

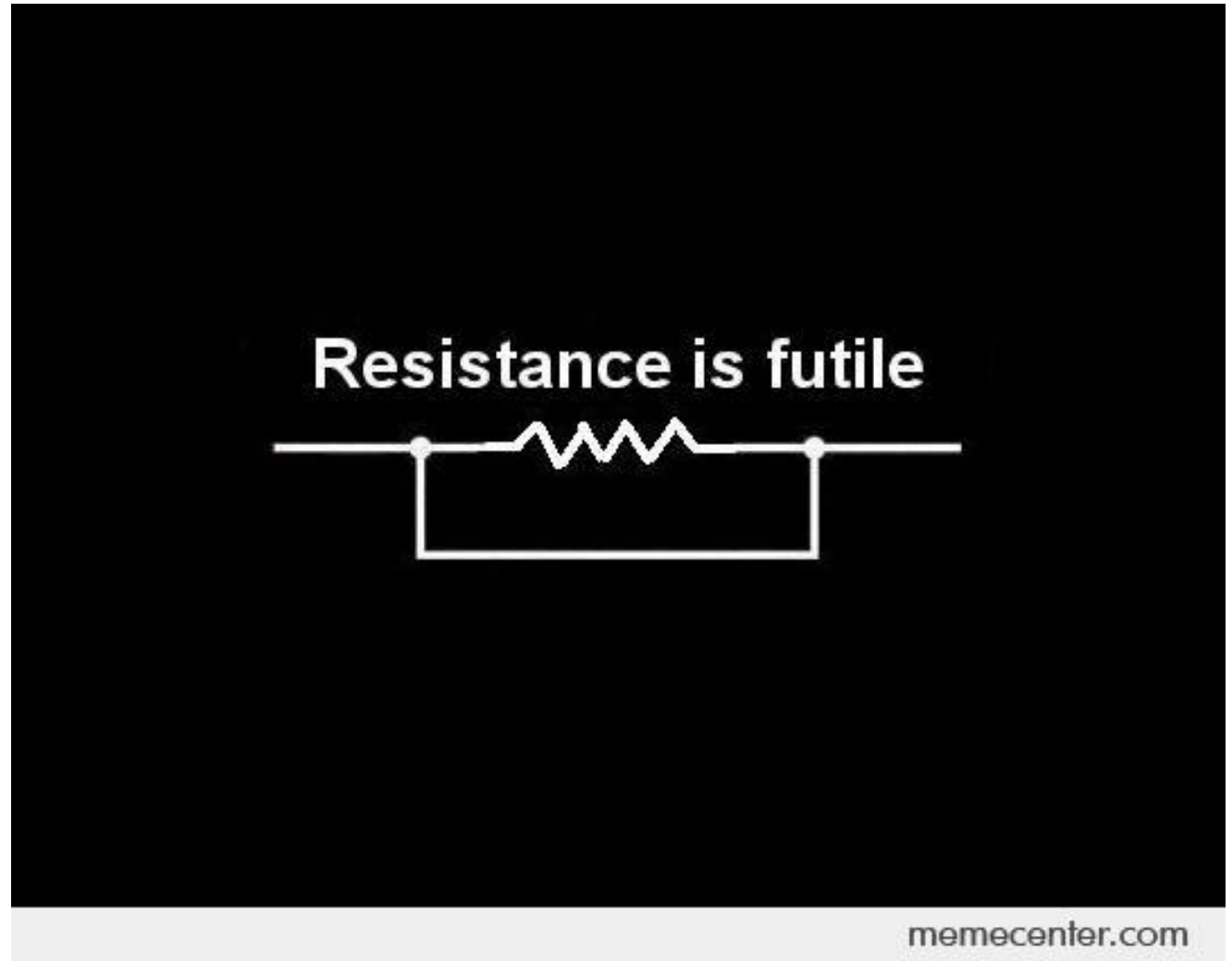
Effects of Rate-Limiting on Wi-Fi Flow

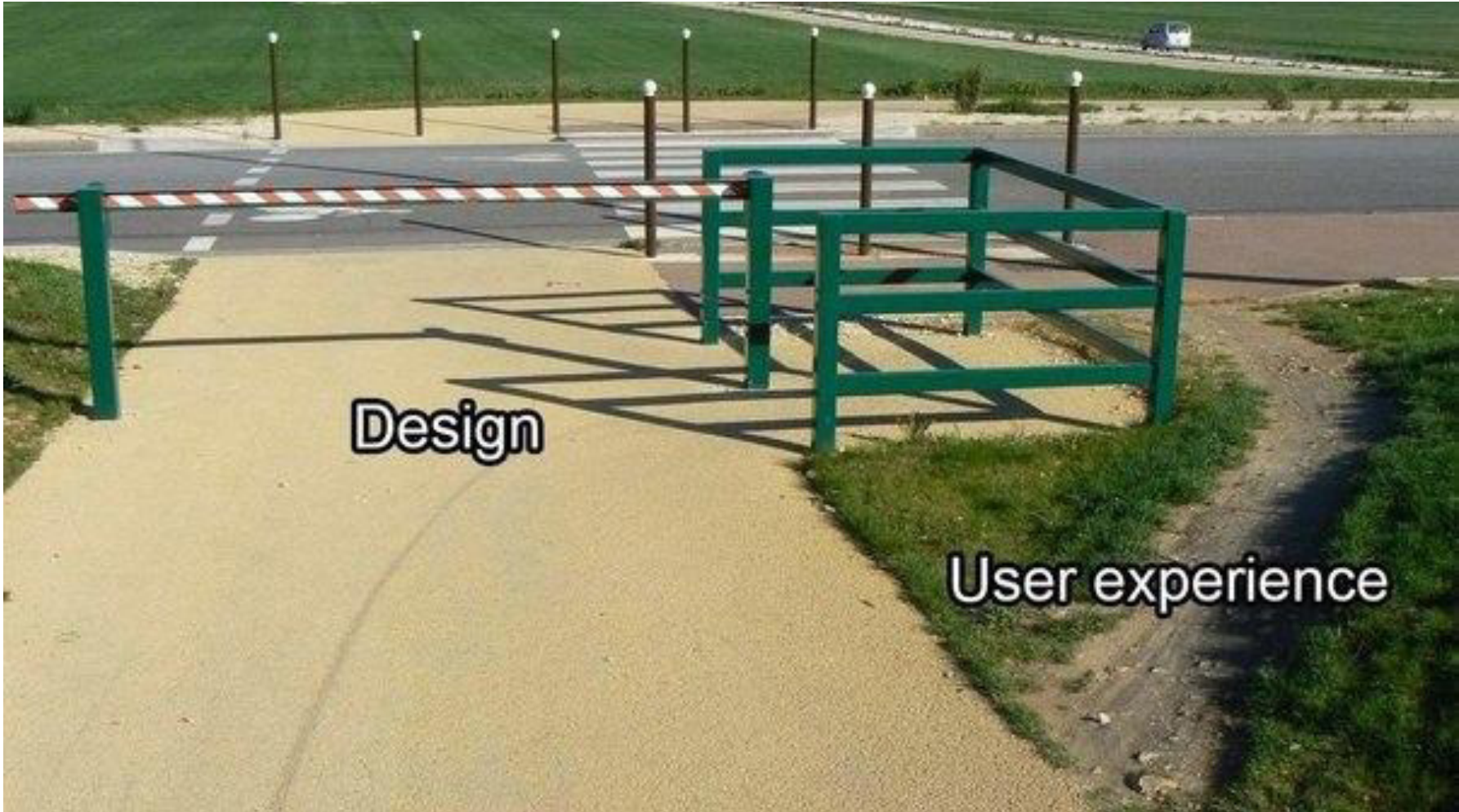
@troymart

#WLPC

#WiFiwithPurpose

When you place an **obstacle** in front of STAs, you are challenging them to find **another** way to access resources...



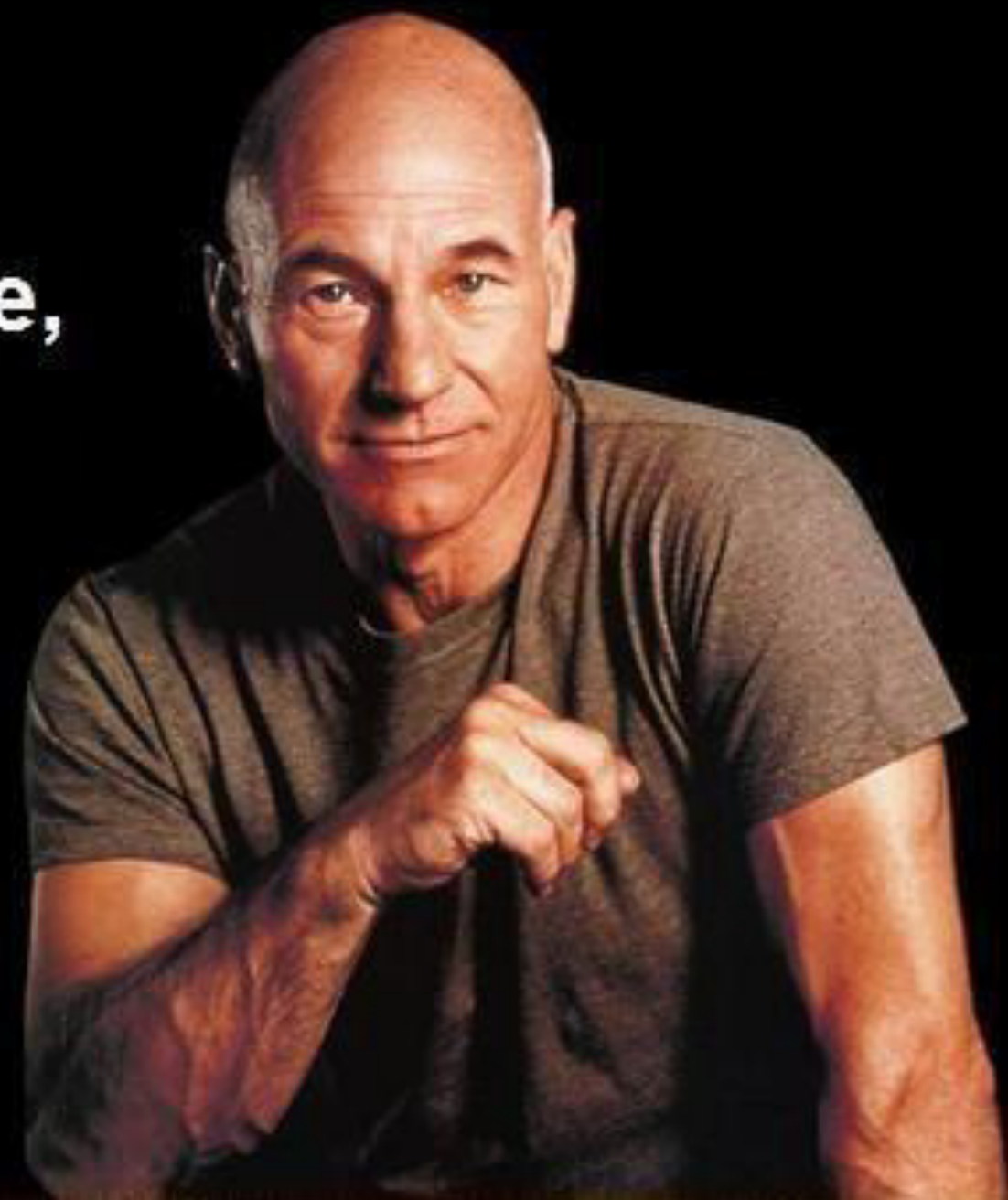


Design

User experience

**"Use the force,
Harry"**

- Gandalf



Microscopic view
of live packets on
your network...



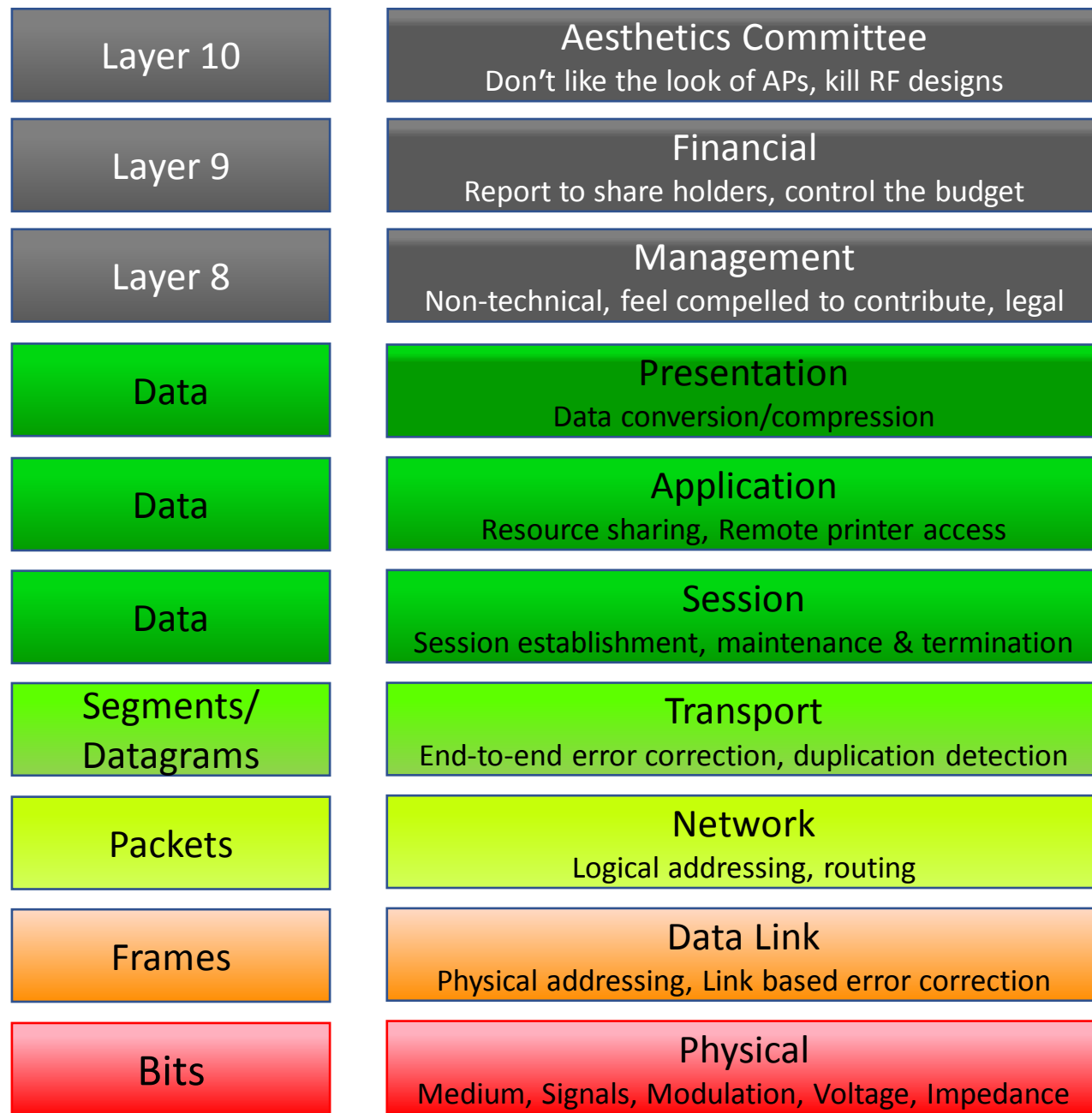


Why this talk??

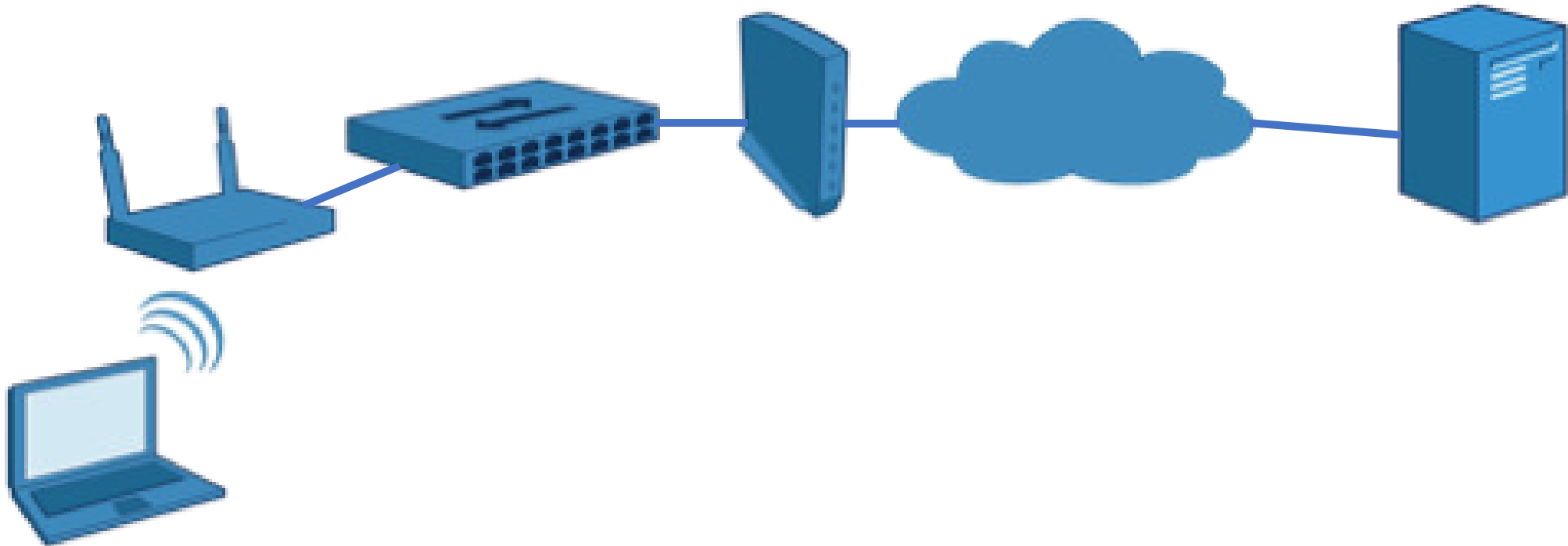
- Undersized Internet pipes
- Bandwidth hungry users
- Bandwidth hungry applications
- New applications are introduced

- Some admins want to rate limit users and applications

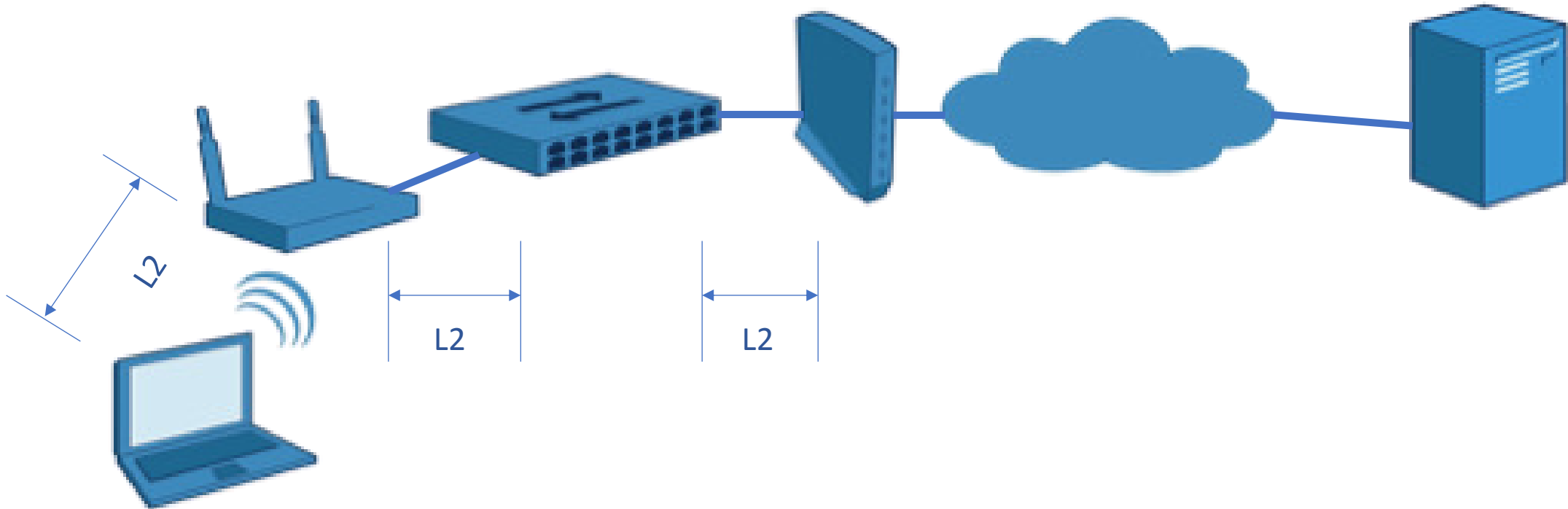
10 Layer OSI Model



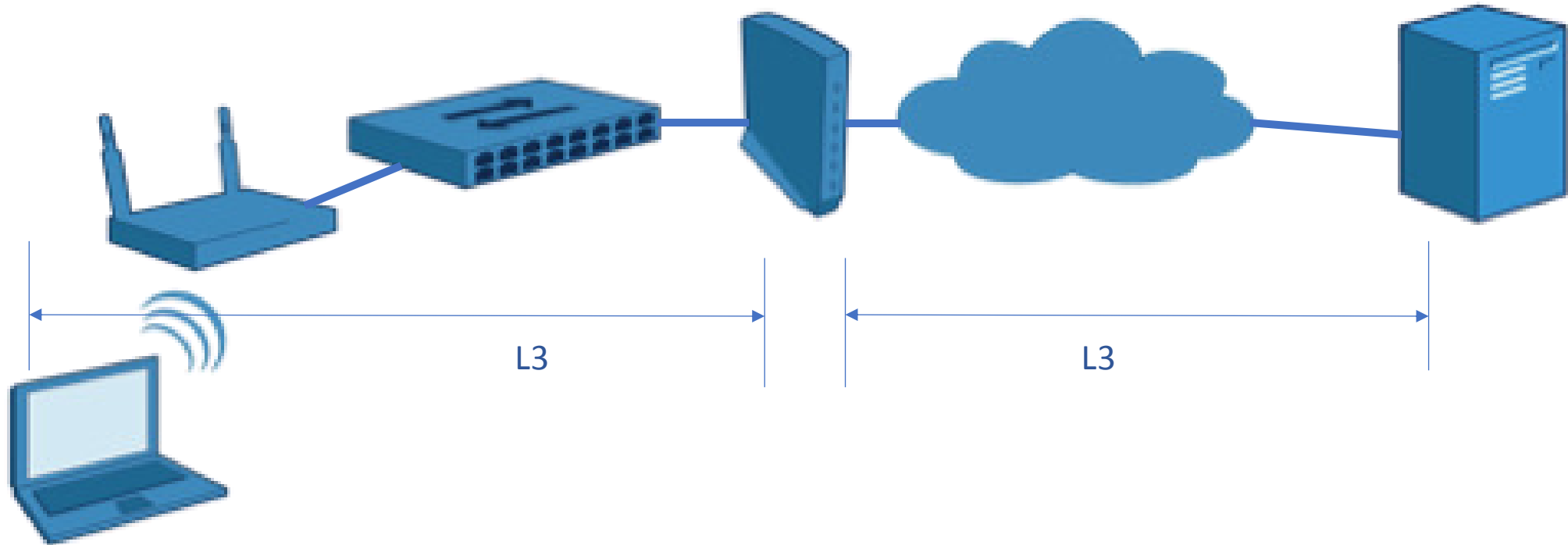
Network Topology



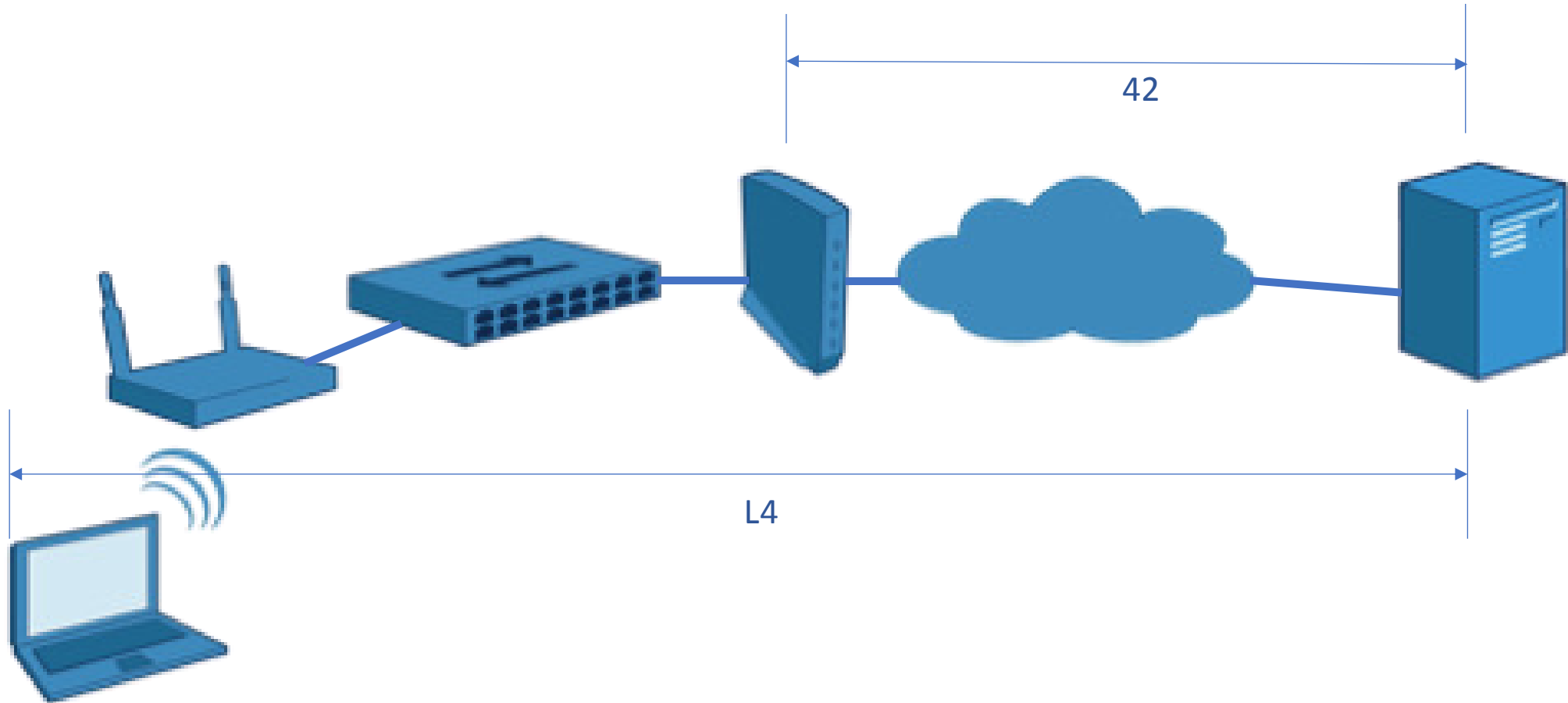
Network Topology – Layer 2 (Data Link)



Network Topology – Layer 3 (Network)



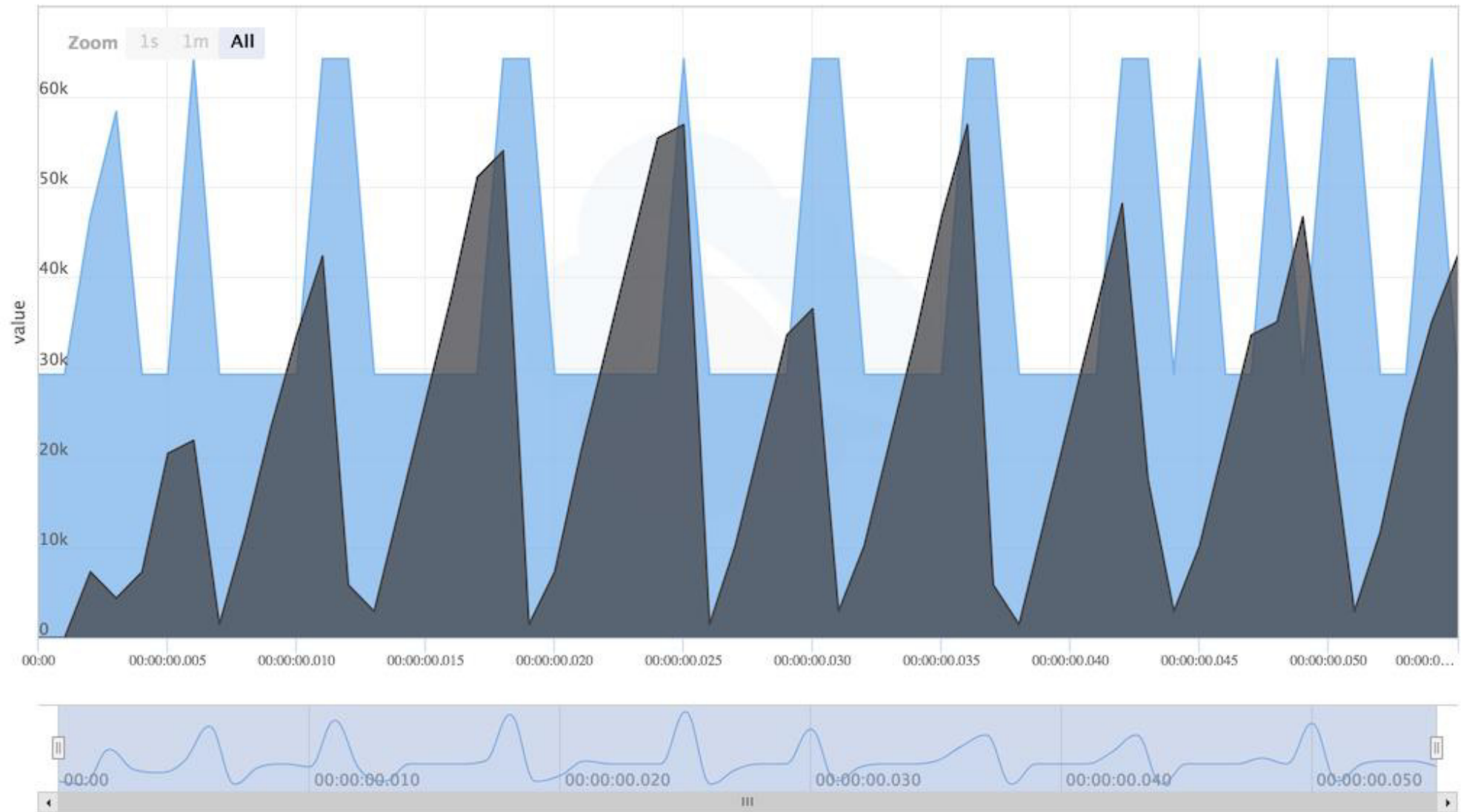
Network Topology – Layer 4 (Transport)



TCP Bytes in Flight vs Window Size 1ms

value at an interval of 1 millisecond

● Max Window Size ● Max Bytes in Flight

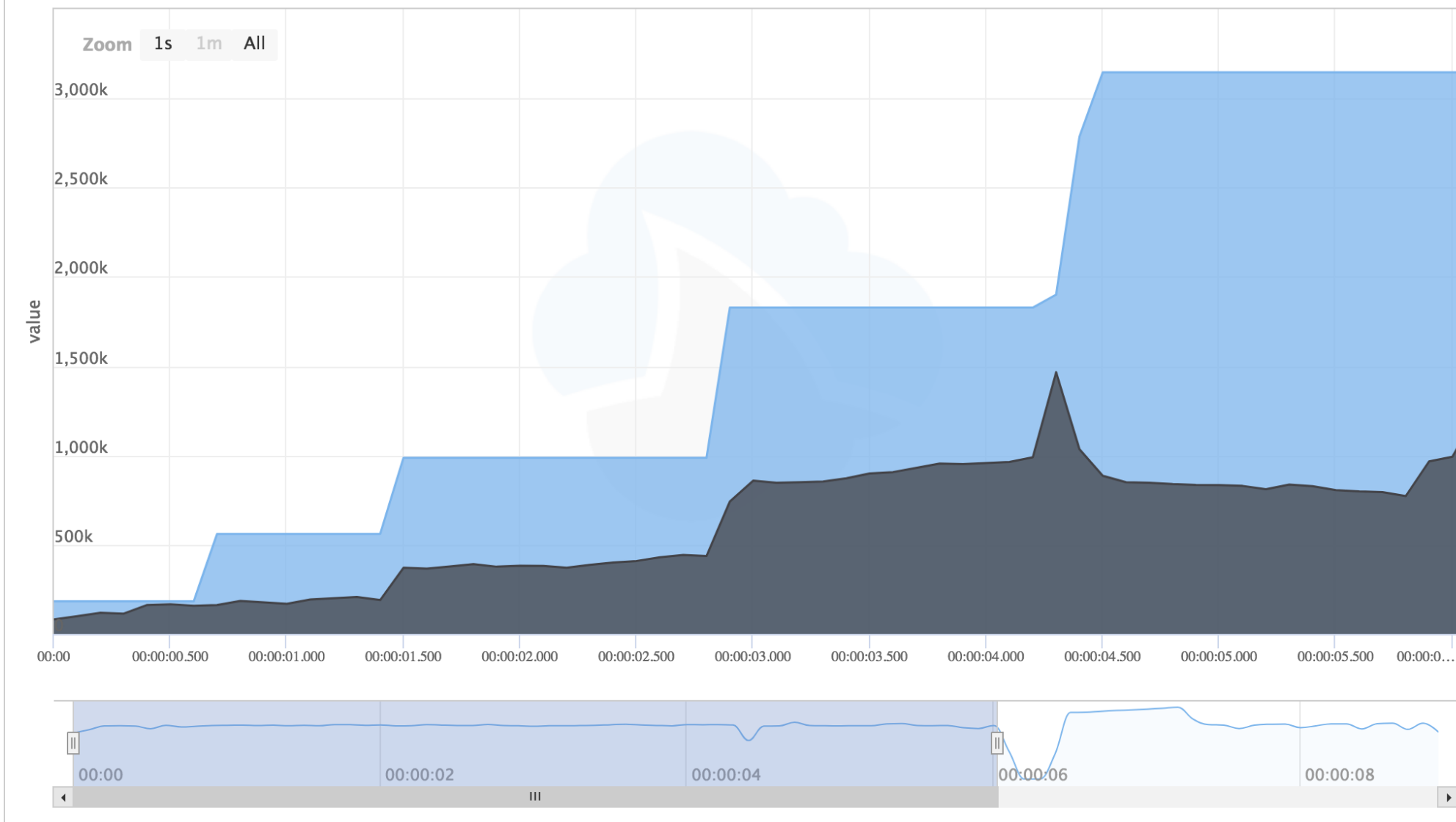


Reference: <https://enterprise.cloudshark.org/blog/tcp-window-scaling-examples/>

TCP Bytes in Flight vs Window Size

value at an interval of 100 milliseconds

● Max Window Size ● Max Bytes in Flight



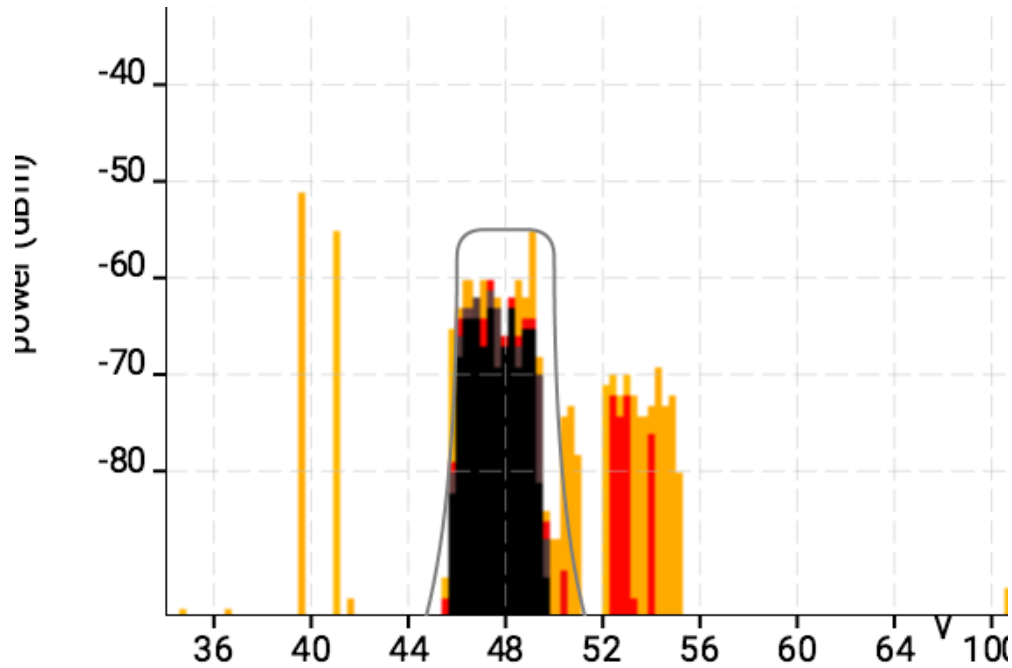
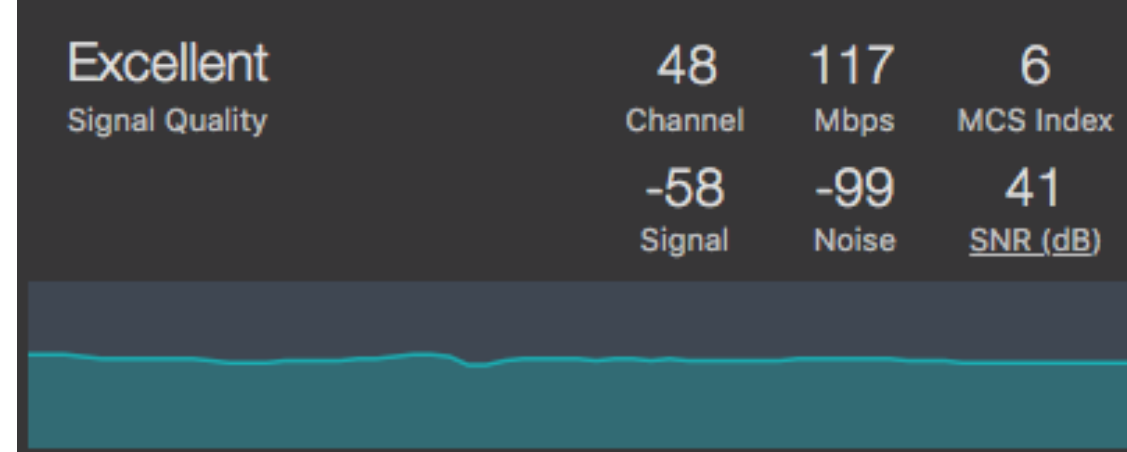
Reference: <https://enterprise.cloudshark.org/blog/tcp-window-scaling-examples/>

Throughput test Results

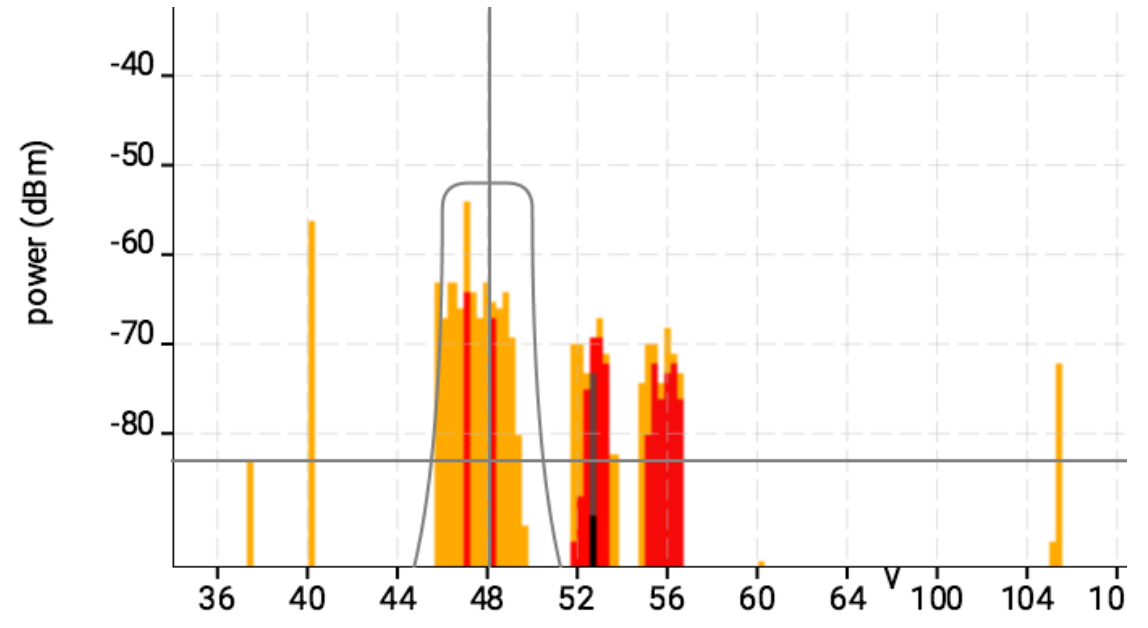
Rate Limit Applied (Mbps)	Transport	Throughput (Mbps)	Data Rate (Mbps)	Time to Transfer
unlimited	TCP	70	117	10s
5	TCP	4.7	117	5min
1	TCP	0.9	117	20min

Wi-Fi data rates remain high – regardless of the TCP rate limiting applied!

Duty Cycle



Unlimited



1 Mbps

Some configuration starting points

- Never tweak .11n/ac/ax MCS rates...unless you enjoy pain
- Leave high data rates on , unless your environment sucks and you don't want to waste time and rate shift down..think high reliability
- Leave lower data rates turned on...42

(wlan.fc.type == 0)&&(wlan.fc.type_subtype == 0x0a)

No.	Time	Protocol	Length	Duration	Info
3951	39.2489...	802.11	55	44	Disassociate, SN=1792, FN=0, Flags=.....C
6872	52.9413...	802.11	55	44	Disassociate, SN=2070, FN=0, Flags=.....C

[Start: 579517008μs]

[End: 579517072μs]

▼ IEEE 802.11 Disassociate, Flags:C

Type/Subtype: Disassociate (0x000a)

▼ Frame Control Field: 0xa000

.... ..00 = Version: 0

.... 00.. = Type: Management frame (0)

1010 = Subtype: 10

► Flags: 0x00

.000 0000 0010 1100 = Duration: 44 microseconds