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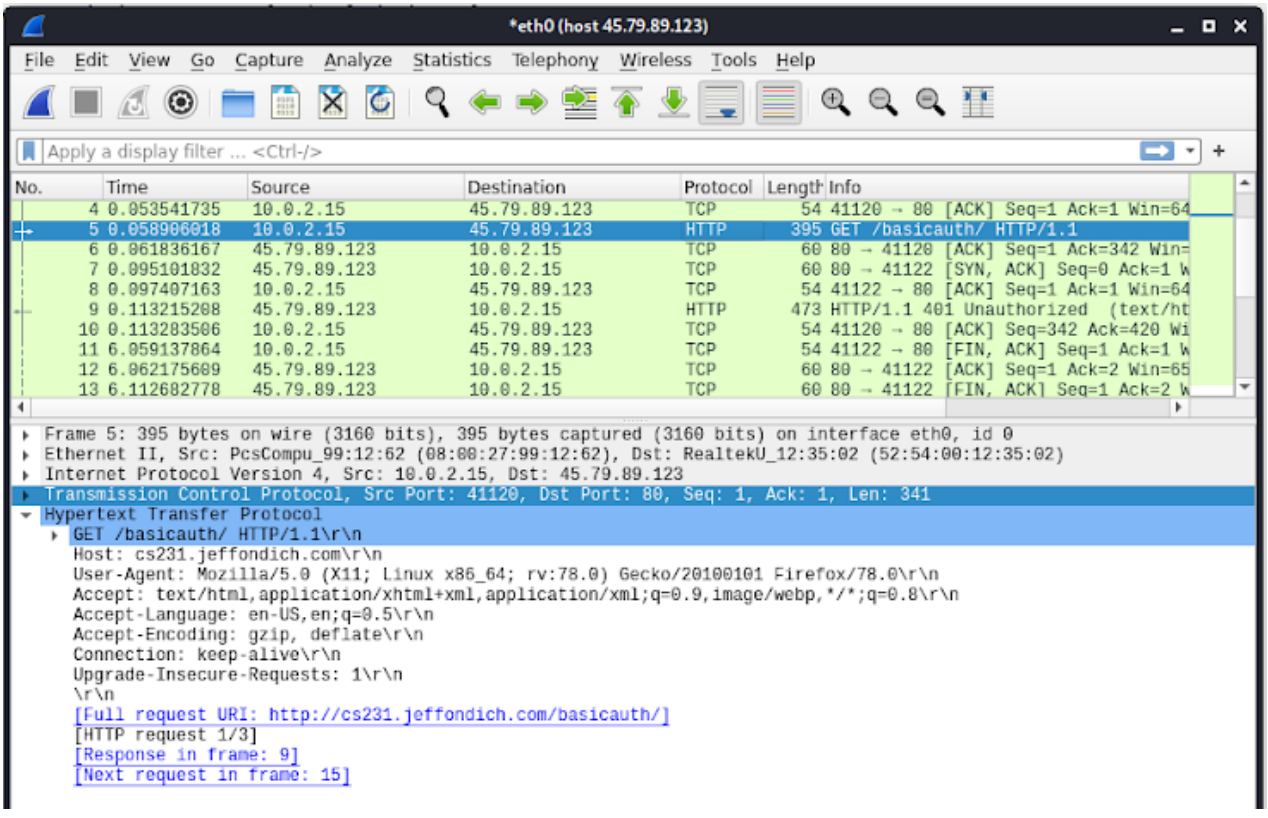
To begin our journey into http://cs231.jeffondich.com/basicauth/, we resolved to determine the IP address of the site. Doing so took a simple command into our terminal: “nslookup cs231.jeffondich.com”. Among other things, the response indicated that the address we were seeking lived at 45.79.89.123, as shown under “Non-authoritative answer: . . . Address:.” Next, we moved to the application Wireshark, where we navigated to the Capture menu and filtered using the command “host 45.79.89.123”.

At this point, Wireshark had begun monitoring our interactions with the server, i.e. the nginx server serving Jeff’s website. Jumping over to a web browser, we entered the url and let fire. Back in Wireshark, we were now confronted with a plethora of interaction frames. The first few were clearly a pair of standard TCP handshakes, as evidenced by the [SYN] and [SYN, ACK] tags sent between our client and the server. The first HTTP



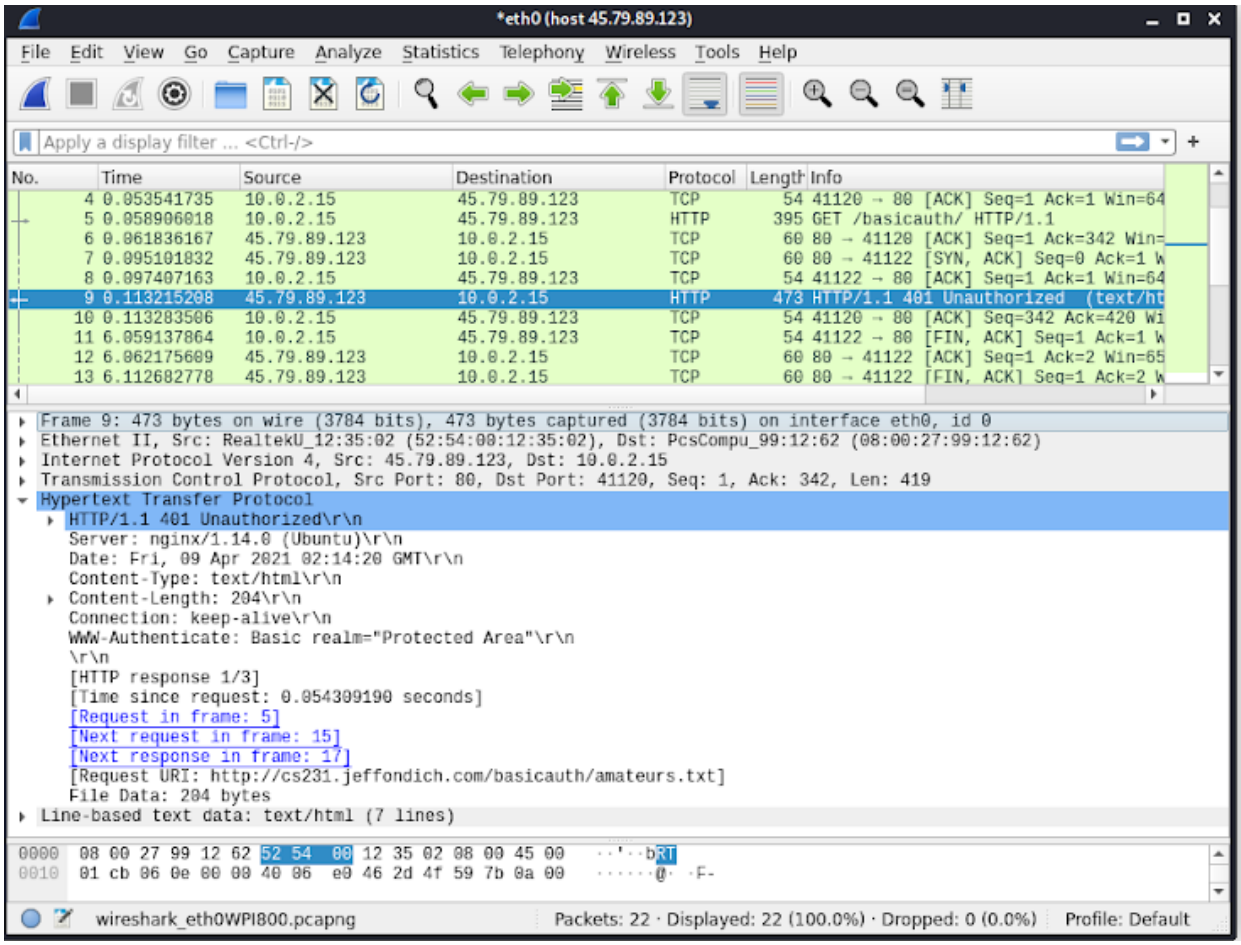
packet was a GET request by our client for the resource /basicauth/. The information for this packet displayed in Wireshark is shown in the image above. This is a standard GET request as specified in the HTTP method specs (https://tools.ietf.org/html/rfc7231#section-4.3); the client is asking the server for the /basicauth/ resource. As can be seen in the request headers, we were using Firefox as our browser, so this is the user-agent associated with the request. Also, note that there is no “Authorization” header field in this request. This is important, because the resource we are trying to access is a protected space; we will see later that this first request does not result in the delivery of the resource, because we are not currently authenticated to access the resource.

The server detects that we are trying to access a protected resource and responds with a challenge with the error code 401. The response includes the “WWW-Authenticate: Basic realm=’Protected Area’\r\n” header field, indicating that the authentication scheme is Basic Authentication and that the name of this protection space (realm) is “Protected Area”. This response format follows the Basic Authentication specs (https://tools.ietf.org/html/rfc7617). The information displayed in Wireshark for the 401 response packet is shown in the image on the next page.

As a result of this challenge, an alert popped up in our browser telling us that “http://cs231.jeffondich.com is requesting your username and password. The site says: ‘Protected Area’”, with text boxes for us to input the username and password.

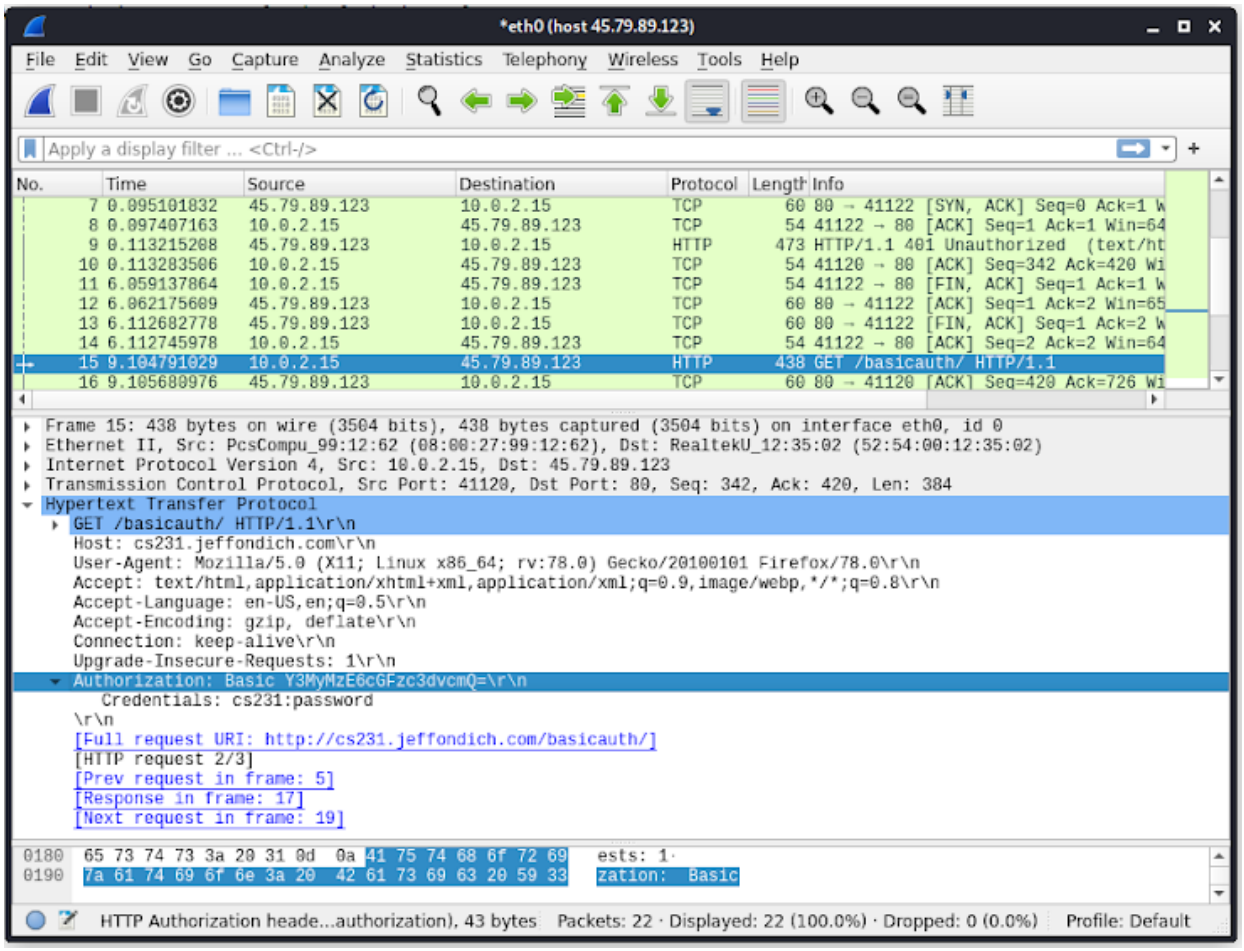
After inputting the credentials in the alert bar in the web browser, we entered the protected space. Back in Wireshark, we clicked through the packets sent and noticed a second GET request for the /basicauth/ resource. Unlike the first request, this one had

an Authorization header indicating that the authentication scheme was “Basic” and containing our credentials encoded in base64. Wireshark provided a “Credentials”



sub-field showing us the plain text. The format of request Authorization header and the user-password format *username:password* follows the Basic Authentication spec. This information was not encrypted. The packet information for the second GET request is shown in the image below. Because this second GET request contained the appropriate authentication information, the server responded with a final HTTP 200 OK response to

deliver the /basicauth/ resource, and we accessed the page.



Moving over to the web browser, we perused through the secret folder, visiting http://cs231.jeffondich.com/basicauth/amateurs.txt, http://cs231.jeffondich.com/basicauth/concrete.txt, and http://cs231.jeffondich.com/basicauth/pigs.txt. The HTTP headers of the GET requests for these pages also included the Authorization section for our credentials, and we did not have to re-enter the credentials. The server did not send any more 401 Unauthorized challenges, only 200 OK responses delivering the requested resources.

Throughout our communications with the nginx web server, we noticed TCP Keep-Alive messages, which we understand to be normal network procedures which

ensure connection between the client and the server. Related to the Keep-Alive messages, RST (reset) messages occasionally occurred. These messages reset the TCP handshake with the browser. To find out more about these messages, we viewed https://en.wikipedia.org/wiki/Keepalive#TCP_keepalive.

Another interesting point we noticed was the fact that the HTTP communication included a correction for the error of entering the /basicauth site without a closing backslash. Wireshark showed a 301 error, essentially redirecting the initial request to instead travel to the correct /basicauth/ url. This is described in the HTTP snippets below:

Client to server -- GET /basicauth HTTP/1.1

Server to client -- HTTP/1.1 301 Moved Permanently

Client to server -- GET /basicauth/ HTTP/1.1

This is a feature that we had certainly taken for granted prior to understanding interactions using Wireshark.

In summary, to navigate through Jeff's website, we first inputted our credentials, then pursued through the files in the secret folder. Through Wireshark, we followed the packets being sent back and forth between us and the server hosting Jeff's website. Because the passwords were sent through basic authentication, it was easy to snoop and find the plaintext password, even though it was encoded in base64. Base64 is not actually encryption, so it is clear that basic authentication is simply not secure in the current context of computer privacy. All in all, Wireshark provided us with many useful insights in this exploration of web server-client communication and Basic Authentication security.