Cybersecurity Incident Report #2: Network Traffic Analysis

Scenario

You work as a security analyst for a travel agency that advertises sales and promotions on the company's website. The employees of the company regularly access the company's sales webpage to search for vacation packages their customers might like. One afternoon, you receive an automated alert from your monitoring system indicating a problem with the web server. You attempt to visit the company's website, but you receive a connection timeout error message in your browser.

You use a packet sniffer to capture data packets in transit to and from the web server. You notice a large number of TCP SYN requests coming from an unfamiliar IP address. The web server appears to be overwhelmed by the volume of incoming traffic and is losing its ability to respond to the abnormally large number of SYN requests. You suspect the server is under attack by a malicious actor.

You take the server offline temporarily so that the machine can recover and return to a normal operating status. You also configure the company's firewall to block the IP address that was sending the abnormal number of SYN requests. You know that your IP blocking solution won't last long, as an attacker can spoof other IP addresses to get around this block. You need to alert your manager about this problem quickly and discuss the next steps to stop this attacker and prevent this problem from happening again. You will need to be prepared to tell your boss about the type of attack you discovered and how it was affecting the web server and employees.

	A	B	C	D	E	F
1	No.	Time	Source	Destination	Protocol	Info
2	47	3.144521	198.51.100.23	192.0.2.1	TCP	42584->443 [SYN] Seq=0 Win-5792 Len=120...
3	48	3.195755	192.0.2.1	198.51.100.23	TCP	443->42584 [SYN, ACK] Seq=0 Win-5792 Len=120...
4	49	3.246989	198.51.100.23	192.0.2.1	TCP	42584->443 [ACK] Seq=1 Win-5792 Len=120...
5	50	3.298223	198.51.100.23	192.0.2.1	HTTP	GET /sales.html HTTP/1.1
6	51	3.349457	192.0.2.1	198.51.100.23	HTTP	HTTP/1.1 200 OK (text/html)
7	52	3.390692	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
8	53	3.441926	192.0.2.1	203.0.113.0	TCP	443->54770 [SYN, ACK] Seq=0 Win-5792 Len=120...
9	54	3.49316	203.0.113.0	192.0.2.1	TCP	54770->443 [ACK Seq=1 Win=5792 Len=0...
10	55	3.544394	198.51.100.14	192.0.2.1	TCP	14785->443 [SYN] Seq=0 Win-5792 Len=120...
11	56	3.599628	192.0.2.1	198.51.100.14	TCP	443->14785 [SYN, ACK] Seq=0 Win-5792 Len=120...
12	57	3.664863	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
13	58	3.730097	198.51.100.14	192.0.2.1	TCP	14785->443 [ACK] Seq=1 Win-5792 Len=120...
14	59	3.795332	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win-5792 Len=120...
15	60	3.860567	198.51.100.14	192.0.2.1	HTTP	GET /sales.html HTTP/1.1
16	61	3.939499	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win-5792 Len=120...
17	62	4.018431	192.0.2.1	198.51.100.14	HTTP	HTTP/1.1 200 OK (text/html)
18	63	4.097363	198.51.100.5	192.0.2.1	TCP	33638->443 [SYN] Seq=0 Win-5792 Len=120...
19	64	4.176295	192.0.2.1	203.0.113.0	TCP	443->54770 [SYN, ACK] Seq=0 Win-5792 Len=120...
20	65	4.255227	192.0.2.1	198.51.100.5	TCP	443->33638 [SYN, ACK] Seq=0 Win-5792 Len=120...
21	66	4.256159	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
22	67	5.235091	198.51.100.5	192.0.2.1	TCP	33638->443 [ACK] Seq=1 Win-5792 Len=120...
23	68	5.236023	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
24	69	5.236955	198.51.100.16	192.0.2.1	TCP	32641->443 [SYN] Seq=0 Win-5792 Len=120...
25	70	5.237887	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
26	71	6.228728	198.51.100.5	192.0.2.1	HTTP	GET /sales.html HTTP/1.1
27	72	6.229638	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
28	73	6.230548	192.0.2.1	198.51.100.16	TCP	443->32641 [RST, ACK] Seq=0 Win-5792 Len=120...
29	74	6.330539	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
30	75	6.330885	198.51.100.7	192.0.2.1	TCP	42584->443 [SYN] Seq=0 Win=5792 Len=0...
31	76	6.331231	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
32	77	7.330577	192.0.2.1	198.51.100.5	TCP	HTTP/1.1 504 Gateway Time-out (text/html)
33	78	7.351323	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
34	79	7.360768	198.51.100.22	192.0.2.1	TCP	6345->443 [SYN] Seq=0 Win=5792 Len=0...
35	80	7.380773	192.0.2.1	198.51.100.7	TCP	443->42584 [RST, ACK] Seq=1 Win-5792 Len=120...
36	81	7.380878	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
37	82	7.383879	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
38	83	7.482754	192.0.2.1	203.0.113.0	TCP	443->54770 [RST, ACK] Seq=1 Win=5792 Len=0...
39	84	7.581629	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
40	85	7.680504	192.0.2.1	198.51.100.22	TCP	443->6345 [RST, ACK] Seq=1 Win=5792 Len=0...
41	86	7.709377	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
42	87	7.738241	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
43	88	7.767105	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
44	89	13.895969	192.0.2.1	203.0.113.0	TCP	443->54770 [RST, ACK] Seq=1 Win=5792 Len=0...
45	90	13.919832	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
46	91	13.943695	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
47	92	13.967558	192.0.2.1	198.51.100.16	TCP	443->32641 [RST, ACK] Seq=1 Win-5792 Len=120...
48	93	13.991421	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
49	94	14.015245	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
50	95	14.439072	192.0.2.1	203.0.113.0	TCP	443->54770 [RST, ACK] Seq=1 Win=5792 Len=0...
51	96	14.862899	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
52	97	14.886727	198.51.100.9	192.0.2.1	TCP	4631->443 [SYN] Seq=0 Win=5792 Len=0...
53	98	15.310554	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
54	99	15.734381	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
55	100	16.158208	192.0.2.1	203.0.113.0	TCP	443->54770 [RST, ACK] Seq=1 Win=5792 Len=0...
56	101	16.582035	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
57	102	17.005862	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...

	A	B	C	D	E	F
1	No.	Time	Source	Destination	Protocol	Info
58	103	17.429678	192.0.2.1	203.0.113.0	TCP	443->54770 [RST, ACK] Seq=1 Win=5792 Len=0...
59	104	17.452693	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
60	105	17.475708	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
61	106	17.498723	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
62	107	17.521738	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
63	108	17.544753	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
64	109	17.567768	192.0.2.1	203.0.113.0	TCP	443->54770 [RST, ACK] Seq=1 Win=5792 Len=0...
65	110	17.590783	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
66	111	18.413795	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
67	112	18.436807	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
68	113	18.459819	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
69	114	18.482831	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
70	115	18.506655	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
71	116	18.529667	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
72	117	18.552679	192.0.2.1	203.0.113.0	TCP	443->54770 [RST, ACK] Seq=1 Win=5792 Len=0...
73	118	18.875692	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
74	119	19.198705	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
75	120	19.521718	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
76	121	19.844731	192.0.2.1	198.51.100.9	TCP	443->4631 [RST, ACK] Seq=1 Win=5792 Len=0...
77	122	20.167744	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
78	123	20.490757	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
79	124	20.81377	192.0.2.1	203.0.113.0	TCP	443->54770 [RST, ACK] Seq=1 Win=5792 Len=0...
80	125	21.136783	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
81	126	21.459796	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
82	127	21.782809	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
83	128	22.105822	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
84	129	22.428835	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
85	130	22.751848	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
86	131	23.074861	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
87	132	23.397874	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
88	133	23.720887	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
89	134	24.0439	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
90	135	24.366913	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
91	136	24.689926	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
92	137	25.012939	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
93	138	25.335952	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
94	139	25.658965	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
95	140	25.981978	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
96	141	26.304991	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
97	142	26.628004	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
98	143	26.951017	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
99	144	27.27403	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
100	145	27.597043	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
101	146	27.920056	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
102	147	28.243069	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
103	148	28.566082	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
104	149	28.889095	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
105	150	29.212108	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
106	151	29.535121	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
107	152	29.858134	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
108	153	30.181147	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
109	154	30.50416	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
110	155	30.827173	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
111	156	31.150186	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
112	157	31.473199	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...
113	158	31.796212	203.0.113.0	192.0.2.1	TCP	54770->443 [SYN] Seq=0 Win=5792 Len=0...

Section 1: Identify the type of attack that may have caused this network interruption
One likely explanation for the website's connection timeout error message is that the webserver is experiencing a SYN flood attack. The logs show that an unknown IP address is attempting to flood the webserver with SYN requests. At first the log shows normal web traffic. The employee IP is making a SYN request and then the request is acknowledged by the web server, and the employee is granted access to the website. But on the 52nd message to the web server the SYN flood attack begins. It starts slowly at first, and the employees are still able to connect to the website. But soon we the RST, ACK packet and employees are unable to access the website. When the employees try to send another SYN request they receive a 504 Gateway Timeout on the HTTP protocol. After this the web server is no longer able to acknowledge requests from the employee IP, and the rest of the log fills up with SYN requests being launched by the unknown IP address.

Section 2: Explain how the attack is causing the website to malfunction
When website visitors try to establish a connection with the web server, a three-way handshake occurs using the TCP protocol. The three way handshake starts when the SYN packet makes a request from the visitor's device to the web server. When the SYN request reaches the web server it will create the SYN,ACK packet to agree to the visitor's request to connect to it. Then the visitor’s device will create an ACK packet to acknowledge the permission granted to it to connect. After this the TCP connection is successfully made. When the malicious actor sends a large amount of SYN packets all at once it takes away the web server's resources, so that it is not able to acknowledge anyone else’s requests. The three way handshake isn’t able to get past the first step, and the SYN request is sent but never acknowledged by the web server. The logs indicate that the server is being over inundated with SYN requests from the malicious actor’s IP address, so it is not able to receive any SYN requests which prevents anyone from accessing the site. A way to mitigate this can be to configure the firewall or IDS to limit the number of SYN requests coming from a single IP address.