

- Do đường truyền vật lý (kiểm tra lại kết nối, cáp).
- IP không tồn tại, máy PC đích bị tắt
- Máy đích bị chặn bởi Firewall, firewall cấm ping (tắt firewall, hoặc cấu hình lại).
- Gửi thành công nhưng firewall bên máy đích chặn ping => không reply được.

# ICMP (PING CMD)



A screenshot of a Windows command prompt window. The title bar is blue and contains the text 'C:\Windows\system32\cmd.exe' along with standard window controls. The command prompt itself has a black background with white text. The user has entered the command 'ping 192.168.1.100'. The output shows four failed replies from 192.168.1.13, each stating 'Destination host unreachable.' The ping statistics at the bottom show 'Packets: Sent = 4, Received = 4, Lost = 0 (0% loss)', which is a bit unusual for a failed ping.

```
C:\Users\Home>ping 192.168.1.100

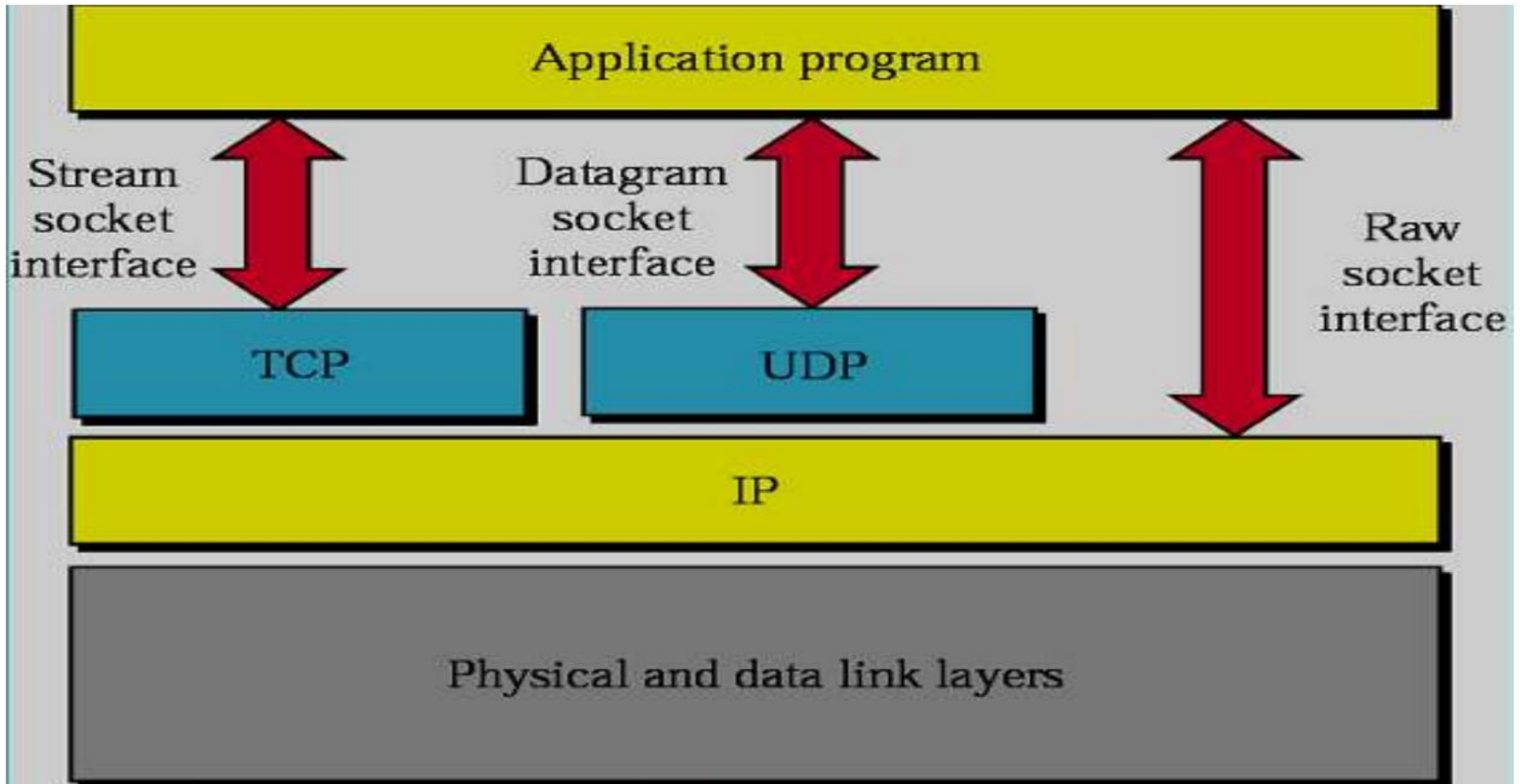
Pinging 192.168.1.100 with 32 bytes of data:
Reply from 192.168.1.13: Destination host unreachable.
Reply from 192.168.1.13: Destination host unreachable.
Reply from 192.168.1.13: Destination host unreachable.
Reply from 192.168.1.13: Destination host unreachable.

Ping statistics for 192.168.1.100:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
```

## •Nguyên nhân:

- Router không biết đường đi.
- IP không tồn tại, máy PC đích bị tắt.
- Do đường truyền vật lý.

# RAW SOCKET



# RAW SOCKET

SocketType	Protocoltype	Description
Dgram	Udp	Connectionless communication
Stream	Tcp	Connection-oriented communication
Raw	Icmp	Internet Control Message Protocol
Raw	Raw	Plain IP packet communication

# RAW PING (IN C#)

```
Socket host = new Socket(AddressFamily.InterNetwork,  
                           SocketType.Raw,  
                           ProtocolType.Icmp);
```

- Sử dụng Raw Socket ( $\neq$  TCP,  $\neq$  UDP)
- ProtocolType: Icmp

# RAW PING (IN C#)

```
Socket host = new Socket(AddressFamily.InterNetwork,  
                           SocketType.Raw,  
                           ProtocolType.Icmp);
```

- Gửi gói dữ liệu Raw
- ICMP là giao thức không hướng kết nối
- Sử dụng phương thức SendTo() của lớp Socket để gửi
- Cổng trong giao thức ICMP không quan trọng

# RAW PING (IN C#)

```
Socket host = new Socket(AddressFamily.InterNetwork,  
                           SocketType.Raw,  
                           ProtocolType.Icmp);
```

- Nhận gói dữ liệu Raw
- Sử dụng phương thức ReceiveForm của lớp Socket
- Dữ liệu nhận về là một gói tin IP chúng ta phải tách ra để lấy gói tin ICMP
- Raw Socket không tự định dạng gói tin ICMP => tự định dạng



# RAW PING (IN C#)

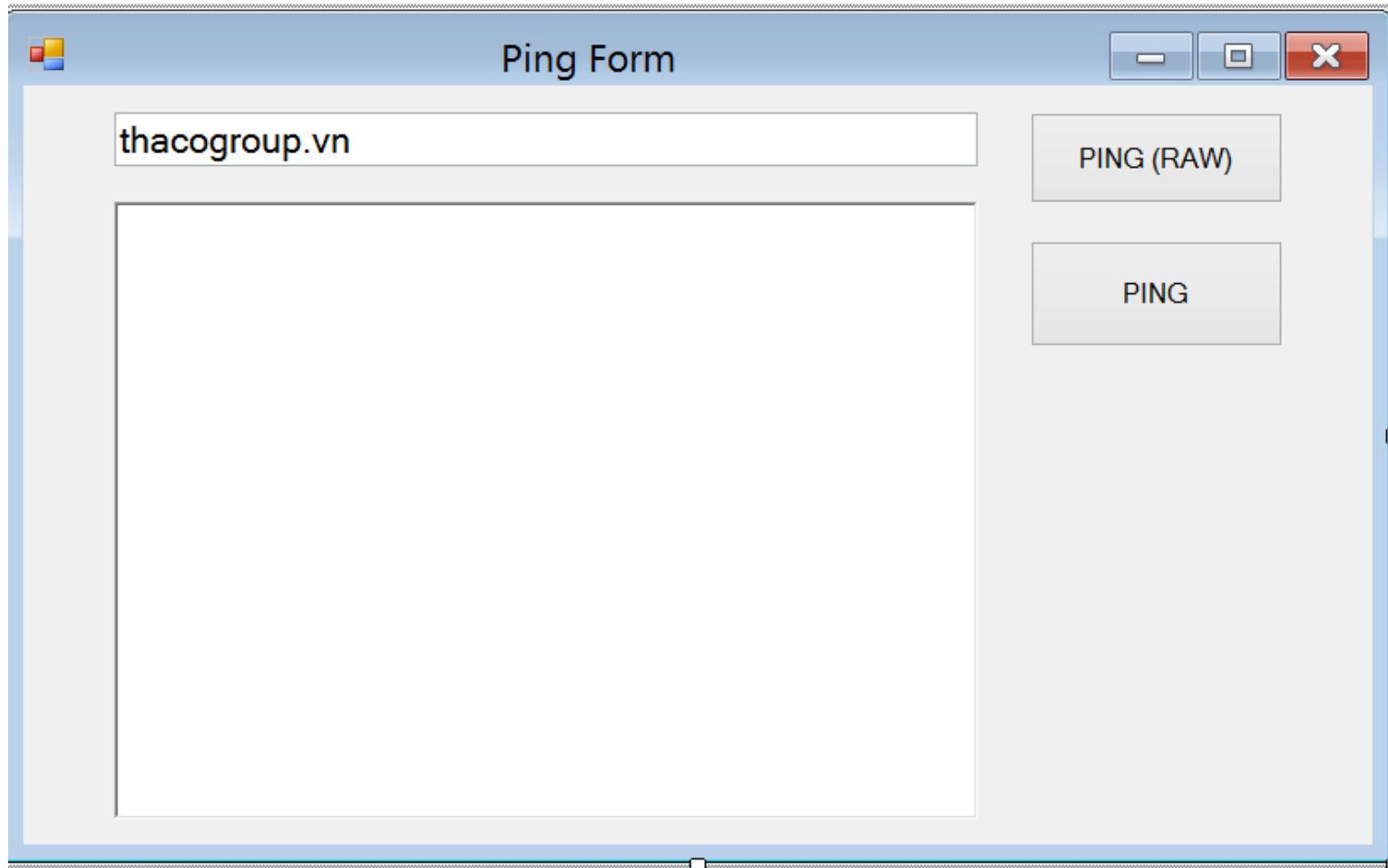
```
class ICMP {  
    public byte Type;  
    public byte Code;  
    public UInt16 Checksum;  
    public int Messagesize;  
    public byte[] Message = new byte[1024];  
    public ICMP() {  
    }  
}
```

# RAW PING (C#)

```
ICMP packet = new ICMP();  
packet.Type = 0x08;  
packet.Code = 0x00;  
packet.Checksum = 0;
```

Type = 8 -> echo request, code = 0

# RAW PING (C#)



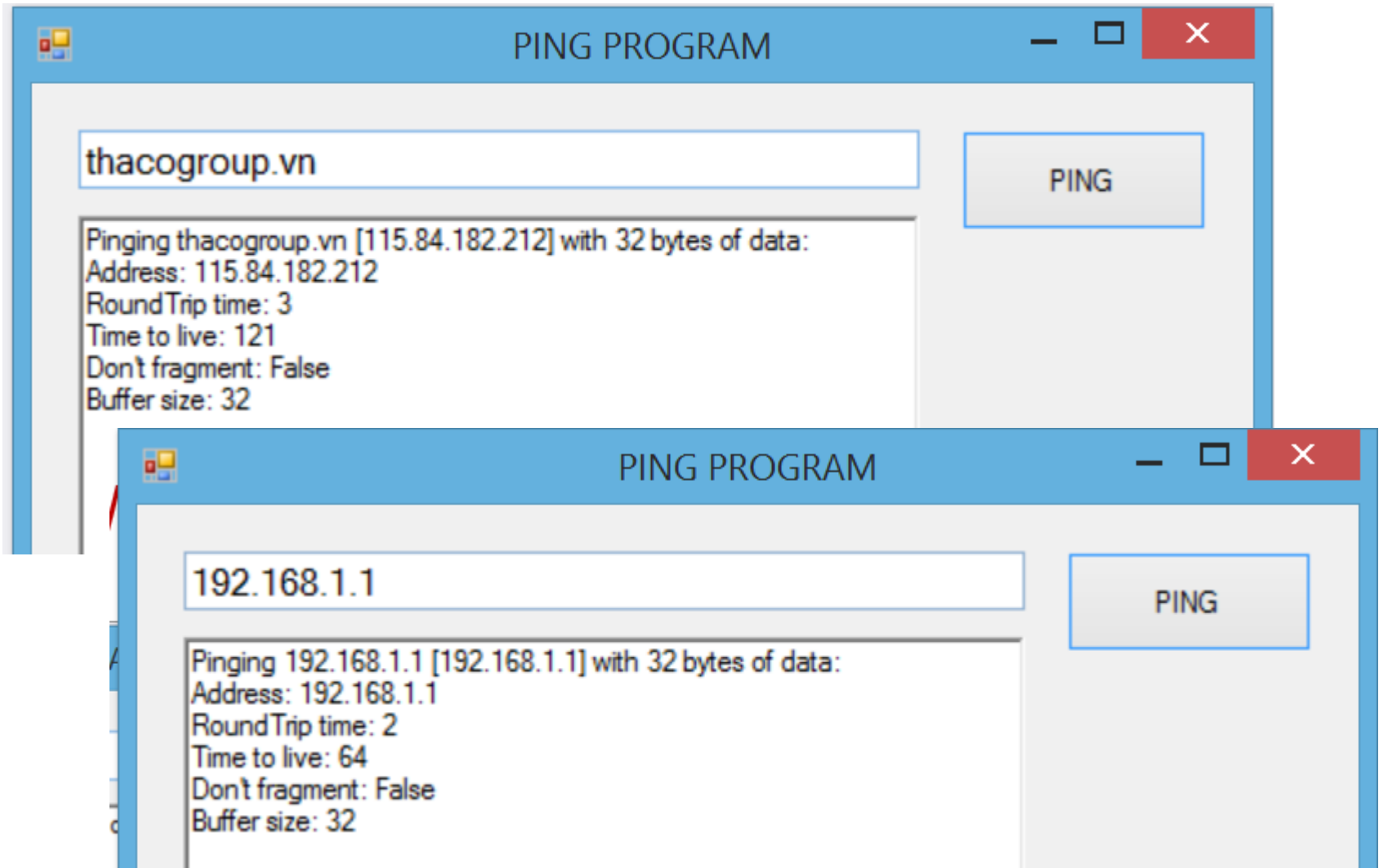
The image shows a screenshot of a Windows application window titled "Ping Form". The window has a standard Windows XP-style title bar with minimize, maximize, and close buttons. Inside the window, there is a text input field at the top left containing the text "thacogroup.vn". Below this input field is a large, empty rectangular area, likely intended for displaying ping results. To the right of the input field, there are two buttons: "PING (RAW)" and "PING". The "PING (RAW)" button is positioned above the "PING" button. The window is set against a light gray background.

# CLASS PING (IN C#)

- Sử dụng System.Net.NetworkInformation
- Tham khảo thêm tại:

<https://docs.microsoft.com/en-us/dotnet/api/system.net.networkinformation.ping?view=netframework-4.8>

# CLASS PING (IN C#) - DEMO



# CLASS PING (IN C#)

```
private void btnPing_Click(object sender, EventArgs e)
{
    rtbResult.Clear();
    string rs = "";
    Ping pingSender = new Ping();
    PingOptions options = new PingOptions();
    options.DontFragment = true;
    string data = "aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa";
    byte[] buffer = Encoding.ASCII.GetBytes(data);
    int timeout = 120;
    PingReply reply =
pingSender.Send(txtDest.Text.Trim(), timeout, buffer,
options);
```

# CLASS PING (IN C#)

```
if (reply.Status == IPStatus.TimedOut)
{
    rs = "Request Timed out";
    rtbResult.Text += rs + "\r\n";
}
else
{
    rs = "Pinging " + txtDest.Text.Trim() + " [" +
reply.Address.ToString() + "] with 32 bytes of data:";
    rtbResult.Text += rs + "\r\n";
}
```

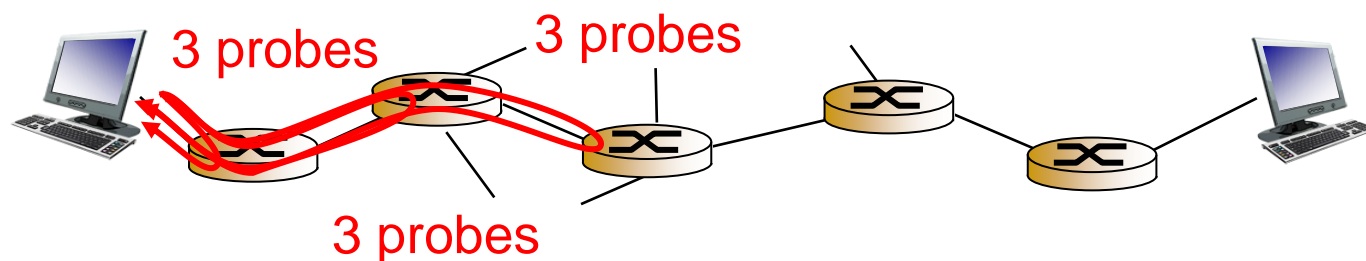
# CLASS PING (IN C#)

```
if (reply.Status == IPStatus.Success)
{
    rs = "Address: " + reply.Address.ToString();
    rtbResult.Text += rs + "\r\n";
    rs = "RoundTrip time: " +
reply.RoundtripTime;
    rtbResult.Text += rs + "\r\n";
    rs = "Time to live: " + reply.Options.Ttl;
    rtbResult.Text += rs + "\r\n";
    rs = "Don't fragment: " +
reply.Options.DontFragment;
    rtbResult.Text += rs + "\r\n";
    rs = "Buffer size: " + reply.Buffer.Length;
    rtbResult.Text += rs + "\r\n";
}
}
}
```



# ĐỘ TRỄ VÀ ĐỊNH TUYẾN TRÊN INTERNET “THỰC TẾ”

- Độ trễ và sự mất mát trên Internet “thực tế” trông như thế nào
- Chương trình **traceroute**: giúp đo lường độ trễ từ nguồn tới thiết bị định tuyến cái mà dọc theo con đường Internet từ đầu cuối này đến đầu cuối kia đến đích. Với tất cả  $i$ :
  - Gửi 3 gói tin sẽ đến bộ định tuyến  $i$  trên đường tới đích
  - Router  $i$  sẽ trả về các gói tin cho người gửi
  - Khoảng thời gian lần gửi giữa truyền và trả lời



Giới thiệu

**traceroute:** gaia.cs.umass.edu đến www.eurecom.fr

3 giá trị trễ từ  
gaia.cs.umass.edu đến cs-gw.cs.umass.edu

1	cs-gw (128.119.240.254)	1 ms	1 ms	2 ms
2	border1-rt-fa5-1-0.gw.umass.edu (128.119.3.145)	1 ms	1 ms	2 ms
3	cht-vbns.gw.umass.edu (128.119.3.130)	6 ms	5 ms	5 ms
4	jn1-at1-0-0-19.wor.vbns.net (204.147.132.129)	16 ms	11 ms	13 ms
5	jn1-so7-0-0-0.wae.vbns.net (204.147.136.136)	21 ms	18 ms	18 ms
6	abilene-vbns.abilene.ucaid.edu (198.32.11.9)	22 ms	18 ms	22 ms
7	nycm-wash.abilene.ucaid.edu (198.32.8.46)	22 ms	22 ms	22 ms
8	62.40.103.253 (62.40.103.253)	104 ms	109 ms	106 ms
9	de2-1.de1.de.geant.net (62.40.96.129)	109 ms	102 ms	104 ms
10	de.fr1.fr.geant.net (62.40.96.50)	113 ms	121 ms	114 ms
11	renater-gw.fr1.fr.geant.net (62.40.103.54)	112 ms	114 ms	112 ms
12	nio-n2.cssi.renater.fr (193.51.206.13)	111 ms	114 ms	116 ms
13	nice.cssi.renater.fr (195.220.98.102)	123 ms	125 ms	124 ms
14	r3t2-nice.cssi.renater.fr (195.220.98.110)	126 ms	126 ms	124 ms
15	eurecom-valbonne.r3t2.ft.net (193.48.50.54)	135 ms	128 ms	133 ms
16	194.214.211.25 (194.214.211.25)	126 ms	128 ms	126 ms
17	* * *			
18	* * *			
19	fantasia.eurecom.fr (193.55.113.142)	132 ms	128 ms	136 ms

Trans-oceanic liên kết

\* Không có phản hồi (thăm dò bị mất, router không trả lời)

\* Do some traceroutes from exotic countries at [www.traceroute.org](http://www.traceroute.org)

# TRACERT (WINDOW CMD)

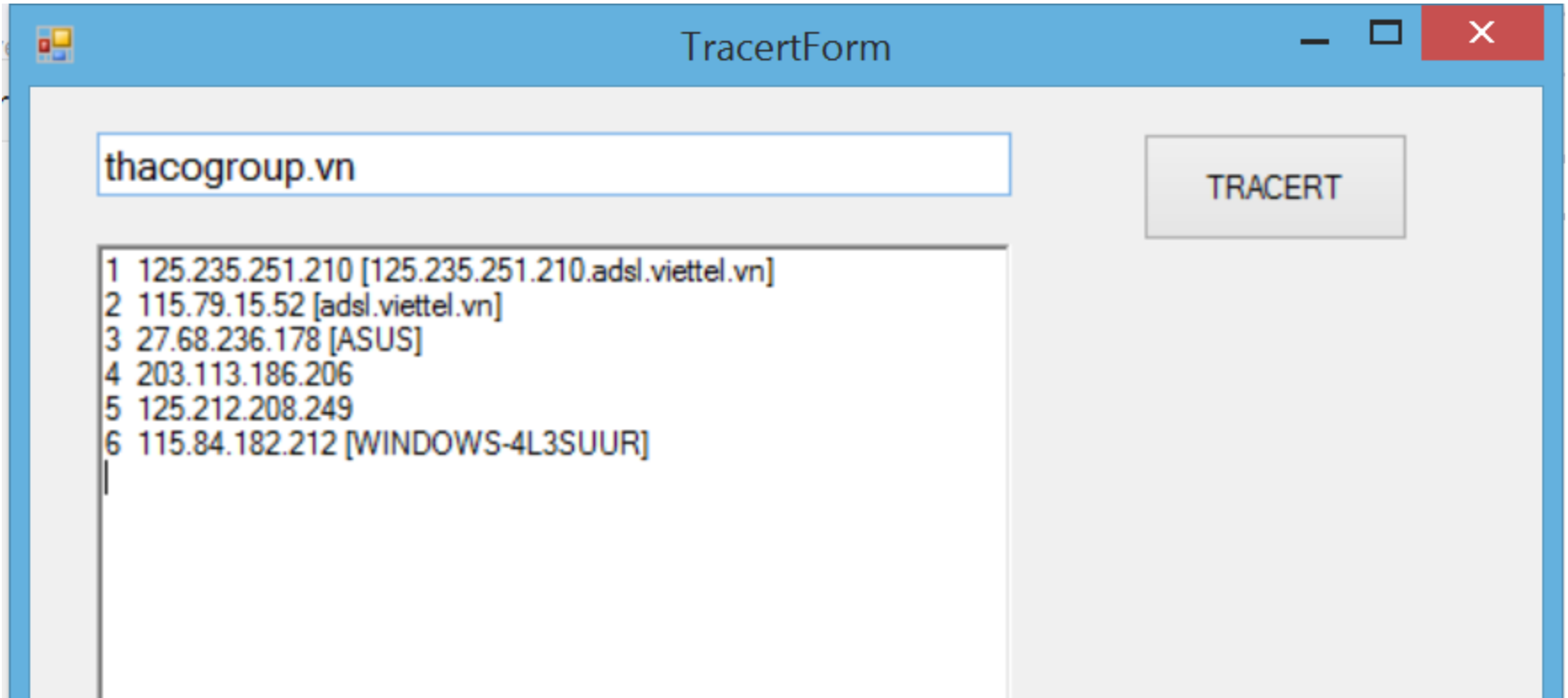
```
C:\Users\Home>tracert thacogroup.vn
```

```
Tracing route to thacogroup.vn [115.84.182.212]  
over a maximum of 30 hops:
```

```
  1      *          *          *      Request timed out.  
  2     3 ms       3 ms       3 ms    125.235.251.210.adsl.viettel.vn [125.235.251.210  
]   
  3     3 ms       6 ms       5 ms    adsl.viettel.vn [115.79.15.52]  
  4     7 ms       3 ms       4 ms    ASUS [27.68.236.178]  
  5     5 ms       *          3 ms    203.113.186.206  
  6     3 ms       4 ms       4 ms    125.212.208.249  
  7     4 ms       4 ms       4 ms    WINDOWS-4L3SUUR [115.84.182.212]
```

```
Trace complete.
```

# VIẾT ỨNG DỤNG TRACERT



The screenshot shows a Windows-style application window titled "TracertForm". It features a text input field containing "thacogroup.vn" and a button labeled "TRACERT". Below the input field is a list box displaying the results of a traceroute:

- 1 125.235.251.210 [125.235.251.210.adsl.viettel.vn]
- 2 115.79.15.52 [adsl.viettel.vn]
- 3 27.68.236.178 [ASUS]
- 4 203.113.186.206
- 5 125.212.208.249
- 6 115.84.182.212 [WINDOWS-4L3SUUR]