# MSCI 445 Lab 3 June 5, 2017

Group 2

Johnson Kan – 20270951

Sarah Watts – 20515933

## Overview

This assignment shows how TCP works from client to server. The concepts covered in this lab are 3 way handshakes, TCP slow start, congestion control and congestion avoidance. This lab was implemented by uploading the file alice.txt to the web server and capturing the packets using wire shark. All questions except 3 & 14 were answered using supplied wire shark traces.

# 1. Capturing a bulk TCP transfer from your computer to a remote server

Sample of self-capture:

	Sa.	imple of self-capture.			
\$1 3,218992000 129.97.43.70	No.				
\$2 3.576726000 129.97.48.70				SSDP	
\$2 3.576726000 129.97.48.70			239.255.255.250	SSDP	
\$\frac{5}{3}\$, \$579640000 129, 97, 48, 70\$  \$128, 119, 245, 12  \$129, 97, 48, 70  \$129, 97, 48, 70  \$129, 97, 48, 70  \$129, 97, 48, 70  \$129, 97, 48, 70  \$129, 97, 48, 70  \$128, 119, 245, 12  \$129, 97, 48, 70  \$128, 119, 245, 12  \$129, 97, 48, 70  \$128, 119, 245, 12  \$129, 97, 48, 70  \$128, 119, 245, 12  \$129, 97, 48, 70  \$129, 97, 50, 141  \$129, 97, 50, 141  \$129, 97, 48, 70  \$129, 97, 50, 141  \$129, 97, 48, 70  \$128, 119, 245, 12  \$129, 97, 50, 141  \$129, 97, 48, 70  \$128, 119, 245, 12  \$129, 97, 50, 141  \$129, 97, 48, 70  \$128, 119, 245, 12  \$129, 97, 50, 141  \$129, 97, 48, 70  \$128, 119, 245, 12  \$129, 97, 50, 141  \$129, 97, 48, 70  \$128, 119, 245, 12  \$129, 97, 50, 141  \$129, 97, 48, 70  \$128, 119, 245, 12  \$129, 97, 50, 141  \$129, 97, 48, 70  \$128, 119, 245, 12  \$129, 97, 50, 141  \$129, 97, 48, 70  \$128, 119, 245, 12  \$129, 97, 50, 141  \$129, 97, 48, 70  \$129, 97, 50, 141  \$129, 97, 48, 70  \$129, 97, 50, 141  \$129, 97, 48, 70  \$129, 97, 50, 141  \$129, 97, 48, 70  \$129, 97, 50, 141  \$129, 97, 48, 70  \$129, 97, 48, 70  \$129, 97, 50, 141  \$129, 97, 48, 70			HP_09:13:a6	IEEE802	
\$ 43.606319000 128.119.245.12			128.119.245.12	TCP	
\$5 3.612968000 129.97.48.70			128.119.245.12	TCP	
56 3.613023000 129,97.48.70 128.119.245.12 TCP 54 53902-80 [ACK] Seq=1 ACK=1 win=65536 Len=0 57 3.613395000 129,97.50.141 129,97.48.70 TCP 60 445-51500 [ACK] Seq=1 ACK=269 win=2048 Len=0 59 3.653330000 129,97.50.141 129,97.48.70 SMB2 322 Create Response File: alice.txt 60 3.653825000 129,97.48.70 128.119.245.12 TCP 703 [TCP segment of a reassembled PDU] 61 3.654007000 129,97.48.70 129,97.50.141 SMB2 171 Read Request Len:16384 off:0 File: alice.txt 62 3.654288000 129,97.50.141 129,97.48.70 TCP 60 445-51500 [ACK] Seq=269 ACK=386 win=2051 Len=0 63 3.654288000 129,97.50.141 129,97.48.70 TCP 60 445-51500 [ACK] Seq=269 ACK=386 win=2051 Len=0 63 3.654288000 129,97.50.141 129,97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 66 3.654289000 129,97.50.141 129,97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 66 3.654289000 129,97.50.141 129,97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 67 3.654368000 129,97.50.141 129,97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 68 3.65428000 129,97.50.141 129,97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 67 3.65436000 129,97.50.141 129,97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 68 3.654563000 129,97.50.141 129,97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 70 3.654563000 129,97.50.141 129,97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 71 3.654564000 129,97.50.141 129,97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 72 3.654565000 129,97.50.141 129,97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 72 3.654565000 129,97.50.141 129,97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 72 3.654565000 129,97.50.141 129,97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 73 3.654565000 129,97.50.141 129,97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 74 3.654566000 129,97.50.141 129,97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 75 3.654566000 129,97.50.141 129,97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 76 3.654566000 129,97.50.141 129,97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 77 3.654566000 129,97.50.141		54 3.606319000 128.119.245.12	129.97.48.70	TCP	60 80+53901 [ACK] Seq=1 Ack=2 Win=237 Len=0
57 3.613395000 129.97.48.70		55 3.612968000 128.119.245.12	129.97.48.70	TCP	66 80→53902 [SYN, ACK] Seq=0 Ack=1 Win=29200 Len=0 MS
\$8 3.613652000 129.97.50.141		56 3.613023000 129.97.48.70	128.119.245.12	TCP	
59 3.653330000 129.97.50.141 129.97.48.70 SMB2 322 Create Response File: alice.txt 60 3.653825000 129.97.48.70 128.119.245.12 TCP 703 [TCP segment of a reassembled PPU] 61 3.65407000 129.97.48.70 129.97.50.141 SMB2 171 Read Request Len:16384 Off:0 File: alice.txt 62 3.654288000 129.97.50.141 129.97.48.70 TCP 60 445-51500 [AcK] Seq=269 Ack=386 win=2051 Len=0 63 3.654288000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PPU] 65 3.654280000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PPU] 66 3.654290000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PPU] 67 3.654366000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PPU] 68 3.654562000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PPU] 69 3.654563000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PPU] 70 3.654563000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PPU] 71 3.654564000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PPU] 72 3.654565000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PPU] 73 3.654565000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PPU] 74 3.654566000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PPU] 75 3.654566000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PPU] 76 3.654566000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PPU] 77 3.654766000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PPU] 78 3.654560000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PPU] 79 3.654766000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PPU] 80 3.655500000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PPU] 81 3.655500000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PPU] 82 3.655500000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PPU] 83 3.655500000 129.97.50.141 129.97.48.70 TCP 1514 [		57 3.613395000 129.97.48.70	129.97.50.141	SMB2	322 Create Request File: alice.txt
60 3.653825000 129.97.48.70		58 3.613652000 129.97.50.141	129.97.48.70	TCP	60 445-51500 [ACK] Seq=1 Ack=269 win=2048 Len=0
61 3.654087000 129.97.48.70 129.97.50.141 SMB2 171 Read Request Len:16384 Off:0 File: alice.txt 62 3.654288000 129.97.50.141 129.97.48.70 TCP 60 445-51500 [ACK] Seq=269 Ack=386 win=2051 Len=0 64 3.654288000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 64 3.654289000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 65 3.654290000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 66 3.654290000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 67 3.65436000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 68 3.654562000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 70 3.654563000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 70 3.654563000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 71 3.654564000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 72 3.654565000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 73 3.654565000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 73 3.654565000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 74 3.654566000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 75 3.654566000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 75 3.65466000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 76 3.65466000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 77 3.65479000 129.97.48.70 129.97.50.141 TCP 54 51500-445 [ACK] Seq=386 ACk=16737 win=256 Len=0 77 3.65479000 129.97.48.70 129.97.50.141 TCP 54 51500-445 [ACK] Seq=386 ACk=16737 win=256 Len=0 77 3.65479000 129.97.48.70 129.97.50.141 TCP 54 51500-445 [ACK] Seq=386 ACk=16737 win=256 Len=0 77 3.65479000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 81 3.655500000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 82 3.655500000 129.97.		59 3.653330000 129.97.50.141	129.97.48.70	SMB2	322 Create Response File: alice.txt
62 3.654288000 129.97.50.141 129.97.48.70 TCP 60 445-51500 [ACK] Seq=269 Ack=386 Win=2051 Len=0 63 3.654288000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 65 3.654289000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 66 3.654290000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 66 3.654290000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 67 3.65436000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 68 3.654562000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 69 3.654563000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 70 3.654563000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 71 3.654563000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 72 3.654563000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 73 3.654565000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 73 3.654565000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 74 3.654566000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 75 3.654566000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 76 3.654566000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 77 3.65479000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 78 3.65479000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 78 3.65479000 129.97.48.70 129.97.50.141 TCP 54 51500-445 [ACK] Seq=386 ACk=16737 Win=256 Len=0 77 3.65479000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 129.97.48.70 TCP 1514 [TCP segment of a reassembled PD		60 3.653825000 129.97.48.70	128.119.245.12	TCP	703 [TCP segment of a reassembled PDU]
63 3.654288000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 64 3.654289000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 65 3.654290000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 66 3.654290000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 67 3.654346000 129.97.48.70 129.97.50.141 TCP 54 51500-445 [ACK] Seq=386 Ack=6109 Win=256 Len=0 68 3.654562000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 69 3.654563000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 70 3.654563000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 71 3.654564000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 72 3.654565000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 73 3.654566000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 74 3.654566000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 75 3.654566000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 76 3.654619000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 77 3.65479000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 78 3.65479000 129.97.48.70 129.97.50.141 TCP 54 51500-445 [ACK] Seq=386 Ack=16737 Win=256 Len=0 77 3.65479000 129.97.48.70 129.97.50.141 TCP 54 51500-445 [ACK] Seq=386 Ack=16737 Win=256 Len=0 80 3.655500000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 81 3.655500000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 82 3.655500000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 83 3.655500000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 84 3.655500000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 85 3.655500000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 86 3.655500000 129.97.50.141 129.97.48.		61 3.654007000 129.97.48.70	129.97.50.141	SMB2	
64 3.654289000 129.97.50.141 129.97.48.70 TCP 1514 TCP segment of a reassembled PDU] 65 3.654290000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 66 3.654290000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 67 3.654346000 129.97.50.141 129.97.48.70 TCP 54 51500-445 [ACK] Seq=386 Ack=6109 Win=256 Len=0 68 3.654563000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 69 3.654563000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 71 3.654563000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 72 3.654563000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 73 3.654565000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 74 3.654566000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 75 3.654566000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 76 3.654566000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 77 3.654566000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 78 3.654566000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 79 3.654799000 129.97.48.70 129.97.50.141 TCP 54 51500-445 [ACK] Seq=386 Ack=16737 Win=256 Len=0 77 3.654799000 129.97.48.70 129.97.50.141 TCP 54 51500-445 [ACK] Seq=386 Ack=16737 Win=256 Len=0 78 3.654907000 129.97.48.70 129.97.50.141 SMB2 171 Read Request Len:16384 off:16384 File: alice.txt 79 3.655243000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 81 3.655500000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 82 3.655500000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 83 3.655500000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 83 3.655500000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU]		62 3.654288000 129.97.50.141	129.97.48.70	TCP	60 445-51500 [ACK] Seq=269 Ack=386 Win=2051 Len=0
65 3.654290000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 66 3.654290000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 67 3.654346000 129.97.50.141 129.97.48.70 TCP 54 51500-445 [ACK] seq=386 Ack=6109 win=256 Len=0 68 3.654562000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 69 3.654563000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 70 3.654563000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 71 3.654564000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 72 3.654565000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 73 3.654565000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 74 3.654566000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 75 3.654566000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 76 3.654566000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 77 3.654766000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 78 3.6545000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 78 3.65479000 129.97.48.70 129.97.50.141 TCP 54 51500-445 [ACK] Seq=386 Ack=16737 win=256 Len=0 77 3.65479000 129.97.48.70 128.119.245.12 TCP 1514 [TCP segment of a reassembled PDU] 78 3.655479000 129.97.48.70 129.97.50.141 SMB2 171 Read Request Len:16384 Off:16384 File: alice.txt 79 3.655243000 129.97.50.141 129.97.48.70 TCP 60 445-51500 [ACK] Seq=16737 Ack=503 win=2051 Len=0 80 3.655500000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 81 3.655500000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 82 3.655500000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 83 3.655500000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU]		63 3.654288000 129.97.50.141	129.97.48.70	TCP	1514 [TCP segment of a reassembled PDU]
66 3.654290000 129.97.50.141 129.97.48.70 TCP 1514 TCP segment of a reassembled PDU] 67 3.654346000 129.97.48.70 129.97.50.141 TCP 54 51500-4445 [ACK] Seq=386 Ack=6109 win=256 Len=0 68 3.654562000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 69 3.654563000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 70 3.654563000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 71 3.654564000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 72 3.654565000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 73 3.654565000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 74 3.654566000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 75 3.654566000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 76 3.654566000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 77 3.654566000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 78 3.654619000 129.97.48.70 129.97.50.141 TCP 54 51500-445 [ACK] Seq=386 Ack=16737 win=256 Len=0 77 3.654779000 129.97.48.70 128.119.245.12 TCP 1514 [TCP segment of a reassembled PDU] 78 3.655430000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 80 3.655500000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 81 3.655500000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 82 3.655500000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 83 3.655500000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 83 3.655500000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 83 3.655500000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU]		64 3.654289000 129.97.50.141	129.97.48.70	TCP	1514 [TCP segment of a reassembled PDU]
67 3.654346000 129.97.48.70 129.97.50.141 TCP 54 51500-445 [ACK] Seq=386 Ack=6109 Win=256 Len=0 68 3.654562000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 70 3.654563000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 71 3.654563000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 72 3.654564000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 73 3.654565000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 73 3.654565000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 74 3.654566000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 75 3.654566000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 75 3.654566000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 75 3.65466000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 77 3.654779000 129.97.48.70 129.97.50.141 TCP 54 51500-445 [ACK] Seq=386 Ack=16737 Win=256 Len=0 129.97.50.141 SMB2 171 Read Request Len:16384 off:16384 File: alice.txt 79 3.655243000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 129.97.48.70 TCP 1514 [TCP segment of		65 3.654290000 129.97.50.141	129.97.48.70	TCP	1514 [TCP segment of a reassembled PDU]
68 3.654562000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 69 3.654563000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 70 3.654563000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 71 3.654564000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 72 3.654565000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 73 3.654565000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 74 3.654566000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 75 3.654566000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 76 3.654566000 129.97.50.141 129.97.48.70 SMB2 462 Read Response 76 3.654619000 129.97.48.70 129.97.50.141 TCP 54 51500-445 [ACK] Seq=386 Ack=16737 win=256 Len=0 77 3.654779000 129.97.48.70 128.119.245.12 TCP 1514 [TCP segment of a reassembled PDU] 78 3.654907000 129.97.48.70 129.97.50.141 SMB2 171 Read Request Len:16384 off:16384 File: alice.txt 79 3.655243000 129.97.50.141 129.97.48.70 TCP 60 445-51500 [ACK] Seq=16737 Ack=503 win=2051 Len=0 80 3.655500000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 81 3.655502000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 82 3.655502000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 83 3.655502000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 83 3.655502000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU]		66 3.654290000 129.97.50.141	129.97.48.70	TCP	1514 [TCP segment of a reassembled PDU]
69 3.654563000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 70 3.654563000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 71 3.654564000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 72 3.654565000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 73 3.654565000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 74 3.654566000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 75 3.654566000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 76 3.654566000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 77 3.65479000 129.97.48.70 129.97.50.141 TCP 54 51500-445 [ACK] Seq=386 Ack=16737 Win=256 Len=0 77 3.65479000 129.97.48.70 128.119.245.12 TCP 1514 [TCP segment of a reassembled PDU] 78 3.655490000 129.97.50.141 SMB2 171 Read Request Len:16384 Off:16384 File: alice.txt 79 3.655243000 129.97.50.141 129.97.48.70 TCP 60 445-51500 [ACK] Seq=16737 Ack=503 Win=2051 Len=0 80 3.655500000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 81 3.655502000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 82 3.655502000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 83 3.655502000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU]		67 3.654346000 129.97.48.70	129.97.50.141	TCP	54 51500-445 [ACK] Seq=386 Ack=6109 Win=256 Len=0
70 3.654563000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 71 3.654564000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 72 3.654565000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 73 3.654565000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 74 3.654566000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 75 3.654566000 129.97.50.141 129.97.48.70 SMB2 462 Read Response 76 3.654619000 129.97.48.70 129.97.50.141 TCP 54 51500-445 [ACK] Seq=386 Ack=16737 Win=256 Len=0 77 3.654779000 129.97.48.70 128.119.245.12 TCP 1514 [TCP segment of a reassembled PDU] 78 3.655479000 129.97.48.70 129.97.50.141 SMB2 171 Read Request Len:16384 Off:16384 File: alice.txt 79 3.655243000 129.97.50.141 129.97.48.70 TCP 60 445-51500 [ACK] Seq=16737 Ack=503 Win=2051 Len=0 80 3.655500000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 81 3.655500000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 82 3.655500000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 83 3.655500000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 83 3.655500000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 83 3.655500000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU]		68 3.654562000 129.97.50.141	129.97.48.70	TCP	1514 [TCP segment of a reassembled PDU]
71 3.654564000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 72 3.654565000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 73 3.654565000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 74 3.654566000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 75 3.654566000 129.97.50.141 129.97.48.70 SMB2 462 Read Response 76 3.654619000 129.97.48.70 129.97.50.141 TCP 54 51500-445 [ACK] Seq=386 Ack=16737 Win=256 Len=0 77 3.654799000 129.97.48.70 128.119.245.12 TCP 1514 [TCP segment of a reassembled PDU] 78 3.654907000 129.97.48.70 129.97.50.141 SMB2 171 Read Request Len:16384 off:16384 File: alice.txt 79 3.655500000 129.97.50.141 129.97.48.70 TCP 60 445-51500 [ACK] Seq=16737 Ack=503 Win=2051 Len=0 80 3.655500000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 81 3.655501000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 82 3.655502000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 83 3.655502000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 83 3.655502000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 83 3.655502000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU]		69 3.654563000 129.97.50.141	129.97.48.70	TCP	1514 [TCP segment of a reassembled PDU]
72 3.654565000 129.97.50.141 129.97.48.70 TCP 1514 TCP segment of a reassembled PDU] 73 3.654565000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 74 3.654566000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 75 3.654566000 129.97.50.141 129.97.48.70 SMB2 462 Read Response 76 3.654619000 129.97.48.70 129.97.50.141 TCP 54 51500-445 [ACK] Seq=386 Ack=16737 Win=256 Len=0 77 3.654779000 129.97.48.70 128.119.245.12 TCP 1514 [TCP segment of a reassembled PDU] 78 3.654970000 129.97.48.70 129.97.50.141 SMB2 171 Read Request Len:16384 off:16384 File: alice.txt 79 3.655243000 129.97.50.141 129.97.48.70 TCP 60 445-51500 [ACK] Seq=16737 Ack=503 Win=2051 Len=0 80 3.655500000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 81 3.655501000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 82 3.655502000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 83 3.655502000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 84 3.655502000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 85 3.655502000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU]		70 3.654563000 129.97.50.141	129.97.48.70	TCP	1514 [TCP segment of a reassembled PDU]
73 3.654565000 129.97.50.141 129.97.48.70 TCP 1514 TCP segment of a reassembled PDU] 74 3.654566000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 75 3.654566000 129.97.50.141 129.97.48.70 SMB2 462 Read Response 76 3.654619000 129.97.48.70 129.97.50.141 TCP 54 51500-445 [ACK] Seq=386 ACk=16737 Win=256 Len=0 77 3.654779000 129.97.48.70 128.119.245.12 TCP 1514 [TCP segment of a reassembled PDU] 78 3.654907000 129.97.48.70 129.97.50.141 SMB2 171 Read Request Len:16384 Off:16384 File: alice.txt 79 3.655243000 129.97.50.141 129.97.48.70 TCP 60 445-51500 [ACK] Seq=16737 ACK=503 Win=2051 Len=0 80 3.655500000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 81 3.6555500000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 82 3.6555502000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 83 3.655502000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 83 3.655502000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU]		71 3.654564000 129.97.50.141	129.97.48.70	TCP	1514 [TCP segment of a reassembled PDU]
74 3.654566000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 75 3.654566000 129.97.50.141 129.97.48.70 SMB2 462 Read Response 76 3.654619000 129.97.48.70 129.97.50.141 TCP 54 51500-445 [AcK] Seq=386 Ack=16737 Win=256 Len=0 77 3.654779000 129.97.48.70 128.119.245.12 TCP 1514 [TCP segment of a reassembled PDU] 78 3.654907000 129.97.48.70 129.97.50.141 SMB2 171 Read Request Len:16384 Off:16384 File: alice.txt 79 3.655243000 129.97.50.141 129.97.48.70 TCP 60 445-51500 [AcK] Seq=16737 Ack=503 Win=2051 Len=0 80 3.655500000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 81 3.655501000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 82 3.655502000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 83 3.655502000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 83 3.655502000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU]		72 3.654565000 129.97.50.141	129.97.48.70	TCP	1514 [TCP segment of a reassembled PDU]
75 3.654566000 129.97.50.141 129.97.48.70 SMB2 462 Read Response 76 3.654619000 129.97.48.70 129.97.50.141 TCP 54 51500-445 [ACK] Seq=386 Ack=16737 Win=256 Len=0 77 3.654799000 129.97.48.70 128.119.245.12 TCP 1514 [TCP segment of a reassembled PDU] 78 3.654907000 129.97.48.70 129.97.50.141 SMB2 171 Read Request Len:16384 off:16384 File: alice.txt 79 3.655243000 129.97.50.141 129.97.48.70 TCP 60 445-51500 [ACK] Seq=16737 Ack=503 Win=2051 Len=0 80 3.655500000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 81 3.655501000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 82 3.655502000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 83 3.655502000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 83 3.655502000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU]		73 3.654565000 129.97.50.141	129.97.48.70	TCP	1514 [TCP segment of a reassembled PDU]
76 3.654619000 129.97.48.70 129.97.50.141 TCP 54 51500-445 [ACK] Seq=386 Ack=16737 win=256 Len=0 77 3.654779000 129.97.48.70 128.119.245.12 TCP 1514 [TCP segment of a reassembled PDU] 78 3.654907000 129.97.48.70 129.97.50.141 SMB2 171 Read Request Len:16384 Off:16384 File: alice.txt 79 3.655243000 129.97.50.141 129.97.48.70 TCP 60 445-51500 [ACK] Seq=16737 Ack=503 win=2051 Len=0 80 3.655500000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 81 3.655501000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 82 3.655502000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 83 3.655502000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU]		74 3.654566000 129.97.50.141	129.97.48.70	TCP	1514 [TCP segment of a reassembled PDU]
77 3.654779000 129.97.48.70 128.119.245.12 TCP 1514 [TCP segment of a reassembled PDU] 78 3.654907000 129.97.48.70 129.97.50.141 SMB2 171 Read Request Len:16384 Off:16384 File: alice.txt 79 3.655243000 129.97.50.141 129.97.48.70 TCP 60 445-51500 [ACK] Seq=16737 Ack=503 win=2051 Len=0 80 3.655500000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 81 3.655501000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 82 3.655502000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 83 3.655502000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU]		75 3.654566000 129.97.50.141	129.97.48.70	SMB2	462 Read Response
78 3.6554907000 129.97.48.70 129.97.50.141 SMB2 171 Read Request Len:16384 Off:16384 File: alice.txt 79 3.655243000 129.97.50.141 129.97.48.70 TCP 60 445-51500 [ACK] Seq=16737 ACk=503 Win=2051 Len=0 80 3.655500000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 81 3.655501000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 82 3.655502000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 83 3.655502000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU]		76 3.654619000 129.97.48.70	129.97.50.141	TCP	54 51500→445 [ACK] Seq=386 Ack=16737 Win=256 Len=0
79 3.655243000 129.97.50.141 129.97.48.70 TCP 60 445-51500 [ACK] Seq=16737 Ack=503 Win=2051 Len=0 80 3.655500000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 81 3.655501000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 82 3.655502000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 83 3.655502000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU]		77 3.654779000 129.97.48.70	128.119.245.12	TCP	1514 [TCP segment of a reassembled PDU]
80 3.655500000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 81 3.655501000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 82 3.655502000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 83 3.655502000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU]		78 3.654907000 129.97.48.70	129.97.50.141	SMB2	171 Read Request Len:16384 Off:16384 File: alice.txt
81 3.655501000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 82 3.655502000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 83 3.655502000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU]		79 3.655243000 129.97.50.141	129.97.48.70	TCP	60 445+51500 [ACK] Seq=16737 Ack=503 Win=2051 Len=0
82 3.655502000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU] 83 3.655502000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU]		80 3.655500000 129.97.50.141	129.97.48.70	TCP	1514 [TCP segment of a reassembled PDU]
83 3.655502000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU]		81 3.655501000 129.97.50.141	129.97.48.70	TCP	1514 [TCP segment of a reassembled PDU]
		82 3.655502000 129.97.50.141	129.97.48.70	TCP	1514 [TCP segment of a reassembled PDU]
84 3.655503000 129.97.50.141 129.97.48.70 TCP 1514 [TCP segment of a reassembled PDU]		83 3.655502000 129.97.50.141	129.97.48.70	TCP	1514 [TCP segment of a reassembled PDU]
		84 3.655503000 129.97.50.141	129.97.48.70	TCP	1514 [TCP segment of a reassembled PDU]

# 2. A first look at the captured trace

### Question 1

The IP address of the source computer is 192.168.1.102 and the TCP port number is 1161.

```
| Length | Info | 62 1161-80 | [SYN] | Seq=0 | win=16384 | Len=0 | MS
     1 0.000000
                  Source
192.168.1.102
                                          Destination
128.119.245.12
     2 0.023172
                    128,119,245,12
                                          192.168.1.102
                                                                              62 80+1161 [SYN, ACK] Seq=0 Ack=1 Win=584
                                                                  TCP
                                                                              54 1161→80 [ACK] Seq=1 Ack=1 Win=17520 Le
                                          128.119.245.12
     3 0.023265
                    192.168.1.102
                                                                 TCP
     4 0.026477
                    192, 168, 1, 102
                                          128.119.245.12
                                                                             619 [TCP segment of a reassembled PDU]
                                                                 TCP
                                                                            1514 [TCP segment of a reassembled PDU]
     5 0.041737
                    192.168.1.102
                                          128.119.245.12
                                                                  TCP
     6 0.053937
                    128, 119, 245, 12
                                          192.168.1.102
                                                                 TCP
                                                                             60 80→1161 [ACK] Seq=1 Ack=566 Win=6780 L
     7 0.054026
                    192.168.1.102
                                          128.119.245.12
                                                                 TCP
                                                                            1514 [TCP segment of a reassembled PDU]
     8 0.054690
                    192, 168, 1, 102
                                          128.119.245.12
                                                                 TCP
                                                                            1514 [TCP segment of a reassembled PDU]
     9 0.077294
                    128.119.245.12
                                          192.168.1.102
                                                                  TCP
                                                                              60 80→1161 [ACK] Seq=1 Ack=2026 Win=8760
    10 0.077405
                    192.168.1.102
                                          128.119.245.12
                                                                 TCP
                                                                            1514 [TCP segment of a reassembled PDU]
    11 0.078157
                   192.168.1.102
                                          128.119.245.12
                                                                 TCP
                                                                           1514 [TCP segment of a reassembled PDU]
    12 0.124085
                    128, 119, 245, 12
                                          192.168.1.102
                                                                 TCP
                                                                              60 80→1161 [ACK] Seq=1 Ack=3486 Win=11680
    13 0.124185
                   192.168.1.102
                                          128.119.245.12
                                                                  TCP
                                                                            1201 [TCP segment of a reassembled PDU]
    14 0.169118
                    128.119.245.12
                                          192.168.1.102
                                                                  TCP
                                                                              60 80-1161 [ACK] Seq=1 Ack=4946 win=14600
    15 0.217299
                    128.119.245.12
                                          192.168.1.102
                                                                  TCP
                                                                              60 80-1161 [ACK] Seq=1 Ack=6406 Win=17520
    16 0.267802
                    128.119.245.12
                                          192.168.1.102
                                                                              60 80+1161 [ACK] Seq=1 Ack=7866 win=20440
                                                                  TCP
    17 0.304807
                    128.119.245.12
                                          192.168.1.102
                                                                              60 80-1161 [ACK] Seq=1 Ack=9013 Win=23360
⊕ Frame 1: 62 bytes on wire (496 bits), 62 bytes captured (496 bits)

⊕ Ethernet II, Src: Actionte_8a:70:1a (00:20:e0:8a:70:1a), Dst: LinksysG_da:af:73 (00:06:25:da:af:73)

■ Internet Protocol Version 4, Src: 192.168.1.102 (192.168.1.102), Dst: 128.119.245.12 (128.119.245.12)

☐ Transmission Control Protocol, Src Port: 1161 (1161), Dst Port: 80 (80), Seq: 0, Len: 0.

   Source Port: 1161 (1161)
    Destination Port: 80 (80)
    [Stream index: 0]
    [TCP Segment Len: 0]
    Sequence number: 0
                           (relative sequence number)
    Acknowledgment number: 0
    Header Length: 28 bytes
 ± .... 0000 0000 0010 = Flags: 0x002 (SYN)
    Window size value: 16384
    [Calculated window size: 16384]

    ⊕ Checksum: 0xf6e9 [validation disabled]

    Urgent pointer: 0
  ⊕ Options: (8 bytes), Maximum segment size, No-Operation (NOP), No-Operation (NOP), SACK permitted
```

The IP address of gaia.cs.umass.edu is 128.119.245.12 and the TCP port number is 80.

	1 0,000000	192.168.1.102	128.119.245.12	TCP	62 1161-80 [SYN] Seq=0 Win=16384 Len=0 MS					
	2 0.023172	128.119.245.12	192.168.1.102	TCP	62 80-1161 [SYN, ACK] Seg=0 Ack=1 Win=584					
	3 0.023265	192.168.1.102	128.119.245.12	TCP	54 1161→80 [ACK] Seg=1 Ack=1 Win=17520 Le					
	4 0.026477	192.168.1.102	128.119.245.12	TCP	619 [TCP segment of a reassembled PDU]					
	5 0.041737	192.168.1.102	128.119.245.12	TCP	1514 [TCP segment of a reassembled PDU]					
	6 0.053937	128.119.245.12	192.168.1.102	TCP	60 80→1161 [ACK] Seq=1 Ack=566 Win=6780 L					
	7 0.054026	192.168.1.102	128.119.245.12	TCP	1514 [TCP segment of a reassembled PDU]					
	8 0.054690	192.168.1.102	128.119.245.12	TCP	1514 [TCP segment of a reassembled PDU]					
	9 0.077294	128.119.245.12	192.168.1.102	TCP	60 80→1161 [ACK] Seq=1 Ack=2026 Win=8760					
	10 0.077405	192.168.1.102	128.119.245.12	TCP	1514 [TCP segment of a reassembled PDU]					
	11 0.078157	192.168.1.102	128.119.245.12	TCP	1514 [TCP segment of a reassembled PDU]					
	12 0.124085	128.119.245.12	192.168.1.102	TCP	60 80→1161 [ACK] Seq=1 Ack=3486 Win=11680					
	13 0.124185	192.168.1.102	128.119.245.12	TCP	1201 [TCP segment of a reassembled PDU]					
	14 0.169118	128.119.245.12	192.168.1.102	TCP	60 80→1161 [ACK] Seq=1 Ack=4946 Win=14600					
	15 0.217299	128.119.245.12	192.168.1.102	TCP	60 80→1161 [ACK] Seq=1 Ack=6406 Win=17520					
	16 0.267802	128.119.245.12	192.168.1.102	TCP	60 80→1161 [ACK] Seq=1 Ack=7866 Win=20440					
	17 0.304807	128.119.245.12	192.168.1.102	TCP	60 80→1161 [ACK] Seq=1 Ack=9013 Win=23360					
41	10 0 305040	100 100 1 100	100 110 045 10	TCD	1514 Fron					
					<u>"</u>					
			s), 62 bytes captured (							
					onte_8a:70:1a (00:20:e0:8a:70:1a)					
					Dst: 192.168.1.102 (192.168.1.102)					
			Port: 80 (80), DST Por	t: 1161 (1	161), Seq: 0, Ack: 1, Len: 0					
1	Source Port:									
		ort: 1161 (1161)								
	[Stream index									
	[TCP Segment									
	Sequence numb Acknowledgmen		sequence number) ative ack number)							
			ative ack number)							
1	Header Length: 28 bytes									
"	⊞ 0000 0001 0010 = Flags: 0x012 (SYN, ACK)									
1	Window size value: 5840									
1	[calculated window size: 5840] ⊕ Checksum: 0x774d [validation disabled]									
"		•	abied]							
1	Urgent pointe		ont size No Operation	(NOB) No	Operation (NOP), SACK permitted					
	SEQ/ACK anal		enc 31ze, No-operación	(NOP), NO-	operation (NOP), SACK permitted					
"	LDEQ/ACK dildi	ysisj								

Protocol Length Info

Destination

### Question 3

The IP address of the source computer is 129.97.48.70 and the TCP port number is 53901.

```
Length Info
143 M-SEARCH * HTTP/1.1
                                                                    Protocol
     Destination 239, 255, 255, 250
     50 3.218992000 129.97.73.90
                                                                                143 M-SEARCH * HTTP/1.1
                                             239, 255, 255, 250
                                                                    SSDP
     52 3.576726000 129.97.48.70
                                             128.119.245.12
                                                                    TCP
                                                                                 54 53901-80 [FIN, ACK] Seq=1 Ack=1 Win=256 Len=0
                                                                                              [SYN] Seq=0 Win=8192 Len=0 MSS=1460 WS
                                             128.119.245.12
                                                                    TCF
     54 3.606319000 128.119.245.12
                                             129.97.48.70
                                                                    TCP
                                                                                 60 80+53901 [ACK] Seq=1 Ack=2 Win=237 Len=0
     55 3.612968000 128.119.245.12
                                             129.97.48.70
                                                                    TCP
                                                                                 66 80-53902 [SYN, ACK] Seq=0 Ack=1 Win=29200 Len=0
     56 3.613023000 129.97.48.70
                                             128.119.245.12
                                                                    TCP
                                                                                 54 53902-80 [ACK] Seq=1 Ack=1 Win=65536 Len=0
     57 3.613395000 129.97.48.70
                                            129.97.50.141
129.97.48.70
                                                                    SMB2
                                                                                322 Create Request File: alice.txt
                                                                                60 445-51500 [ACK] Seq=1 Ack=269 Win=2048 Len=0 322 Create Response File: alice.txt
     58 3.613652000 129.97.50.141
                                                                    TCP
     59 3.653330000 129.97.50.141
                                             129.97.48.70
                                                                    SMB2
     60 3.653825000 129.97.48.70
                                             128.119.245.12
                                                                    TCP
                                                                                703 [TCP segment of a reassembled PDU]
     61 3.654007000 129.97.48.70
                                             129.97.50.141
                                                                     SMB2
                                                                                171 Read Request Len:16384 Off:O File: alice.txt
     62 3.654288000 129.97.50.141
                                             129.97.48.70
                                                                    TCP
                                                                                 60 445→51500 [ACK] Seq=269 Ack=386 Win=2051 Len=0
     63 3.654288000 129.97.50.141
                                             129, 97, 48, 70
                                                                    TCP
                                                                               1514 [TCP segment of a reassembled PDU]
     64 3.654289000 129.97.50.141
                                             129, 97, 48, 70
                                                                               1514 [TCP segment of a reassembled PDU]
                                                                    TCP
     65 3.654290000 129.97.50.141
                                             129.97.48.70
                                                                               1514 [TCP segment of a reassembled PDU]
                                                                    TCP
     66 3.654290000 129.97.50.141
                                             129.97.48.70
                                                                    ТСР
                                                                               1514 [TCP segment of a reassembled PDU]
⊞ Frame 52: 54 bytes on wire (432 bits), 54 bytes captured (432 bits) on interface 0
⊕ Ethernet II, Src: Asustekc_b4:82:5b (e0:3f:49:b4:82:5b), Dst: Hewlett-_86:29:00 (00:17:a4:86:29:00)
⊕ Internet Protocol Version 4, Src: 129.97.48.70 (129.97.48.70), Dst: 128.119.245.12 (128.119.245.12)
  Transmission Control Protocol, Src Port: 53901 (53901), Dst Port: 80 (80), Seq: 1, Ack: 1, Len: 0
   Source Port: 53901 (53901)
    Destination Port: 80 (80)
     [Stream index: 0]
     [TCP Seament Len: 0]
    Sequence number: 1
                            (relative sequence number)
    Acknowledgment number: 1
                                   (relative ack number)
    Header Length: 20 bytes
  Window size value: 256
     [Calculated window size: 256]
  [window size scaling factor: -1 (unknown)]

⊕ Checksum: 0x2746 [validation disabled]
    Urgent pointer: 0
```

### 3. TCP Basics

### Question 4

The sequence number of the TCP SYN segment is 0. In the "Info" field, the packet is identified as [SYN] from the source, the server then acknowledges the packet with [SYN, ACK].

```
Destination 128.119.245.12

        Protocol
        Length
        Info

        TCP
        62
        1161-80
        [SYN]
        Seq=0
        Win=16384
        Len=0
        MSS=1460
        SACK_PERM=1

                       Source
192.168.1.102
       2 0.023172
                       128.119.245.12
                                                  192.168.1.102
                                                                                            62 80→1161 [SYN, ACK] Seq=0 Ack=1 Win=5840 Len=0 MSS=1460
                                                                             TCP
                                                                                          54 1161-80 [ACK] Seq=1 Ack=1 Win=17520 Len=0
619 1161-80 [PSH, ACK] Seq=1 Ack=1 Win=17520 Len=565
       3 0.023265
                       192.168.1.102
                                                  128, 119, 245, 12
                                                                             TCP
      4 0.026477
                       192, 168, 1, 102
                                                  128, 119, 245, 12
                                                                             TCP
       5 0.041737
                       192.168.1.102
                                                                                         1514 1161-80 [PSH, ACK] Seq=566 Ack=1 Win=17520 Len=1460
                                                  128.119.245.12
                                                                             TCP
      6 0.053937
                       128.119.245.12
                                                  192.168.1.102
                                                                             TCP
                                                                                            60 80-1161 [ACK] Seq=1 Ack=566 Win=6780 Len=0
                                                                                         1514 1161-80 [ACK] Seq=2026 Ack=1 Win=17520 Len=1460
                                                  128, 119, 245, 12
       7 0.054026
                       192.168.1.102
                                                                             TCP
Frame 1: 62 bytes on wire (496 bits), 62 bytes captured (496 bits)
⊕ Ethernet II, Src: Actionte_8a:70:1a (00:20:e0:8a:70:1a), Dst: Linksysg_da:af:73 (00:06:25:da:af:73)
⊕ Internet Protocol Version 4, Src: 192.168.1.102 (192.168.1.102), Dst: 128.119.245.12 (128.119.245.12)
☐ Transmission Control Protocol, Src Port: 1161 (1161), Dst Port: 80 (80), Seq: 0, Len: 0
    Source Port: 1161 (1161)
Destination Port: 80 (80)
     [Stream index: 0]
     [TCP Seament Len: 0]
                               (relative sequence number)
   Sequence number: 0
    Acknowledgment number: 0
Header Length: 28 bytes
  000. .... = Reserved: Not set ...0 .... = Nonce: Not set
       .... 0... = Congestion Window Reduced (CWR): Not set
       .... .0. .... = ECN-Echo: Not set
.... .0. ... = Urgent: Not set
       .... ...0 .... = Acknowledgment: Not set
      [Severity level: Chat]
[Group: Sequence]
.....0 = Fin: Not set
    Window size value: 16384
[Calculated window size: 16384]

    ⊕ Checksum: 0xf6e9 [validation disabled]

    Urgent pointer: 0
  ⊕ Options: (8 bytes), Maximum segment size, No-Operation (NOP), No-Operation (NOP), SACK permitted
```

### Question 5

The sequence number of the SYNACK segment is 0. The ACK number is 1. This number was set to 1 to indicate the receipt of the SYN flag in the first packet. In the "Info" field, the packet is identified with [SYN, ACK].

```
| Protocol | Length | Info
| TCP | 62 1161-80 | [SYN] | Seq=0 | Win=16384 | Len=0 | MSS=1460 | SACK_PERM
       Time
1 0.000000
                                                     Destination 128.119.245.12
                        Source 192.168.1.102
                                                                                                 62 80-1161 [SYN, ACK] Seq=0 Ack=1 Win=5840 Len=0 MSS=1460
      2 0.023172
                         128.119.245.12
                                                     192.168.1.102
                                                                                  TCP
       4 0.026477
                         192.168.1.102
                                                     128.119.245.12
                                                                                  TCP
                                                                                                619 1161-80 [PSH, ACK] Seq=1 Ack=1 Win=17520 Len=565
       5 0.041737
                                                     128.119.245.12
                                                                                               1514 1161-80 [PSH, ACK] Seg=566 Ack=1 Win=17520 Len=1460
                         192.168.1.102
                                                                                  TCP
       6 0.053937
                         128, 119, 245, 12
                                                     192.168.1.102
                                                                                  TCP
                                                                                                 60 80→1161 [ACK] Seq=1 Ack=566 Win=6780 Len=0
       7 0 054026
                         192.168.1.102
                                                      128, 119, 245, 12
                                                                                  TCP
                                                                                               1514 1161-80 [ACK] Seq=2026 Ack=1 Win=17520 Len=1460
⊞ Frame 2: 62 bytes on wire (496 bits), 62 bytes captured (496 bits)
⊕ Ethernet II, Src: LinksysG_da:af:73 (00:06:25:da:af:73), Dst: Actionte_8a:70:1a (00:20:e0:8a:70:1a)
⊕ Internet Protocol Version 4, Src: 128.119.245.12 (128.119.245.12), Dst: 192.168.1.102 (192.168.1.102)
□ Transmission Control Protocol, Src Port: 80 (80), Dst Port: 1161 (1161), Seq: 0, Ack: 1, Len: 0
     Source Port: 80 (80)
     Destination Port: 1161 (1161)
     [Stream index: 0]
      [TCP Seament Len: 0]
   Sequence number: 0 (relative sequence number)
Acknowledgment number: 1 (relative ack number)
     Header Length: 28 bytes
  ... 0000 0001 0010 = Flags: 0x012 (SYN, ACK)
000. ... = Reserved: Not set
...0 ... = Nonce: Not set
       \dots 0... = Congestion Window Reduced (CWR): Not set
       .... 0.... = ECN-Echo: Not set
       .... ..0. .... = Urgent: Not set
       .... = Acknowledgment: Set
       .... 0... = Push: Not set
        .... .... .0.. = Reset: Not set
              .... ..1. = Syn: Set
       ☐ [Expert Info (Chat/Sequence): Connection establish acknowledge (SYN+ACK): server port 80] [Connection establish acknowledge (SYN+ACK): server port 80]
             [Severity level: Chat]
     [Group: Sequence]
.... ... 0 = Fin: Not set
Window size value: 5840
     [Calculated window size: 5840]

    ⊕ Checksum: 0x774d [validation disabled]

     Urgent pointer: 0
  ⊕ Options: (8 bytes), Maximum segment size, No-Operation (NOP), No-Operation (NOP), SACK permitted ⊕ [SEQ/ACK analysis]
```

The sequence number of TCP segment containing the HTTP POST command is 1.

```
|Protocol | Length | Info
TCP | 62 1161+80 [SYN] Seq=0 Win=16384 Len=0 MSS=1460 SACK
                                             Destination 128.119.245.12
       Time
1 0.000000
                     Source
192.168.1.102
      2 0.023172
                     128.119.245.12
                                             192.168.1.102
                                                                                   62 80-1161 [SYN, ACK] Seq=0 Ack=1 Win=5840 Len=0 MSS
                                                                      TCP
                                              128.119.245.12
                                                                                   54 1161-80 [ACK] Seq=1 Ack=1 Win=17520 Len=0
                     192.168.1.102
                                                                      TCP
                     192.168.1.102
                                             128.119.245.12
                                                                      TCP
                                                                                  619 1161→80 [PSH, ACK] Seq=1 Ack=1 Win=17520 Len=565
      4 0.026477
      5 0.041737
                     192.168.1.102
                                              128.119.245.12
                                                                      TCP
                                                                                 1514 1161-80 [PSH, ACK] Seq=566 Ack=1 win=17520 Len=14
                                                                                   60 80-1161 [ACK] Seq=1 Ack=566 Win=6780 Len=0
                     128, 119, 245, 12
      6 0.053937
                                             192.168.1.102
                                                                      TCP
      7 0.054026
                                             128.119.245.12
                                                                                1514 1161-80 [ACK] Seq=2026 Ack=1 Win=17520 Len=1460
                     192,168,1,102
                                                                      TCP
⊞ Frame 4: 619 bytes on wire (4952 bits), 619 bytes captured (4952 bits)
⊞ Ethernet II, Src: Actionte_8a:70:1a (00:20:e0:8a:70:1a), Dst: LinksysG_da:af:73 (00:06:25:da:af:73)
# Internet Protocol Version 4, Src: 192.168.1.102 (192.168.1.102), Dst: 128.119.245.12 (128.119.245.12)
☐ Transmission Control Protocol, Src Port: 1161 (1161), Dst Port: 80 (80), Seq: 1, Ack: 1, Len: 565
    Source Port: 1161 (1161)
    Destination Port: 80 (80)
    [Stream index: 0]
     [TCP Segment Len: 565]
  Sequence number: 1 (relative sequence number)
     [Next sequence number: 566
                                     (relative sequence number)]
    Acknowledgment number: 1
Header Length: 20 bytes
                                   (relative ack number)
  ± .... 0000 0001 1000 = Flags: 0x018 (PSH, ACK)
    Window size value: 17520
     [Calculated window size: 17520]
  [Window size scaling factor: -2 (no window scaling used)]

⊕ Checksum: Ox1fbd [validation disabled]
    Urgent pointer: 0
  □ Data (565 bytes)
    Data: 504f5354202f657468657265616c2d6c6162732f6c616233...
```

No. Time	Source	Destination	Protocol	Length Info				
1 0.0000		128.119.245.12	TCP			=0 Win=16384 Len=		
2 0.0231		192.168.1.102	TCP			] Seq=0 Ack=1 Win		=0 MSS=1460 S
3 0.0232		128.119.245.12	TCP			=1 Ack=1 Win=1752		
4 0.0264 5 0.0417		128.119.245.12	TCP			Seq=1 Ack=1 Win		
6 0.0539		128.119.245.12 192.168.1.102	TCP TCP			] Seq=566 Ack=1 W =1 Ack=566 Win=678		Len=1400
7 0.0540		128.119.245.12	TCP			=1 ACK=300 WTN=070 =2026 ACK=1 Win=1		1460
8 0.0546		128.119.245.12	TCP			=3486 Ack=1 Win=1		
9 0.0772		192.168.1.102	TCP			=1 Ack=2026 Win=8		
10 0.0774	105 192.168.1.102	128.119.245.12	TCP	1514 1161-	80 [ACK] Seq	=4946 Ack=1 Win=1	7520 Len=	1460
11 0.0781		128.119.245.12	TCP			=6406 Ack=1 Win=1		
12 0.1240		192.168.1.102	TCP			=1 Ack=3486 Win=1:		
13 0.1241		128.119.245.12	TCP			] Seq=7866 Ack=1 \		
14 0.1691 15 0.2172		192.168.1.102 192.168.1.102	TCP TCP			=1 Ack=4946 Win=14 =1 Ack=6406 Win=1		
16 0.2678		192.168.1.102	TCP			=1 Ack=0400 Win=1 =1 Ack=7866 Win=2		
							0440 ECII-	0
Packet	Sent Time	Received	RTT (se	econas)	Equatio	n		
		Time						
	0.026477	0.053937		0.02746	B2-A2			
	0.041737	0.077294	0.02	8472125	0.875*0	C2+0.125*(B	3-	
					A3)			
	0.054026	0.124085	0.03	3670484	0.875*0	C3+0.125*(B	4-	
					A4)			
	0.05469	0.169118	0.04	3765174	0.875*0	C4+0.125*(B	5-	
					A5)			
	0.077405	0.217299	0.05	5781277	0.875*0	C5+0.125*(B	6-	
					A6)			
	0.078157	0.267802	0.07	2514242	0.875*0	C6+0.125*(B	7-	
					A7)			

## Question 8

No.	Time	Source	Destination	Protocol	Lenath Info
140.	1 0.000000	192.168.1.102	128,119,245,12	TCP	62 1161-80 [SYN] Seq=0 Win=16384 Len=0 MSS=1460 SACK_PERM=1
	2 0.023172	128.119.245.12	192.168.1.102	TCP	62 80-1161 [SYN, ACK] Seq=0 Ack=1 Win=5840 Len=0 MSS=1460 S/
	3 0.023265	192.168.1.102	128.119.245.12	TCP	54 1161-80 [ACK] Seg=1 Ack=1 Win=17520 Len=0
	4 0.026477	192.168.1.102	128.119.245.12	TCP	619 1161→80 [PSH, ACK] Seq=1 Ack=1 Win=17520 Len=565
	5 0.041737	192.168.1.102	128.119.245.12	TCP	1514 1161-80 [PSH, ACK] Seq=566 Ack=1 Win=17520 Len=1460
	6 0.053937	128.119.245.12	192.168.1.102	TCP	60 80→1161 [ACK] Seq=1 Ack=566 Win=6780 Len=0
	7 0.054026	192.168.1.102	128.119.245.12	TCP	1514 1161→80 [ACK] Seq=2026 Ack=1 Win=17520 Len=1460
	8 0.054690	192.168.1.102	128.119.245.12	TCP	1514 1161→80 [ACK] Seq=3486 Ack=1 Win=17520 Len=1460
	9 0.077294	128.119.245.12	192.168.1.102	TCP	60 80→1161 [ACK] Seq=1 Ack=2026 Win=8760 Len=0
	10 0.077405	192.168.1.102	128.119.245.12	TCP	1514 1161→80 [ACK] Seq=4946 Ack=1 Win=17520 Len=1460
	11 0.078157	192.168.1.102	128.119.245.12	TCP	1514 1161→80 [ACK] Seq=6406 Ack=1 Win=17520 Len=1460
	12 0.124085	128.119.245.12	192.168.1.102	TCP	60 80→1161 [ACK] Seq=1 Ack=3486 Win=11680 Len=0
	13 0.124185	192.168.1.102	128.119.245.12	TCP	1201 1161→80 [PSH, ACK] Seq=7866 Ack=1 Win=17520 Len=1147
	14 0.169118	128.119.245.12	192.168.1.102	TCP	60 80→1161 [ACK] Seq=1 Ack=4946 Win=14600 Len=0
	15 0.217299	128.119.245.12	192.168.1.102	TCP	60 80→1161 [ACK] Seq=1 Ack=6406 Win=17520 Len=0
	16 0.267802	128.119.245.12	192.168.1.102	TCP	60 80-1161 [ACK] 5eq=1 Ack=7866 Win=20440 Len=0

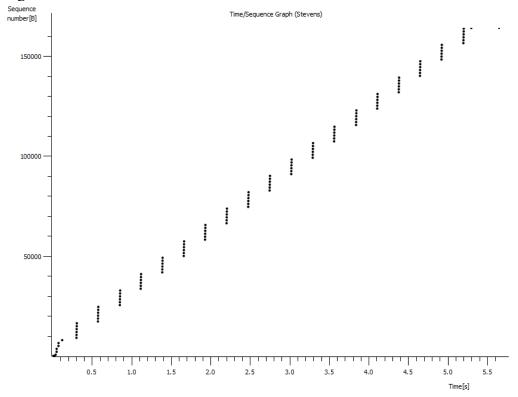
Packet	Length (Bytes)
	565
	1460
	1460
	1460
	1460
	1460

The minimum amount of available buffer space advertised at the received for the entire trace is 5840 bytes. The receiver buffer space continues to grow and never throttle the sender.

Vo.	Time	Source	Destination	Protocol	Length  Info	
	1 0.000000	192.168.1.102	128.119.245.12	TCP	62 1161→80 [5\	N] Seq=0 Win=16384 <u>Len=0 MSS=</u> 1460 SACK_PERM=1
	2 0.023172	128.119.245.12	192.168.1.102	TCP	62 80+1161 [51	N, ACK] Seq=0 Ack=1 Win=5840 Len=0 MSS=1460 SACK_PERM=1
	3 0.023265	192.168.1.102	128.119.245.12	TCP	54 1161→80 [AC	[K] Seq=1 Ack=1 Win= <mark>17520 Len=</mark> 0
	4 0.026477	192.168.1.102	128.119.245.12	TCP	619 1161→80 [PS	SH, ACK] Seq=1 Ack=1 Win=17520 Len=565
	5 0.041737	192.168.1.102	128.119.245.12	TCP	1514 1161→80 [PS	SH, ACK] Seq=566 Ack=1 Win=17520 Len=1460
	6 0.053937	128.119.245.12	192.168.1.102	TCP	60 80+1161 [AC	[K] Seq=1 Ack=566 Win=6780 Len=0
	7 0.054026	192.168.1.102	128.119.245.12	TCP		[K] Seq=2026 Ack=1 Win=17520 Len=1460
	8 0.054690	192.168.1.102	128.119.245.12	TCP	1514 1161→80 [AC	[K] Seq=3486 Ack=1 Win=17520 Len=1460
	9 0.077294	128.119.245.12	192.168.1.102	TCP	60 80+1161 [AC	[K] Seq=1 Ack=2026 Win=8760 Len=0
	10 0.077405	192.168.1.102	128.119.245.12	TCP	1514 1161→80 [AC	[K] Seq=4946 Ack=1 Win=17520 Len=1460
	11 0.078157	192.168.1.102	128.119.245.12	TCP	1514 1161→80 [AC	[K] Seq=6406 Ack=1 Win=17520 Len=1460
	12 0.124085	128.119.245.12	192.168.1.102	TCP	60 80+1161 [AC	[K] Seq=1 Ack=3486 Win=11680 Len=0
	13 0.124185	192.168.1.102	128.119.245.12	TCP	1201 1161→80 [PS	SH, ACK] Seq=7866 Ack=1 Win=17520 Len=1147
	14 0.169118	128.119.245.12	192.168.1.102	TCP	60 80+1161 [AC	[K] Seq=1 Ack=4946 Win=14600 Len=0
	15 0.217299	128.119.245.12	192.168.1.102	TCP	60 80+1161 [AC	[K] Seq=1 Ack=6406 Win=17520 Len=0
	16 0.267802	128.119.245.12	192.168.1.102	TCP	60 80→1161 [AC	[K] Seq=1 Ack=7866 Win=20440 Len=0
	17 0.304807	128.119.245.12	192.168.1.102	TCP	60 80+1161 [AC	[K] Seq=1 Ack=9013 Win=23360 Len=0
	10 0 705040	107 160 1 107	170 110 745 17	TCD		127 Can 0017 Acts 1 Win 17570 I an 1460
			), 62 bytes captured (4			
			(00:06:25:da:af:73), D			
			28.119.245.12 (128.119.			
			Port: 80 (80), Dst Port	: 1161 (:	l161), Seq: 0, Ack:	1, Len: 0
	Source Port: 8					
		ort: 1161 (1161)				
	[Stream index:					
	[TCP Segment L					
	Sequence number		equence number)			
	Acknowledgment		tive ack number)			
	Header Length:					
		l_0010 = Flags: 0x01	2 (SYN, ACK)			
	Window size va					
		indow size: 5840]				
		74d [validation disal	bled]			
	Urgent pointer					
			nt size, No-Operation (	NOP), NO	-Operation (NOP), SA	CK permitted
+	[SEQ/ACK analy	/sis]				

## Question 10

The sequence numbers are increasing for time 0 to End of transmission, this means that no segments were retransmitted.



No. Time	Source	Destination	Protocol	Length Info		
1 0.000000	192.168.1.102	128.119.245.12	TCP		[SYN]	Seq=0 Win=16384 Len=0 MSS=1460 SACK_PERM=1
2 0.023172	128.119.245.12	192.168.1.102	TCP			ACK] Seq=0 Ack=1 Win=5840 Len=0 MSS=1460 S/
3 0.023265	192.168.1.102	128.119.245.12	TCP			Seq=1_Ack=1 Win=17520 Len=0
4 0.026477	192.168.1.102	128.119.245.12	TCP			ACK] Seq=1 Ack=1 Win=17520 Len=565
5 0.041737	192.168.1.102	128.119.245.12	TCP			ACK] Seq=566 Ack=1 Win=17520 Len=1460
6 0.053937	128.119.245.12	192.168.1.102	TCP			Seq=1 Ack=566 Win=6780 Len=0
7 0.054026	192.168.1.102	128.119.245.12	TCP			Seq=2026 Ack=1 Win=17520 Len=1460
8 0.054690	192.168.1.102	128.119.245.12	TCP			Seq=3486 Ack=1 Win=17520 Len=1460
9 0.077294	128.119.245.12	192.168.1.102	TCP			Seq=1 Ack=2026 Win=8760 Len=0
11 0.078157	192.168.1.102 192.168.1.102	128.119.245.12 128.119.245.12	TCP TCP			Seq=4946 Ack=1 Win=17520 Len=1460 Seq=6406 Ack=1 Win=17520 Len=1460
12 0.124085	128.119.245.12	192.168.1.102	TCP			Seq=1 Ack=3486 Win=11680 Len=0
13 0.124185	192.168.1.102	128.119.245.12	TCP			ACK] Seg=7866 Ack=1 Win=17520 Len=1147
14 0.169118	128.119.245.12	192.168.1.102	TCP			Seg=1 Ack=4946 Win=14600 Len=0
15 0.217299	128, 119, 245, 12	192.168.1.102	TCP			Seg=1 Ack=6406 Win=17520 Len=0
16 0.267802	128.119.245.12	192.168.1.102	TCP			Seg=1 Ack=7866 Win=20440 Len=0
ACK	ACK data	ACK				
ACK	ACK data	ACK sequence				
ACK	ACK data 565					
ACK		sequence				
ACK	565	sequence 556				
ACK	565 1460	<b>sequence</b> 556 2026				
ACK	565 1460 1460	556 2026 3486				

No. 14, 15 and 16 shown above are examples where the receiver is accepting every other receipt segment.

## Question 12

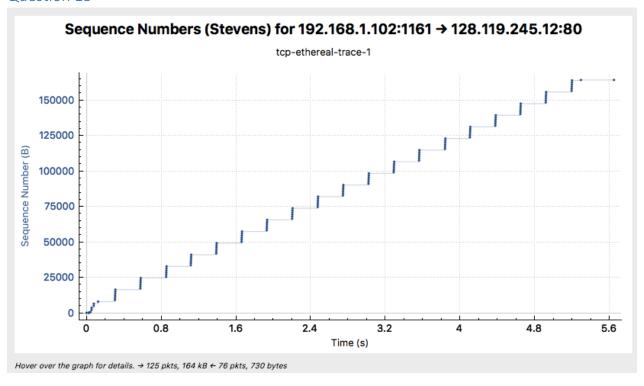
Start Time (seconds): 0.026477 End Time (seconds): 5.461175

Total Data (bytes): 164091 - 1 = 164090Throughput:  $164090/5.434698 = \sim 30.2$ Kb/sec

	- I-	le .	le u u	In a s	the state of	le e
No.	Time	Source	Destination	Protocol		Info
	1 0.000000	192.168.1.102	128.119.245.12	TCP		52 1161-80 [SYN] Seq=0 win=16384 Len=0 MSS=1460 SACK_PERM=1
	2 0.023172	128.119.245.12	192.168.1.102	TCP	62	52 80-1161 [SYN, ACK] Seq=0 Ack=1 Win=5840 Len=0 MSS=1460 SACK_PERM=1
	3 0.023265	192.168.1.102	128.119.245.12	TCP	54	54 1161→80 [ACK] Seq=1 Ack=1 Win=17520 Len=0
	4 0.026477	192.168.1.102	128.119.245.12	TCP	619	L9 1161→80 [PSH, ACK] Seq=1 Ack=1 Win=17520 Len=565
	5 0.041737	192.168.1.102	128.119.245.12	TCP	1514	L4 1161→80 [PSH, ACK] Seq=566 Ack=1 Win=17520 Len=1460
No.	Time	Source	Destination		Protocol	Length Info
	407 5 202024	102 150 1 102	420 440 245 42			
	197 5.202024	192.168.1.102	128.119.245.12		TCP	326 1161→80 [PSH, ACK] Seq=163769 Ack=1 Win=17520 Len=272
	198 5.297257	128.119.245.12	192.168.1.102		TCP	60 80-1161 [ACK] Seq=1 Ack=159389 Win=62780 Len=0
	199 5.297341	192.168.1.102	128.119.245.12		TCP	104 1161-80 [PSH, ACK] Seq=164041 Ack=1 Win=17520 Len=50
	200 5.389471	128.119.245.12	192.168.1.102		TCP	60 80-1161 [ACK] Seq=1 Ack=162309 Win=62780 Len=0
	201 5.447887	128.119.245.12	192.168.1.102		TCP	60 80-1161 [ACK] Seq=1 Ack=164041 Win=62780 Len=0
	202 5.455830	128.119.245.12	192.168.1.102		TCP	60 80-1161 [ACK] Seq=1 Ack=164091 win=62780 Len=0
	203 5.461175	128.119.245.12	192.168.1.102		TCP	784 80→1161 [PSH, ACK] Seq=1 Ack=164091 win=62780 Len=730

# 4. TCP congestion control in action

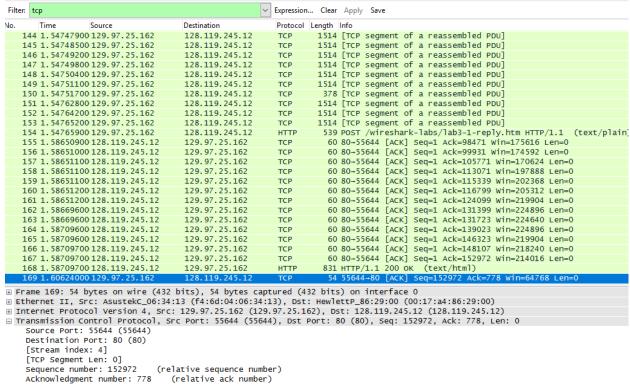
## Question 13



The TCP's slow start phase begins at time 0 until time 0.2 seconds. After the slow start phase, congestion avoidance takes over. The idealized behavior of TCP studied in the text is for the transmission to grow but instead the packets are sent in batches of 6.

## Question 14

Filter:	tcp	\	Expression	Clear	Apply Save
۱o.	Time Source	Destination	Protocol	Length	Info
	13 1.38594600 129.97.25.162	128.119.245.12	TCP	54	55635→80 [FIN, ACK] Seq=1 Ack=1 Win=256 Len=0
	14 1.38600900 129.97.25.162	128.119.245.12	TCP	54	55632→80 [FIN, ACK] Seq=1 Ack=1 Win=256 Len=0
	15 1.38604800 129.97.25.162	128.119.245.12	TCP	54	55634-80 [FIN, ACK] Seq=1 Ack=1 Win=256 Len=0
	16 1.38608900 129.97.25.162	128.119.245.12	TCP		55633-80 [FIN, ACK] Seq=1 Ack=1 Win=256 Len=0
	17 1.38714500 129.97.25.162	128.119.245.12	TCP	66	55644→80 [SYN] Seq=0 Win=8192 Len=0 MSS=1460 WS=256 SACK_PERM=1
	19 1.41968600 128.119.245.12	129.97.25.162	TCP		80-55635 [FIN, ACK] Seq=1 Ack=2 Win=229 Len=0
	20 1.41968700 128.119.245.12	129.97.25.162	TCP	60	80→55633 [ACK] Seq=1 Ack=2 Win=237 Len=0
	21 1.41976700 129.97.25.162	128.119.245.12	TCP		55635-80 [ACK] Seq=2 Ack=2 Win=256 Len=0
	22 1.42528500 128.119.245.12	129.97.25.162	TCP		80→55632 [FIN, ACK] Seq=1 Ack=2 Win=229 Len=0
	23 1.42528600 128.119.245.12	129.97.25.162	TCP		80-55634 [FIN, ACK] Seq=1 Ack=2 Win=229 Len=0
	24 1.42533700 129.97.25.162	128.119.245.12	TCP		55632-80 [ACK] Seq=2 Ack=2 Win=256 Len=0
	25 1.42537500 129.97.25.162	128.119.245.12	TCP		55634→80 [ACK] Seq=2 Ack=2 Win=256 Len=0
	26 1.42708400 128.119.245.12	129.97.25.162	TCP		80-55644 [SYN, ACK] Seq=0 Ack=1 Win=29200 Len=0 MSS=1460 SACK_PERM=1 WS=12
_	27 1.42716300 129.97.25.162	128.119.245.12	TCP		55644→80 [ACK] Seq=1 Ack=1 Win=65536 Len=0
	28 1.42756100 129.97.25.162	128.119.245.12	TCP		[TCP segment of a reassembled PDU]
	29 1.42768100 129.97.25.162	128.119.245.12	TCP	1514	[TCP segment of a reassembled PDU]
	30 1.42769000 129.97.25.162	128.119.245.12	TCP		[TCP segment of a reassembled PDU]
	31 1.42769500 129.97.25.162	128.119.245.12	TCP		[TCP segment of a reassembled PDU]
	32 1.42770000 129.97.25.162	128.119.245.12	TCP	1514	[TCP segment of a reassembled PDU]
	33 1.42770600 129.97.25.162	128.119.245.12	TCP		[TCP segment of a reassembled PDU]
	34 1.42771200 129.97.25.162	128.119.245.12	TCP	1514	[TCP segment of a reassembled PDU]
	35 1.42771800 129.97.25.162	128.119.245.12	TCP	1514	[TCP segment of a reassembled PDU]
	36 1.42772400 129.97.25.162	128.119.245.12	TCP		[TCP segment of a reassembled PDU]
	37 1.42773000 129.97.25.162	128.119.245.12	TCP		[TCP segment of a reassembled PDU]
	38 1.46709700 128.119.245.12	129.97.25.162	TCP	60	80-55644 [ACK] Seq=1 Ack=651 Win=30592 Len=0

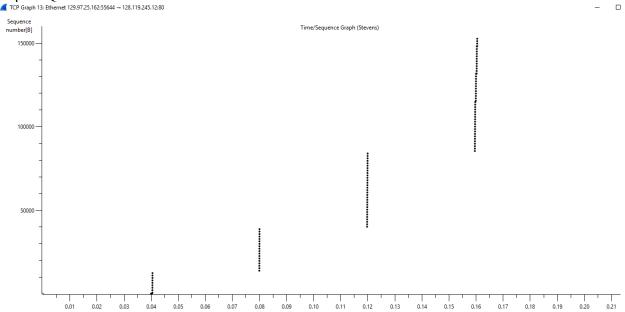


Repeat Question 12:

Start Time (seconds): 1.427 End Time (seconds): 1.606

Total Data (bytes): 152972 - 1 = 152971Throughput: 152971/0.179 = ~855Kb/sec

### Repeat Question 13:



The TCP's slow start phase begins at time 0.04 seconds. After the slow start, TCP's linear speed growth takes over. The idealized behavior of TCP studied in the text is seen as the packets are doubling each time.