Assignment 2

1. To calculate the min distribution for the client server, the formula Dcs = max {NF/us, F/dmin} is used where F = 15 \* 1024 = 15360 Mbits, us = 30 Mbps and dmin = 2 Mbps.

Client Server

|  |  |  |  |
| --- | --- | --- | --- |
|  | 10 | 100 | 1000 |
| 300 Kbps | 7680 | 51200 | 512000 |
| 700 Kbps | 7680 | 51200 | 512000 |
| 2 Mbps | 7680 | 51200 | 512000 |

To calculate the min distribution for P2P, the formula DP2P = max{F/us, F/dmin, NF/(us +)}.

P2P

|  |  |  |  |
| --- | --- | --- | --- |
|  | 10 | 100 | 1000 |
| 300 Kbps | 7680 | 25904 | 47559 |
| 700 Kbps | 7680 | 15616 | 21525 |
| 2 Mbps | 7680 | 7680 | 7680 |

1. A sender can send a maximum of 256 packets.

Number of bits = 256\*128\*8 = 262144 bits

Data rate = 262144 bits / 30 s = 8738 bits/s

Therefore the maximum data rate per connection is **8738 bits/s**.

1. TCPthroughput  <= TCPwindow / RTT

TCPthroughput  <= 32 Kbyte / 100 ms = 0.32 Kbytes/ms = 320 Kbytes/s

Therefore, the maximum throughput that can be achieved by TCP in this scenario is **320 Kbytes/s.**

1. TCPwindow => bandwidth\*RTT

TCPwindow => 100 Mbps \* 1 ms = 12500 bytes

Therefore, the minimum TCP window size is **12500 bytes.**

1. Number of packets = 1 Mbps / 1460 bytes = 718.2 packets (1 mbps = 104876 bitps)

To achieve 1 Mbps, 718.2 packets will have to be sent per second, but since the TCP acknowledges every other segment, then 359.1 packets will be sent per second.

Assuming that an acknowledgment has size 40 bytes (20 bytes for TCP header and 20 byters for IP header) then:

Bandwidth = 40 bytes \* 391.1 packets = 14364 bytes/s = 114.91 kbps

Therefore the uplink bandwidth to achieve the data throughput of 1 Mbps will be **114.91 kbps.**

**Note:** All calculations assuming that 1024 bits in 1 byte, 1024 bytes in 1 mb, etc.