

Arthur de Sá Braz de Matos

a) Transferência Confiável

tcp.flags.ack == 1 and ip.dst == 192.168.0.3						
No.	Time	Source	Destination	Protocol	Length	Info
158	10.580651	34.233.10.80	192.168.0.3	TLSv1.2	117	Application Data, Application Data
164	11.351488	20.42.65.85	192.168.0.3	TCP	60	443 → 53286 [SYN, ACK] Seq=0 Ack=1 Win=65535 Len=0 MSS=1440 WS=256 SACK_PERM
167	11.481554	20.42.65.85	192.168.0.3	TLSv1.3	153	Hello Retry Request, Change Cipher Spec
169	11.622017	20.42.65.85	192.168.0.3	TLSv1.3	1514	Server Hello
170	11.622017	20.42.65.85	192.168.0.3	TCP	1514	443 → 53286 [ACK] Seq=1560 Ack=955 Win=4193536 Len=1460 [TCP PDU reassembled in 172]
171	11.622017	20.42.65.85	192.168.0.3	TCP	1514	443 → 53286 [ACK] Seq=3020 Ack=955 Win=4193536 Len=1460 [TCP PDU reassembled in 172]
172	11.622017	20.42.65.85	192.168.0.3	TLSv1.3	209	Application Data
176	11.752387	20.42.65.85	192.168.0.3	TCP	60	443 → 53286 [ACK] Seq=4635 Ack=5275 Win=4194560 Len=0
177	11.752387	20.42.65.85	192.168.0.3	TCP	60	443 → 53286 [ACK] Seq=4635 Ack=8155 Win=4194560 Len=0
178	11.752387	20.42.65.85	192.168.0.3	TCP	60	443 → 53286 [ACK] Seq=4635 Ack=9595 Win=4193024 Len=0
179	11.752387	20.42.65.85	192.168.0.3	TCP	60	443 → 53286 [ACK] Seq=4635 Ack=12475 Win=4194560 Len=0
180	11.752387	20.42.65.85	192.168.0.3	TCP	60	443 → 53286 [ACK] Seq=4635 Ack=15180 Win=4194560 Len=0
181	11.752387	20.42.65.85	192.168.0.3	TLSv1.3	157	Application Data
182	11.761569	20.42.65.85	192.168.0.3	TLSv1.3	519	Application Data
186	11.891831	20.42.65.85	192.168.0.3	TCP	60	443 → 53286 [ACK] Seq=5204 Ack=15205 Win=4194304 Len=0
197	14.344614	34.233.10.80	192.168.0.3	TCP	66	443 → 53288 [SYN, ACK] Seq=0 Ack=1 Win=26883 Len=0 MSS=1460 SACK_PERM WS=256
200	14.485172	34.233.10.80	192.168.0.3	TCP	60	443 → 53288 [ACK] Seq=1 Ack=1461 Win=45056 Len=0
201	14.485172	34.233.10.80	192.168.0.3	TCP	60	443 → 53288 [ACK] Seq=1 Ack=2016 Win=47872 Len=0
202	14.485172	34.233.10.80	192.168.0.3	TLSv1.3	288	Server Hello, Change Cipher Spec, Application Data, Application Data
206	14.625070	34.233.10.80	192.168.0.3	TCP	60	443 → 53288 [ACK] Seq=235 Ack=2080 Win=47872 Len=0
207	14.625070	34.233.10.80	192.168.0.3	TLSv1.3	233	Application Data
208	14.625070	34.233.10.80	192.168.0.3	TLSv1.3	116	Application Data
209	14.625070	34.233.10.80	192.168.0.3	TLSv1.3	85	Application Data
210	14.625070	34.233.10.80	192.168.0.3	TCP	60	443 → 53288 [ACK] Seq=507 Ack=5092 Win=68608 Len=0
211	14.625070	34.233.10.80	192.168.0.3	TCP	60	443 → 53288 [ACK] Seq=507 Ack=7546 Win=73728 Len=0
214	14.675023	34.233.10.80	192.168.0.3	TCP	1514	443 → 53288 [ACK] Seq=507 Ack=7546 Win=73728 Len=1460 [TCP PDU reassembled in 216]
215	14.675023	34.233.10.80	192.168.0.3	TCP	1514	443 → 53288 [ACK] Seq=1967 Ack=7546 Win=73728 Len=1460 [TCP PDU reassembled in 216]
216	14.675023	34.233.10.80	192.168.0.3	TLSv1.3	1128	Application Data
221	14.805396	34.233.10.80	192.168.0.3	TCP	60	443 → 53288 [ACK] Seq=4501 Ack=7577 Win=73728 Len=0
222	14.845341	20.42.65.85	192.168.0.3	TCP	66	443 → 53289 [SYN, ACK] Seq=0 Ack=1 Win=65535 Len=0 MSS=1440 WS=256 SACK_PERM

b) Início de Conexão

tcp.flags.syn == 1 and ip.dst == 192.168.0.3						
No.	Time	Source	Destination	Protocol	Length	Info
12773	329.923667	20.189.173.12	192.168.0.3	TCP	66	443 → 53323 [SYN, ACK] Seq=0 Ack=1 Win=65535 Len=0 MSS=1440 WS=256 SACK_PERM
12776	329.933043	20.189.173.12	192.168.0.3	TCP	66	443 → 53324 [SYN, ACK] Seq=0 Ack=1 Win=65535 Len=0 MSS=1440 WS=256 SACK_PERM
12889	336.470643	20.189.173.12	192.168.0.3	TCP	66	443 → 53326 [SYN, ACK] Seq=0 Ack=1 Win=65535 Len=0 MSS=1440 WS=256 SACK_PERM
12961	340.076567	20.189.173.12	192.168.0.3	TCP	66	443 → 53328 [SYN, ACK] Seq=0 Ack=1 Win=65535 Len=0 MSS=1440 WS=256 SACK_PERM
13430	405.380434	52.178.17.234	192.168.0.3	TCP	66	443 → 53332 [SYN, ACK] Seq=0 Ack=1 Win=65535 Len=0 MSS=1440 WS=256 SACK_PERM
14062	482.796781	128.116.102.4	192.168.0.3	TCP	66	443 → 53338 [SYN, ACK] Seq=0 Ack=1 Win=62720 Len=0 MSS=1400 SACK_PERM WS=16384
14650	611.718514	34.36.57.103	192.168.0.3	TCP	66	443 → 53340 [SYN, ACK] Seq=0 Ack=1 Win=65535 Len=0 MSS=1412 SACK_PERM WS=256
19199	722.797899	128.116.127.4	192.168.0.3	TCP	66	443 → 53359 [SYN, ACK] Seq=0 Ack=1 Win=62720 Len=0 MSS=1324 SACK_PERM WS=16384
20940	1011.615488	51.105.71.136	192.168.0.3	TCP	66	443 → 53414 [SYN, ACK] Seq=0 Ack=1 Win=65535 Len=0 MSS=1440 WS=256 SACK_PERM
21094	1060.861765	181.213.132.2	192.168.0.3	TCP	62	53 → 53421 [SYN, ACK] Seq=0 Ack=1 Win=2105 Len=0 MSS=1460 SACK_PERM
21465	1145.128060	13.89.179.14	192.168.0.3	TCP	66	443 → 53432 [SYN, ACK] Seq=0 Ack=1 Win=65535 Len=0 MSS=1440 WS=256 SACK_PERM
22230	1267.641381	13.89.179.14	192.168.0.3	TCP	66	443 → 53455 [SYN, ACK] Seq=0 Ack=1 Win=65535 Len=0 MSS=1440 WS=256 SACK_PERM
22765	1392.087135	20.189.173.1	192.168.0.3	TCP	66	443 → 53473 [SYN, ACK] Seq=0 Ack=1 Win=65535 Len=0 MSS=1440 WS=256 SACK_PERM
23419	1488.223328	13.89.179.14	192.168.0.3	TCP	66	443 → 53497 [SYN, ACK] Seq=0 Ack=1 Win=65535 Len=0 MSS=1440 WS=256 SACK_PERM
24223	1643.631401	52.183.220.149	192.168.0.3	TCP	66	443 → 53522 [SYN, ACK] Seq=0 Ack=1 Win=65535 Len=0 MSS=1440 WS=256 SACK_PERM
24868	1743.101934	181.213.132.2	192.168.0.3	TCP	62	53 → 53539 [SYN, ACK] Seq=0 Ack=1 Win=2105 Len=0 MSS=1460 SACK_PERM
24994	1759.868918	13.107.5.93	192.168.0.3	TCP	66	443 → 53543 [SYN, ACK] Seq=0 Ack=1 Win=65535 Len=0 MSS=1440 WS=256 SACK_PERM
25102	1760.938135	13.107.5.93	192.168.0.3	TCP	66	443 → 53545 [SYN, ACK] Seq=0 Ack=1 Win=65535 Len=0 MSS=1440 WS=256 SACK_PERM
25121	1761.280351	13.107.5.93	192.168.0.3	TCP	66	443 → 53546 [SYN, ACK] Seq=0 Ack=1 Win=65535 Len=0 MSS=1440 WS=256 SACK_PERM
25134	1761.370422	13.107.5.93	192.168.0.3	TCP	66	443 → 53547 [SYN, ACK] Seq=0 Ack=1 Win=65535 Len=0 MSS=1440 WS=256 SACK_PERM
25178	1764.563434	13.107.5.93	192.168.0.3	TCP	66	443 → 53548 [SYN, ACK] Seq=0 Ack=1 Win=65535 Len=0 MSS=1440 WS=256 SACK_PERM
25185	1764.634025	13.107.5.93	192.168.0.3	TCP	66	443 → 53549 [SYN, ACK] Seq=0 Ack=1 Win=65535 Len=0 MSS=1440 WS=256 SACK_PERM
25186	1764.634025	13.107.5.93	192.168.0.3	TCP	66	443 → 53550 [SYN, ACK] Seq=0 Ack=1 Win=65535 Len=0 MSS=1440 WS=256 SACK_PERM
25257	1765.054462	13.107.5.93	192.168.0.3	TCP	66	443 → 53551 [SYN, ACK] Seq=0 Ack=1 Win=65535 Len=0 MSS=1440 WS=256 SACK_PERM
25291	1765.715108	13.107.5.93	192.168.0.3	TCP	66	443 → 53552 [SYN, ACK] Seq=0 Ack=1 Win=65535 Len=0 MSS=1440 WS=256 SACK_PERM
25684	1803.193526	128.116.127.4	192.168.0.3	TCP	66	443 → 53566 [SYN, ACK] Seq=0 Ack=1 Win=62720 Len=0 MSS=1324 SACK_PERM WS=16384
25978	1821.671890	34.36.57.103	192.168.0.3	TCP	66	443 → 53581 [SYN, ACK] Seq=0 Ack=1 Win=65535 Len=0 MSS=1412 SACK_PERM WS=256
26549	1903.404301	100.27.82.244	192.168.0.3	TCP	66	443 → 53595 [SYN, ACK] Seq=0 Ack=1 Win=26883 Len=0 MSS=1460 SACK_PERM WS=256
26723	1904.174608	204.79.197.203	192.168.0.3	TCP	66	443 → 53597 [SYN, ACK] Seq=0 Ack=1 Win=65535 Len=0 MSS=1440 WS=256 SACK_PERM
32480	1906.126357	181.213.132.2	192.168.0.3	TCP	62	53 → 53613 [SYN, ACK] Seq=0 Ack=1 Win=2105 Len=0 MSS=1460 SACK_PERM

c) Término de Conexão

tcp.flags.fin == 1 and ip.dst == 192.168.0.3						
No.	Time	Source	Destination	Protocol	Length	Info
9512	231.953365	34.237.73.95	192.168.0.3	TLSv1.2	102	Application Data, Application Data
10743	246.999272	100.27.82.244	192.168.0.3	TCP	60	443 → 53298 [FIN, ACK] Seq=7727 Ack=13354 Win=108800 Len=0
10764	247.319538	204.79.197.203	192.168.0.3	TCP	60	443 → 53304 [FIN, ACK] Seq=16361 Ack=3577 Win=4194304 Len=0
12835	331.164196	20.189.173.12	192.168.0.3	TLSv1.3	519	Application Data
12909	337.030142	20.189.173.12	192.168.0.3	TLSv1.3	519	Application Data
12985	340.614147	20.189.173.12	192.168.0.3	TLSv1.3	519	Application Data
13268	385.476572	3.212.42.48	192.168.0.3	TCP	60	443 → 53322 [FIN, ACK] Seq=9960 Ack=7485 Win=72448 Len=0
13330	394.478401	104.20.2.154	192.168.0.3	TCP	60	443 → 53276 [FIN, ACK] Seq=40 Ack=2 Win=10 Len=0
13335	394.798644	104.20.2.154	192.168.0.3	TCP	60	443 → 53277 [FIN, ACK] Seq=40 Ack=2 Win=10 Len=0
13855	443.308549	34.36.57.103	192.168.0.3	TCP	60	443 → 53290 [FIN, ACK] Seq=799 Ack=2073 Win=268800 Len=0
13866	443.408707	128.116.127.4	192.168.0.3	TCP	60	443 → 53282 [FIN, ACK] Seq=55875 Ack=6190 Win=65536 Len=0
19851	843.172023	128.116.127.4	192.168.0.3	TLSv1.3	78	Application Data
20964	1032.663328	51.105.71.136	192.168.0.3	TCP	60	443 → 53414 [FIN, ACK] Seq=4721 Ack=3263 Win=4194560 Len=0
22084	1226.820140	34.36.57.103	192.168.0.3	TCP	60	443 → 53340 [FIN, ACK] Seq=928 Ack=2136 Win=267776 Len=0
22171	1255.098474	13.89.179.14	192.168.0.3	TCP	60	443 → 53432 [FIN, ACK] Seq=6487 Ack=497 Win=4194048 Len=0
22697	1365.109488	13.89.179.14	192.168.0.3	TCP	60	443 → 53455 [FIN, ACK] Seq=6487 Ack=529 Win=4194048 Len=0
23442	1488.716062	13.89.179.14	192.168.0.3	TCP	60	443 → 53497 [FIN, ACK] Seq=6487 Ack=529 Win=4194048 Len=0
23471	1502.078480	20.189.173.1	192.168.0.3	TCP	60	443 → 53473 [FIN, ACK] Seq=6953 Ack=1639 Win=4194560 Len=0
24248	1644.409329	52.183.220.149	192.168.0.3	TCP	60	443 → 53522 [FIN, ACK] Seq=4394 Ack=2675 Win=12583680 Len=0
25159	1761.592398	13.107.5.93	192.168.0.3	TCP	60	443 → 53547 [FIN, ACK] Seq=7404 Ack=1158 Win=4193280 Len=0
25173	1764.143077	13.107.5.93	192.168.0.3	TCP	60	443 → 53543 [FIN, ACK] Seq=6892 Ack=1477 Win=4194560 Len=0
25230	1764.814765	13.107.5.93	192.168.0.3	TCP	60	443 → 53548 [FIN, ACK] Seq=6974 Ack=2044 Win=4193792 Len=0
25245	1764.836045	13.107.5.93	192.168.0.3	TCP	60	443 → 53550 [FIN, ACK] Seq=6899 Ack=2107 Win=4193792 Len=0
25274	1765.195172	13.107.5.93	192.168.0.3	TCP	60	443 → 53545 [FIN, ACK] Seq=6892 Ack=1484 Win=4194560 Len=0
25279	1765.275333	13.107.5.93	192.168.0.3	TCP	60	443 → 53551 [FIN, ACK] Seq=6975 Ack=2101 Win=4193792 Len=0
25288	1765.595482	13.107.5.93	192.168.0.3	TCP	60	443 → 53546 [FIN, ACK] Seq=6893 Ack=1477 Win=4194560 Len=0
25355	1769.078097	13.107.5.93	192.168.0.3	TCP	60	443 → 53549 [FIN, ACK] Seq=6894 Ack=1475 Win=4194560 Len=0
25359	1769.959662	13.107.5.93	192.168.0.3	TCP	60	443 → 53552 [FIN, ACK] Seq=6987 Ack=1474 Win=4194560 Len=0
25587	1793.122728	128.116.102.4	192.168.0.3	TCP	60	443 → 53338 [FIN, ACK] Seq=93886 Ack=9305 Win=65536 Len=0
35721	1910.145246	181.213.132.2	192.168.0.3	TCP	60	53 → 53633 [FIN, ACK] Seq=94 Ack=53 Win=37960 Len=0

d) Controle de Fluxo

tcp.window_size < 65535 and ip.dst == 192.168.0.3						
No.	Time	Source	Destination	Protocol	Length	Info
23	2.642429	128.116.127.4	192.168.0.3	TLSv1.2	93	Application Data
24	2.642429	128.116.127.4	192.168.0.3	TLSv1.2	78	Application Data
25	2.642429	128.116.127.4	192.168.0.3	TCP	60	443 → 52344 [FIN, ACK] Seq=64 Ack=1 Win=4 Len=0
26	2.751966	128.116.127.4	192.168.0.3	TCP	66	443 → 53282 [SYN, ACK] Seq=0 Ack=1 Win=62720 Len=0 MSS=1324 SACK_PERM WS=16384
34	2.809857	128.116.127.4	192.168.0.3	TCP	60	[TCP Retransmission] 443 → 53282 [FIN, ACK] Seq=64 Ack=1 Win=4 Len=0
71	3.253406	128.116.127.4	192.168.0.3	TCP	117	[TCP Retransmission] 443 → 52344 [FIN, PSH, ACK] Seq=1 Ack=1 Win=4 Len=63
95	3.783660	20.150.179.231	192.168.0.3	TLSv1.2	85	Encrypted Alert
97	3.913633	128.116.127.4	192.168.0.3	TCP	117	[TCP Retransmission] 443 → 52344 [FIN, PSH, ACK] Seq=1 Ack=1 Win=4 Len=63
158	5.270888	128.116.127.4	192.168.0.3	TCP	117	[TCP Retransmission] 443 → 52344 [FIN, PSH, ACK] Seq=1 Ack=1 Win=4 Len=63
139	5.375317	34.36.57.103	192.168.0.3	TLSv1.2	127	Application Data
150	7.958067	34.237.73.95	192.168.0.3	TCP	60	443 → 53260 [ACK] Seq=1 Ack=241 Win=181 Len=0
151	7.987942	34.237.73.95	192.168.0.3	TLSv1.2	317	Application Data
158	10.500651	34.233.10.80	192.168.0.3	TLSv1.2	117	Application Data, Application Data
197	14.344614	34.233.10.80	192.168.0.3	TCP	66	443 → 53288 [SYN, ACK] Seq=0 Ack=1 Win=26883 Len=0 MSS=1460 SACK_PERM WS=256
200	14.485172	34.233.10.80	192.168.0.3	TCP	60	443 → 53288 [ACK] Seq=1 Ack=1461 Win=45056 Len=0
201	14.485172	34.233.10.80	192.168.0.3	TCP	60	443 → 53288 [ACK] Seq=1 Ack=2016 Win=47872 Len=0
202	14.485172	34.233.10.80	192.168.0.3	TLSv1.3	288	Server Hello, Change Cipher Spec, Application Data, Application Data
206	14.625070	34.233.10.80	192.168.0.3	TCP	60	443 → 53288 [ACK] Seq=235 Ack=2080 Win=47872 Len=0
207	14.625070	34.233.10.80	192.168.0.3	TLSv1.3	233	Application Data
208	14.625070	34.233.10.80	192.168.0.3	TLSv1.3	116	Application Data
209	14.625070	34.233.10.80	192.168.0.3	TLSv1.3	85	Application Data
242	17.097427	20.150.179.231	192.168.0.3	TCP	85	[TCP Retransmission] 8883 → 61191 [FIN, PSH, ACK] Seq=1 Ack=1 Win=501 Len=31
245	19.210648	34.36.57.103	192.168.0.3	TCP	127	[TCP Retransmission] 443 → 52492 [PSH, ACK] Seq=1 Ack=1 Win=1047 Len=73
246	21.202119	34.237.73.95	192.168.0.3	TLSv1.2	78	Application Data
247	21.581980	34.237.73.95	192.168.0.3	TCP	78	[TCP Retransmission] 443 → 52511 [PSH, ACK] Seq=1 Ack=1 Win=375 Len=24
248	21.973019	34.237.73.95	192.168.0.3	TCP	78	[TCP Retransmission] 443 → 52511 [PSH, ACK] Seq=1 Ack=1 Win=375 Len=24
253	22.782637	34.237.73.95	192.168.0.3	TCP	78	[TCP Retransmission] 443 → 52511 [PSH, ACK] Seq=1 Ack=1 Win=375 Len=24
260	23.913816	34.237.73.95	192.168.0.3	TCP	60	443 → 53260 [ACK] Seq=264 Ack=481 Win=186 Len=0
261	23.913816	34.237.73.95	192.168.0.3	TLSv1.2	317	Application Data
265	24.384756	34.237.73.95	192.168.0.3	TCP	78	[TCP Retransmission] 443 → 52511 [PSH, ACK] Seq=1 Ack=1 Win=375 Len=24

a) Transferência Confiável

1. O emissor envia um segmento de dados com um número de sequência
2. O receptor responde com um ACK contendo o próximo número de sequência esperado
3. Se o emissor não receber um ACK dentro de um determinado tempo, ele retransmite o segmento
4. O receptor descarta segmentos duplicados usando os números de sequência

Esta mecânica garante que nenhum dado seja perdido e que todos os bytes cheguem na ordem correta.

b) Início de Conexão

1. Pacote SYN: O cliente inicia a conexão enviando um pacote com a flag SYN ativada e um número de sequência inicial (ISN)
2. Pacote SYN-ACK: O servidor responde com um pacote que tem as flags SYN e ACK ativadas, seu próprio ISN e um número de confirmação igual ao ISN do cliente + 1
3. Pacote ACK: O cliente completa o handshake enviando um pacote com a flag ACK ativada e um número de confirmação igual ao ISN do servidor + 1

c) Término de Conexão

1. Pacote FIN: O lado que deseja encerrar a conexão envia um pacote com a flag FIN ativada
2. Pacote ACK: O outro lado confirma o recebimento do FIN com um ACK
3. Pacote FIN: O segundo lado também envia um FIN quando está pronto para encerrar
4. Pacote ACK: O lado que iniciou o encerramento confirma o FIN do segundo lado

d) Controle de Fluxo

1. O receptor anuncia quanto espaço tem disponível em seu buffer (janela de recepção)
2. O emissor limita o número de bytes que envia sem confirmação a este valor
3. Quando o buffer do receptor começa a encher, ele reduz o tamanho da janela anunciada

4. O emissor deve respeitar este limite para evitar sobrecarga do receptor

Este mecanismo previne que um emissor rápido sobrecarregue um receptor mais lento, mantendo a eficiência da transferência de dados.