

## Lab-6

1. Do something such that your packet needs to be fragmented. How do you know which is the first fragment of the entire datagram? Which is the last fragment? Get the individual offsets of fragments for the complete datagram.

Set the MTU value more than 1500 to fragment the packet

Ping -l 2000 stanford.edu (MTU =2000, to fragment the packets)

```
PS C:\Users\gurus> netsh interface ipv4 show subinterface
```

MTU	MediaSenseState	Bytes In	Bytes Out	Interface
4294967295		1	0	1175066 Loopback Pseudo-Interface 1
1500	1	0	78349	VMware Network Adapter VMnet1
65535	5	0	0	NonDlxv
1500	1	17834889860	4840112659	Wi-Fi
1500	5	0	0	Ethernet
1500	5	0	0	Local Area Connection* 1
1500	5	0	0	Local Area Connection* 2
1500	1	0	78819	VMware Network Adapter VMnet8
1500	5	0	0	Ethernet 2

```
PS C:\Users\gurus> ping -l 2000 stanford.edu
```

Pinging stanford.edu [171.67.215.200] with 2000 bytes of data:  
Reply from 171.67.215.200: bytes=2000 time=343ms TTL=235  
Reply from 171.67.215.200: bytes=2000 time=283ms TTL=235  
Reply from 171.67.215.200: bytes=2000 time=383ms TTL=235  
Reply from 171.67.215.200: bytes=2000 time=283ms TTL=235

Ping statistics for 171.67.215.200:  
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),  
Approximate round trip times in milli-seconds:  
Minimum = 283ms, Maximum = 383ms, Average = 323ms  
PS C:\Users\gurus>

## First fragment:

More fragment set to 1(means data is fragmented)

Fragment offset = 0(it is set to zero so it is the first fragment)

The image shows a Wireshark packet capture of an ICMP Echo request (ping) from 192.168.0.7 to 171.67.215.200. The packet is fragmented, and the first fragment is highlighted. The packet details pane shows the following information:

- ... 0101 = Header Length: 20 bytes (5)
- > Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
- Total Length: 1500
- Identification: 0xc88c (51340)
- ✓ Flags: 0x2000, More fragments
- 0... .. = Reserved bit: Not set
- 0... .. = Don't fragment: Not set
- ..1. .... = More fragments: Set
- Fragment offset: 0
- Time to live: 128
- Protocol: ICMP (1)
- Header checksum: 0x0000 [validation disabled]
- [Header checksum status: Unverified]
- Source: 192.168.0.7
- Destination: 171.67.215.200
- [Reassembled IPv4 in frame: 628]

## Last Fragment:

More fragment set to 0(means it was the last fragmented packet)

Fragment offset = 1480

The image shows a Wireshark packet capture of an ICMP Echo request (ping) from 192.168.0.7 to 171.67.215.200. The packet is fragmented, and the last fragment is highlighted. The packet details pane shows the following information:

- > Frame 635: 562 bytes on wire (4496 bits), 562 bytes captured (4496 bits) on interface \Device\NPF\_{309848B1-796F-4478-94CE-2AE7C9DA600A}, id 0
- > Ethernet II, Src: D-LinkIn\_a7:c6:ab (f4:8c:eb:a7:c6:ab), Dst: IntelCor\_Ba:c8:39 (5c:87:9c:Ba:c8:39)
- ✓ Internet Protocol Version 4, Src: 171.67.215.200, Dst: 192.168.0.7
- 0100 .... = Version: 4
- ... 0101 = Header Length: 20 bytes (5)
- > Differentiated Services Field: 0x20 (DSCP: CS1, ECN: Not-ECT)
- Total Length: 548
- Identification: 0xa1c2 (41410)
- ✓ Flags: 0x00b9
- 0... .. = Reserved bit: Not set
- ..0. .... = More fragments: Not set
- Fragment offset: 1480
- Time to live: 235
- Protocol: ICMP (1)
- Header checksum: 0xe781 [validation disabled]
- [Header checksum status: Unverified]

Get the individual offsets of fragments for the complete datagram.

no.	time	source	destination	protocol	length	info
627	25.427934	192.168.0.7	171.67.215.200	IPv4	1514	Fragmented IP protocol (proto=ICMP 1, off=0, ID=c88c) [Reassembled in #628]
628	25.427934	192.168.0.7	171.67.215.200	ICMP	562	Echo (ping) request id=0x0001, seq=104/26624, ttl=128 (reply in 635)
634	25.771253	171.67.215.200	192.168.0.7	IPv4	1514	Fragmented IP protocol (proto=ICMP 1, off=0, ID=a1c2) [Reassembled in #635]
635	25.771253	171.67.215.200	192.168.0.7	ICMP	562	Echo (ping) reply id=0x0001, seq=104/26624, ttl=235 (request in 628)
652	26.431568	192.168.0.7	171.67.215.200	IPv4	1514	Fragmented IP protocol (proto=ICMP 1, off=0, ID=c88d) [Reassembled in #653]
653	26.431568	192.168.0.7	171.67.215.200	ICMP	562	Echo (ping) request id=0x0001, seq=105/26880, ttl=128 (reply in 660)
659	26.715032	171.67.215.200	192.168.0.7	IPv4	1514	Fragmented IP protocol (proto=ICMP 1, off=0, ID=ccb6) [Reassembled in #660]
660	26.715032	171.67.215.200	192.168.0.7	ICMP	562	Echo (ping) reply id=0x0001, seq=105/26880, ttl=235 (request in 653)
677	27.435753	192.168.0.7	171.67.215.200	IPv4	1514	Fragmented IP protocol (proto=ICMP 1, off=0, ID=c88e) [Reassembled in #678]
678	27.435753	192.168.0.7	171.67.215.200	ICMP	562	Echo (ping) request id=0x0001, seq=106/27136, ttl=128 (reply in 681)
680	27.818551	171.67.215.200	192.168.0.7	IPv4	1514	Fragmented IP protocol (proto=ICMP 1, off=0, ID=0213) [Reassembled in #681]
681	27.818551	171.67.215.200	192.168.0.7	ICMP	562	Echo (ping) reply id=0x0001, seq=106/27136, ttl=235 (request in 678)
694	28.440353	192.168.0.7	171.67.215.200	IPv4	1514	Fragmented IP protocol (proto=ICMP 1, off=0, ID=c88f) [Reassembled in #695]
695	28.440353	192.168.0.7	171.67.215.200	ICMP	562	Echo (ping) request id=0x0001, seq=107/27392, ttl=128 (reply in 707)
706	28.723512	171.67.215.200	192.168.0.7	IPv4	1514	Fragmented IP protocol (proto=ICMP 1, off=0, ID=28de) [Reassembled in #707]
707	28.723512	171.67.215.200	192.168.0.7	ICMP	562	Echo (ping) reply id=0x0001, seq=107/27392, ttl=235 (request in 695)

Total Length	Source	Destination	More bit	Fragment offset
1500	192.168.0.7	171.67.215.200	1	0
548	192.168.0.7	171.67.215.200	0	1480
1500	171.67.215.200	192.168.0.7	1	0
548	171.67.215.200	192.168.0.7	0	1480

## 2. What fields in the IP header change for each fragment in question #1?

- Total length
- Flags
- Checksum
- Fragment Offset

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ip.src == 171.67.215.200 || ip.dst == 171.67.215.200

No.	Time	Source	Destination	Protocol	Length	Info
627	25.427934	192.168.0.7	171.67.215.200	IPv4	1514	Fragmented IP protocol (proto=ICMP 1, off=0, ID=c88c) [Reassembled in #628]
628	25.427934	192.168.0.7	171.67.215.200	ICMP	562	Echo (ping) request id=0x0001, seq=104/26624, ttl=128 (reply in 635)
634	25.771253	171.67.215.200	192.168.0.7	IPv4	1514	Fragmented IP protocol (proto=ICMP 1, off=0, ID=a1c2) [Reassembled in #635]
635	25.771253	171.67.215.200	192.168.0.7	ICMP	562	Echo (ping) reply id=0x0001, seq=104/26624, ttl=235 (request in 628)
652	26.431568	192.168.0.7	171.67.215.200	IPv4	1514	Fragmented IP protocol (proto=ICMP 1, off=0, ID=c88d) [Reassembled in #653]
653	26.431568	192.168.0.7	171.67.215.200	ICMP	562	Echo (ping) request id=0x0001, seq=105/26880, ttl=128 (reply in 660)
659	26.715032	171.67.215.200	192.168.0.7	IPv4	1514	Fragmented IP protocol (proto=ICMP 1, off=0, ID=ccb6) [Reassembled in #660]
660	26.715032	171.67.215.200	192.168.0.7	ICMP	562	Echo (ping) reply id=0x0001, seq=105/26880, ttl=235 (request in 653)
677	27.435753	192.168.0.7	171.67.215.200	IPv4	1514	Fragmented IP protocol (proto=ICMP 1, off=0, ID=c88e) [Reassembled in #678]
678	27.435753	192.168.0.7	171.67.215.200	ICMP	562	Echo (ping) request id=0x0001, seq=106/27136, ttl=128 (reply in 681)
680	27.818551	171.67.215.200	192.168.0.7	IPv4	1514	Fragmented IP protocol (proto=ICMP 1, off=0, ID=0213) [Reassembled in #681]
681	27.818551	171.67.215.200	192.168.0.7	ICMP	562	Echo (ping) reply id=0x0001, seq=106/27136, ttl=235 (request in 678)
694	28.440353	192.168.0.7	171.67.215.200	IPv4	1514	Fragmented IP protocol (proto=ICMP 1, off=0, ID=c88f) [Reassembled in #695]
695	28.440353	192.168.0.7	171.67.215.200	ICMP	562	Echo (ping) request id=0x0001, seq=107/27392, ttl=128 (reply in 707)
706	28.723512	171.67.215.200	192.168.0.7	IPv4	1514	Fragmented IP protocol (proto=ICMP 1, off=0, ID=28de) [Reassembled in #707]
707	28.723512	171.67.215.200	192.168.0.7	ICMP	562	Echo (ping) reply id=0x0001, seq=107/27392, ttl=235 (request in 695)

0100 .... = Version: 4  
.... 0101 = Header Length: 20 bytes (5)  
> Differentiated Services Field: 0x20 (DSCP: CS1, ECN: Not-ECT)  
Total Length: 1500  
Identification: 0xa1c2 (41410)  
Flags: 0x2000, More fragments  
0... .. = Reserved bit: Not set  
0... .. = Don't fragment: Not set  
..1. .... = More fragments: Set  
Fragment offset: 0  
Time to live: 235  
Protocol: ICMP (1)  
Header checksum: 0xc482 [validation disabled]  
[Header checksum status: unverified]  
Source: 171.67.215.200  
Destination: 192.168.0.7  
[Reassembled IPv4 in frame: 635]

0010 05 dc a1 c2 20 00 eb 01 c4 82 ab 43 d7 c8 c0 a8 ....C....

Wi-Fi

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[[p.src == 171.67.215.200 || p.dst == 171.67.215.200]]

No.	Time	Source	Destination	Protocol	Length	Info
627	25.427934	192.168.0.7	171.67.215.200	IPv4	1514	Fragmented IP protocol (proto=ICMP 1, off=0, ID=c88c) [Reassembled in #628]
628	25.427934	192.168.0.7	171.67.215.200	ICMP	562	Echo (ping) request id=0x0001, seq=104/26624, ttl=128 (reply in 635)
634	25.771253	171.67.215.200	192.168.0.7	IPv4	1514	Fragmented IP protocol (proto=ICMP 1, off=0, ID=a1c2) [Reassembled in #635]
635	25.771253	171.67.215.200	192.168.0.7	ICMP	562	Echo (ping) reply id=0x0001, seq=104/26624, ttl=235 (request in 628)
652	26.431568	192.168.0.7	171.67.215.200	IPv4	1514	Fragmented IP protocol (proto=ICMP 1, off=0, ID=c88d) [Reassembled in #653]
653	26.431568	192.168.0.7	171.67.215.200	ICMP	562	Echo (ping) request id=0x0001, seq=105/26880, ttl=128 (reply in 660)
659	26.715032	171.67.215.200	192.168.0.7	IPv4	1514	Fragmented IP protocol (proto=ICMP 1, off=0, ID=ccb6) [Reassembled in #660]
660	26.715032	171.67.215.200	192.168.0.7	ICMP	562	Echo (ping) reply id=0x0001, seq=105/26880, ttl=235 (request in 653)
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678	27.435753	192.168.0.7	171.67.215.200	ICMP	562	Echo (ping) request id=0x0001, seq=106/27136, ttl=128 (reply in 681)
680	27.818551	171.67.215.200	192.168.0.7	IPv4	1514	Fragmented IP protocol (proto=ICMP 1, off=0, ID=0213) [Reassembled in #681]
681	27.818551	171.67.215.200	192.168.0.7	ICMP	562	Echo (ping) reply id=0x0001, seq=106/27136, ttl=235 (request in 678)
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695	28.440353	192.168.0.7	171.67.215.200	ICMP	562	Echo (ping) request id=0x0001, seq=107/27392, ttl=128 (reply in 707)
706	28.723512	171.67.215.200	192.168.0.7	IPv4	1514	Fragmented IP protocol (proto=ICMP 1, off=0, ID=28de) [Reassembled in #707]
707	28.723512	171.67.215.200	192.168.0.7	ICMP	562	Echo (ping) reply id=0x0001, seq=107/27392, ttl=235 (request in 695)

0100 ... = Version: 4  
... 0101 = Header Length: 20 bytes (5)  
> Differentiated Services Field: 0x20 (DSCP: CS1, ECN: Not-ECT)  
Total Length: 548  
Identification: 0xalc2 (41410)  
Flags: 0x00b9  
... .. = Reserved bit: Not set  
... .. = Don't fragment: Not set  
... .. = More fragments: Not set  
Fragment offset: 1480  
Time to live: 235  
Protocol: ICMP (1)  
Header checksum: 0xe781 [validation disabled]  
[Header checksum status: Unverified]  
Source: 171.67.215.200  
Destination: 192.168.0.7  
[ 2 IPv4 Fragments (2008 bytes): #634(1480), #635(528)]

Frame (562 bytes) Reassembled IPv4 (2008 bytes)