SL with Wireshark – HTTPS

Ever tried using Wireshark to monitor web traffic? You've probably run into a problem? A lot of it is encrypted. Here's how I decrypt SSL with Wireshark.

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> *If you've ever tried using Wireshark to monitor web traffic, you've probably run into a problem – a lot of it is encrypted transmissions. In fact, most sites are using SSL or Transport Layer Security (TLS) encryption to keep their users safe.*

Ubiquitous encryption is a good thing if you're shopping on Amazon, but it's a real pain when you're trying to administer a network. Here's how I decrypt SSL with Wireshark.

In this post we cover:

What are Wireshark and SSL Encryption?

Wireshark is a **network traffic analyzer**; it's a core utility that many administrators use to troubleshoot problems on their networks. Specifically, it captures frames – the building blocks of packets – and lets you sort through and analyze them.

Using Wireshark, you can look at the traffic flowing across your network and dissect it, getting a peek inside of frames at the raw data.

SSL is an encryption protocol that operates on the Transport layer of the OSI model. It uses various encryption methods to secure data as it moves across networks. Note: In this guide, I'll mostly be referring to SSL as a catchall term for SSL and TLS, its successor.

SSL encryption makes using Wireshark more challenging because it prevents administrators from viewing the data that each relevant packet carries. When Wireshark is set up properly, it can decrypt SSL and restore your ability to view the raw data.

Make sure you are using the latest stable version of Wireshark.

Wireshark

Download the latest stable version

See also: Wireshark Alternatives for packet sniffing

Using a pre-master secret key to decrypt SSL and TLS

Using a pre-master secret key to decrypt SSL in Wireshark is the recommended method.

A **pre-master secret key** is generated by the client and used by the server to derive a master key that encrypts the session traffic. It's the current standard in

cryptography and is usually implemented via Diffie-Hellman.

Your browser can be made to log the pre-master secret key, which Wireshark uses to decrypt SSL and TLS sessions.

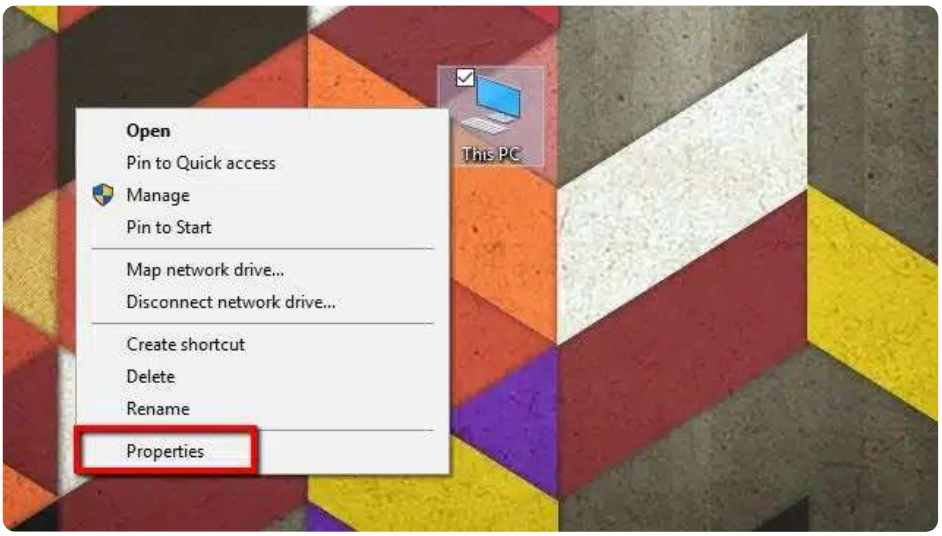
Here are the steps to decrypting SSL and TLS with a pre-master secret key:

- Set an environment variable
- Launch your browser
- Configure Wireshark
- Capture and decrypt the session keys

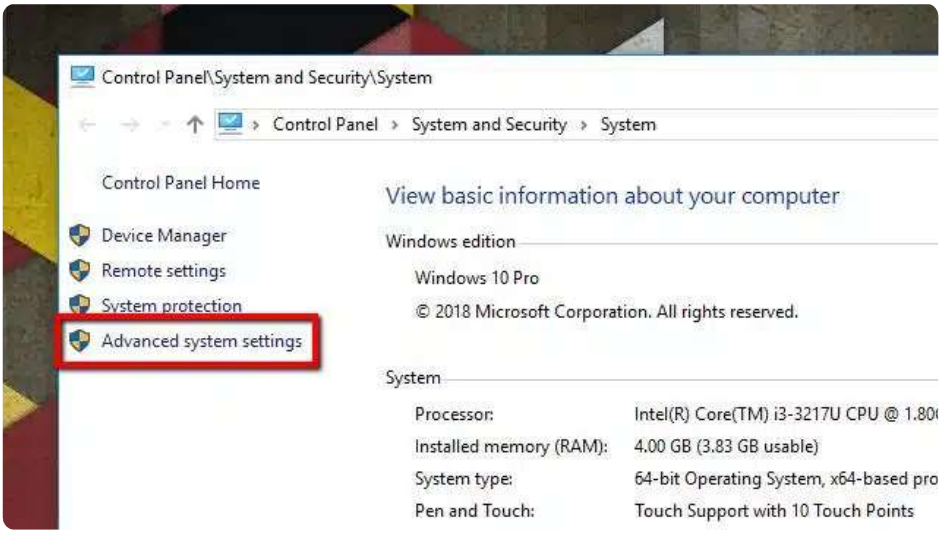
When you're finished, you'll be able to decrypt SSL and TLS sessions in Wireshark without needing access to the target server.

Set a Windows environment variable

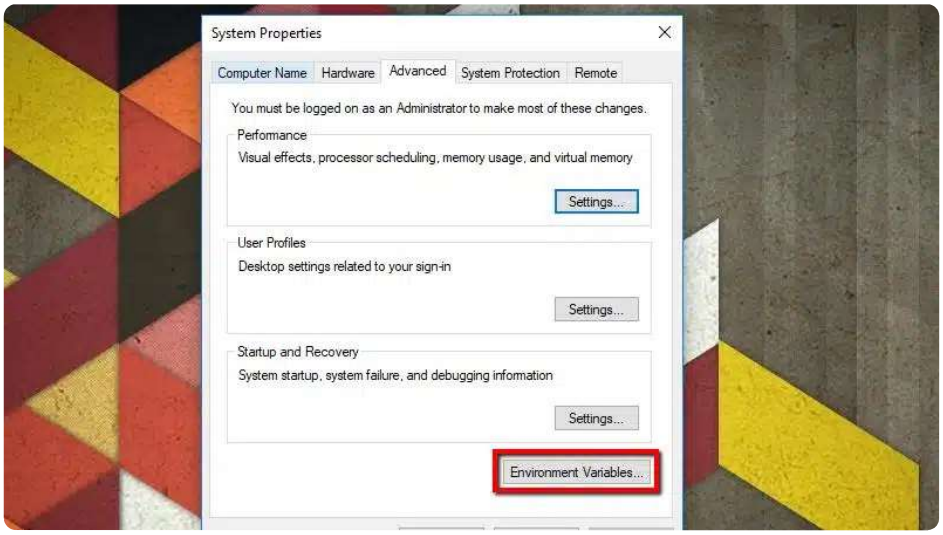
In **Windows systems**, you'll need to set an environment variable using the **Advanced system settings** utility. This variable, named **SSLKEYLOGFILE**, contains a path where the pre-master secret keys are stored.



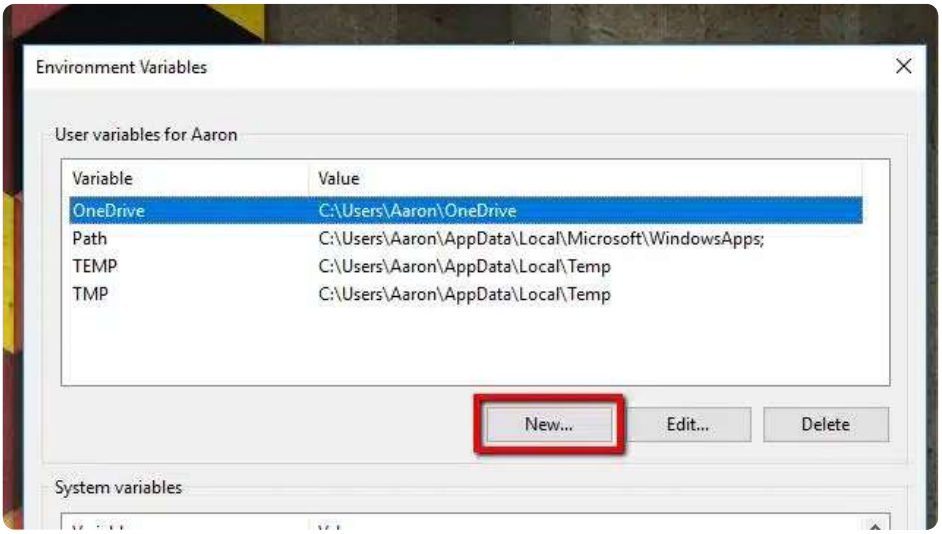
Start by right-clicking on **My Computer**, and selecting **Properties** from the menu. The **System** menu will open.



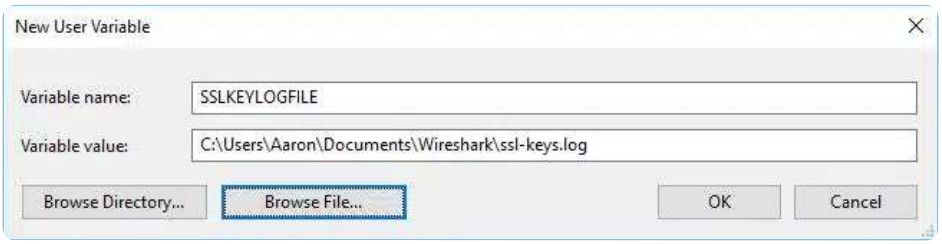
Next, click **Advanced system settings** on the list to the left. The **System Properties** window will open.



On the **Advanced** tab, click the **Environment Variables** button.



Click the **New…** button under **User variables**. You can also create the variable under **System variables** if you'd like to log SSL keys for every user on the system, but I prefer to keep it confined to my profile.



Under **Variable name**, type the following:

```
SSLKEYLOGFILE
```

In the **Variable value** field, type a path to the log file. You can also click the **Browse file…** button and specify the path using the file picker.

> As a note, if you're creating this as a system-wide environment variable, you'll need to use appropriate wildcards or store the file in a place accessible by all users. For instance, you might choose **%USERPROFILE%\App Data\ssl-keys.log** or **C:\ssl-keys.log**.

Once you've finished, click **OK** and move to the next set of steps.

Set a Linux or Mac environment variable

In **Linux** and **Mac**, you'll need to set the **SSLKEYLOGFILE** environment variable using **nano**. In **Linux**, the variable is stored in **~/.bashrc**. On the **Mac**, you'll create the variable in the file **~/.MacOSX/environment**

Open a terminal and **use this command in Linux**:

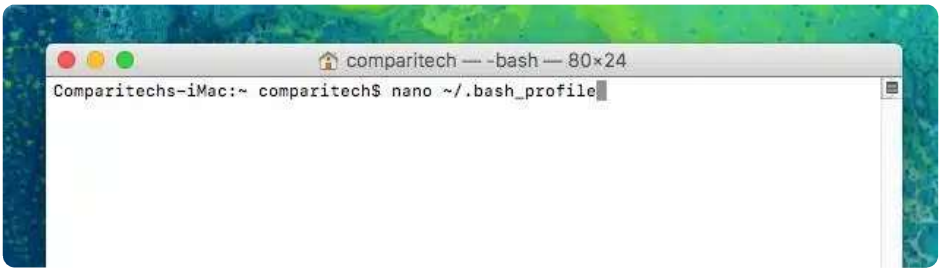
```
nano ~/.bashrc
```

Open **Launchpad**, click **Other**, and launch a terminal to **run this command in Mac OSX**:

```
nano ~/.bash_profile
```

The following steps are the same for both operating systems.

At the end of the file, add this line:




```
export SSLKEYLOGFILE=~/.ssl-key.log
```

Press **Ctrl+X, Y** to save your changes.

Close the terminal window and open another to set the variable, then type the following to confirm it's been set successfully:

```
echo $SSLKEYLOGFILE
```

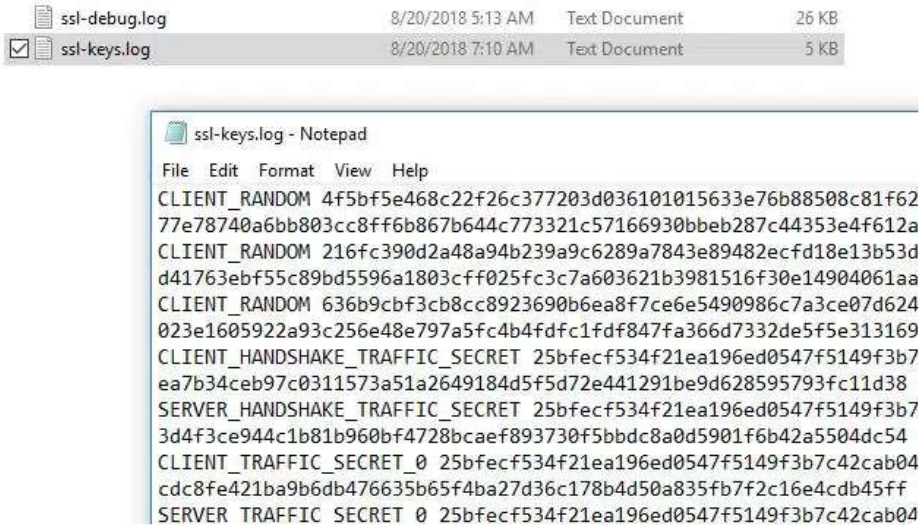
After you execute the command, you should see output similar to the image above. **/Users/comparitech/.ssl-key.log** is the full path to my SSL pre-master key log. Note: You'll want to make a note of yours, which will be different, to enter in Wireshark.

Now that the variable has been set, you can move on to the next set of steps.

Launch your browser and check for the log file

Before you launch Wireshark and configure it to decrypt SSL using a pre-master key, you should start your browser and confirm that the log file is being used.

In order to populate the log, it's important that you visit a site that has SSL enabled. I'm using my own Apache server for testing, but any site will work. One of the biggest benefits of using a pre-master shared key is **you don't need access to the server** to decrypt SSL.



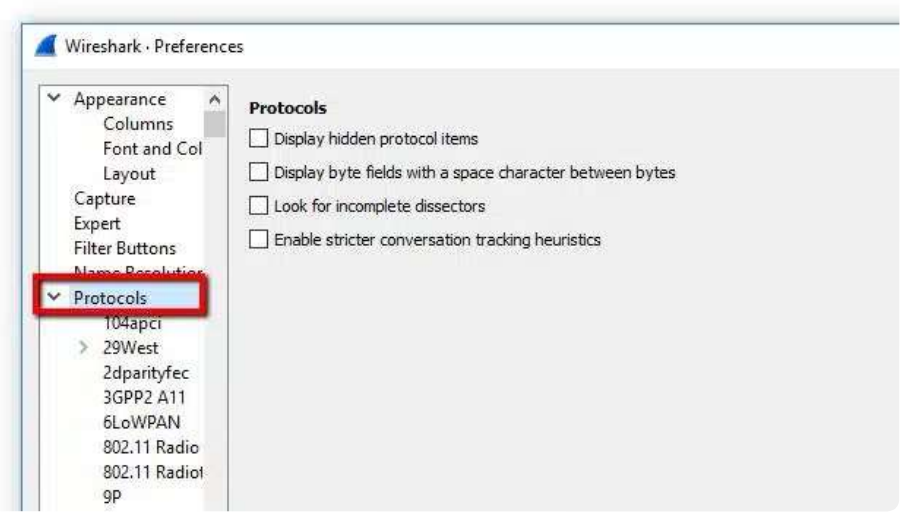
After you've visited a SSL-enabled website, check the file for data. In **Windows**, you can use **Notepad**. In **Linux** or **Mac**, use the following command:

```
cat ~/.ssl-log.key
```

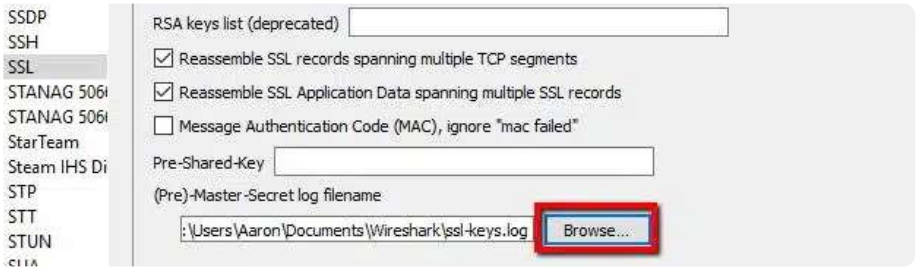
On any operating system, your file should look like mine does above. After you've confirmed that your browser is logging pre-master keys in the location you selected, you can configure Wireshark to use those keys to decrypt SSL.

Configure Wireshark to decrypt SSL

Once your browser is logging pre-master keys, it's time to configure Wireshark to use those logs to decrypt SSL.



Open Wireshark and click **Edit**, then **Preferences**. The **Preferences** dialog will open, and on the left, you'll see a list of items. Expand **Protocols**, scroll down, then click **SSL**.



In the list of options for the SSL protocol, you'll see an entry for **(Pre)-Master-Secret log filename**. Browse to the log file you set up in the previous step, or just paste the path.

When you've finished setting the **(Pre)-Master-Secret log filename**, click **OK** and return to Wireshark. You're ready to move on.

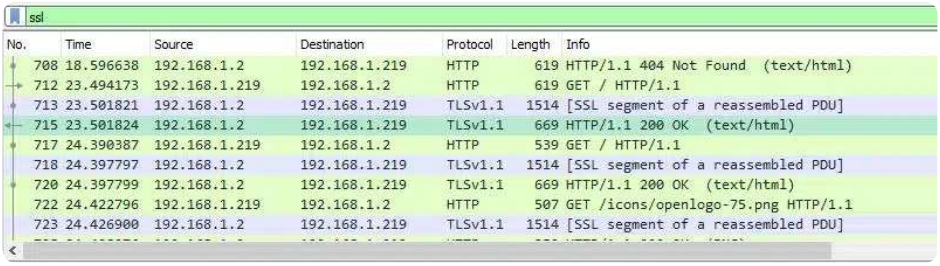
Related post: How to use Wireshark

Capture the session and decrypt SSL

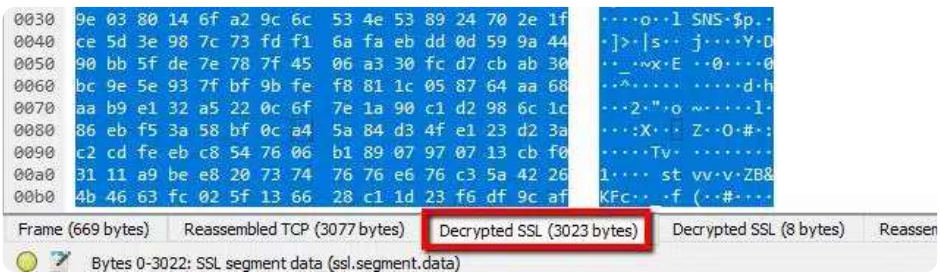
The final step is to capture a test session and make sure that Wireshark decrypts SSL successfully.

- Start an unfiltered capture session, minimize it, and open your browser.
- Visit a secure site in order to generate data, and optionally set a display filter of ‘ssl’ to minimize the session noise.
- Click on any frame containing encrypted data.

In my case, I’ll select one that contains HTTP traffic with text/HTML encoding, since I’d like to see the source code the web server is sending to my browser. But any encrypted transmissions that use a pre-master secret or private key will work with this method. That includes all data utilizing Perfect Forward Encryption (PFE) through Diffie-Hellman or comparable key exchanges.

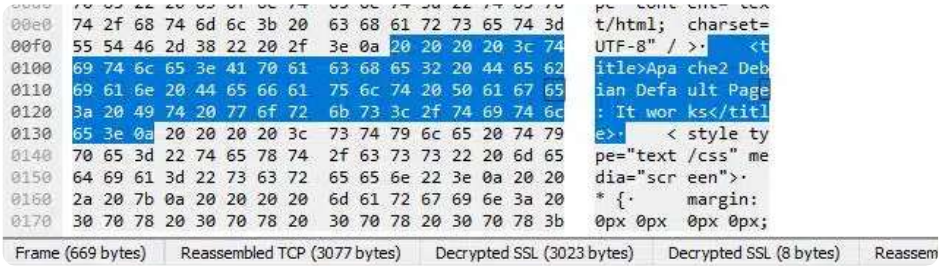


Once you’ve selected an encrypted data frame, look at the **Packet byte view**, and specifically the tabs underneath the view. You should see an entry for **Decrypted SSL** data, among others.



WHAT'S IN THIS ARTICLE?

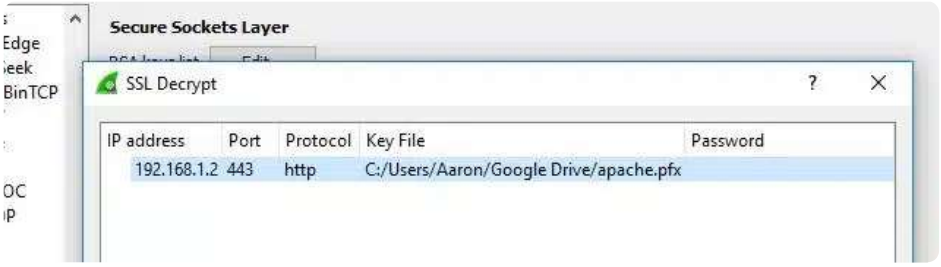
You'll notice that my session still looks like it's full of garbage, and no HTML is visible. That's because my web server (and most Apache servers) use GZIP compression by default.



When you click the **Uncompressed entity body** tab, which only shows up in this case with SSL decryption enabled, you can view the source code of the site. For instance, here's the title element of the default Apache page in plaintext.

Using an RSA key to decrypt SSL

You might have noticed earlier that Wireshark has a field that allows you to upload your RSA keys and use them to decrypt SSL. In practice, **RSA key decryption is deprecated**.



> *The reason decrypting SSL with an RSA key isn't commonly used anymore is that Perfect Forward Encryption (PFE) has made it obsolete. Sessions negotiated with Diffie-Hellman don't use the RSA key directly; instead they generate a one-time*

key, stored only in RAM, that is encrypted using the key on disk.

If you were previously using an RSA key to decode traffic, and it stopped working, you can confirm that the target machine is using Diffie-Hellman exchanges by enabling SSL logging.

To turn on logging, click **Edit** from the toolbar menu and select **Preferences**. Expand the **Protocols** menu item on the left and scroll down to **SSL**. From here, you can click the **Browse** button and set the location of your SSL log.

Once the location is set, all SSL interactions will be logged in the specified file.

```
decrypt_ssl3_record: no decoder available
dissect_ssl3_handshake iteration 1 type 2 offset 5 length 92 bytes, remaining 1
ssl_try_set_version found version 0x0302 -> state 0x91
Calculating hash with offset 5 96
ssl_dissect_hnd_hello common found SERVER_RANDOM -> state 0x93
ssl_set_cipher found CIPHER 0xC013 TLS_ECDHE_RSA_WITH_AES_128_CBC_SHA -> state
tls13_load_secret TLS version 0x302 is not 1.3
tls13_load_secret TLS version 0x302 is not 1.3
  record: offset = 101, reported_length_remaining = 75
dissect_ssl3_record: content_type 20 Change Cipher Spec
```

Capture a session with your SSL-enabled host, then check the logs. Specifically, you should scroll until you find the frame that the TLS handshake was negotiated on. It's likely that you'll see a telltale DHE entry in the cipher string.

That means Diffie-Hellman key exchanges are enabled. In my case, Apache is specifically using

Diffie-Hellman with elliptic-curve keys, which is denoted by the string **ECDHE**.

Scroll a little further and you're likely to see that the master secret cannot be found.

If your logs look like that, and you can't decrypt data using an RSA key, you have no choice but to switch over to the pre-master secret method above.

Since PFE is becoming standard practice, with TLSv1.3 likely forcing the issue, simple RSA key decryption is deprecated and should not be used.

Wireshark makes decrypting SSL traffic easy

I really like the way Wireshark handles the SSL decryption process. Cryptography is complicated, and the standards are constantly changing to be more secure. But once Wireshark and your environment are set up properly, all you have to do is change tabs to view decrypted data. It doesn't get any easier than that.

Related Posts:

- Fix Common Wireshark Startup " no interfaces found" Issue
- Wireshark Cheat Sheet
- How to run a remote packet capture with Wireshark and tcpdump
- Identify hardware with OUI lookup in Wireshark

Wireshark Decrypt SSL FAQs

How do I read TLS packets in Wireshark?

Follow these steps to read TLS packets in Wireshark:

1. Start a packet capture session in Wireshark.
2. In the top menu bar, click on **Edit**, and then select **Preferences** from the drop-down menu.
3. In the Preferences window, expand the **Protocols** node in the left-hand menu tree.
4. Click on SSL. The main panel of the window will show protocol settings.
5. Enter a file name and select a location for **SSL debug file**.
6. Click in **RSA keys list** and then select **Edit** and then **New**.
7. Fill out the information fields in the pop-up window: **IP address**, **Port**, **Protocol** (which will be HTTPS), **Key File**, and **Password**. Press **OK**.
8. Click **OK** in the Preferences screen.

The data field at the bottom of the main Wireshark page will show the decrypted contents of the packet.

How does a 2 way SSL handshake work?

The two-way SSL handshake authenticates both the server and the client. Here are the steps that are carried out in this process:

1. **Client hello**: sent from the client to the server and includes its supported cipher suites and TLS version compatibilities.

2. **Server hello**: sent from the server to the client in response. It contains a link to the server's public certificate and a request for the same back from the client.
3. The browser validates the server certificate and if all is OK, sends a link to its own certificate.
4. The server checks out the client's certificate. If all is OK, session establishment continues.

Is it possible to decrypt passively sniffed SSL/TLS traffic?

Yes. However, you will always need the RSA key in order to decrypt traffic. That could be acquired through legitimate methods and with permission or could be tricked out of the source of the traffic through a "man in the middle" strategy.

8 Comments Leave a comment

Eitan
May 17, 2022 at 9:27 am

It seems that creating the ssl-keys.log doesn't work if you use brave. When I switched to chrome, it created the file immediately.

Reply ▸

Ephraim
May 17, 2022 at 6:12 am

Jon , were you able to generate he sslkeylogfile..thanks

Reply ▸

Don R
April 24, 2022 at 7:15 pm

Thank you for a great tutorial, not just in terms of content but also presentation. Very easy to follow!

Reply ▸

Jon
January 5, 2019 at 10:23 pm

Hi,

IDK why, but my file from SSLKEYLOGFILE doesn't populate 😟
I'm using Win7 64 and tried both: Firefox and Chrome (also 64bit) with admin privileges, even tried to restart system and nothing…
Tried simply with YouTube site (maybe I should clear cookies first to ensure browser will download everything again?) I thought browsers doesn't support this functionality anymore, but this article is so fresh that problem must be on my computer. If you have some advices – I would love to hear 🙂

cheers,
Jon

Reply ▸

J. T.
February 21, 2023 at 9:43 pm

You need to go back to FireFox version 68.1.1 or earlier. You are right, that they do not support that functionality anymore.

Reply ▸

Lucas
June 21, 2022 at 2:08 pm

Start Firefox or Chrome from the same terminal.
For example:

Firefox &

Note: You must start the browser from the same command terminal because the session variable is set only on the terminal.

Reply ▸

Mehedi
August 6, 2019 at 6:35 pm

Environment variables in windows sometimes need restart.

Reply ▸

Amit Pindoria
December 28, 2018 at 3:56 am

Fantastic write up, Aaron. Great job!

Reply ▸

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Comment

Name *

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