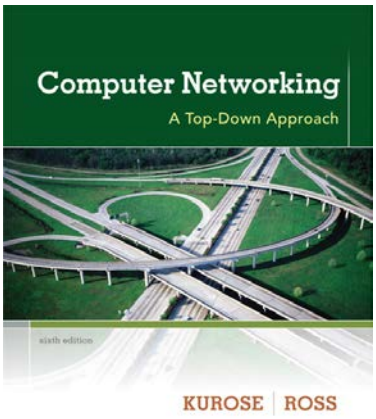
Wireshark Lab: Getting Started v6.0



Supplement to *Computer Networking: A Top-Down Approach, 6th ed.*, J.F. Kurose and K.W. Ross

"Tell me and I forget. Show me and I remember. Involve me and I understand." Chinese proverb

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Note: This document has been modified for use at BYU-Idaho. The original document may be found at: http://www-net.cs.umass.edu/wireshark-labs/. This modified document directs students to answer questions posted in an I-Learn assignment to complete the lab. Modified portions of this document have text in a different color. Wireshark has been made available at BYU-Idaho on the CSEE Linux servers and in the ECEN labs. The version of Wireshark in the ECEN labs is newer than the version on the CSEE servers and the initial screen and some features have changed from what this document describes.

One's understanding of network protocols can often be greatly deepened by "seeing protocols in action" and by "playing around with protocols" – observing the sequence of messages exchanged between two protocol entities, delving down into the details of protocol operation, and causing protocols to perform certain actions and then observing these actions and their consequences. This can be done in simulated scenarios or in a "real" network environment such as the Internet. In the Wireshark labs you'll be doing in this course, you'll be working with traces of various network applications running in different scenarios using your own computer or on the CSEE Linux servers or in the ECEN labs. You'll observe the network protocols … "in action," interacting and exchanging messages with protocol entities executing elsewhere in the Internet. … You'll observe, and you'll learn, by doing.

In this first Wireshark lab, you'll get acquainted with Wireshark, and analyze a simple trace.

The basic tool for observing the messages exchanged between executing protocol entities is called a **packet sniffer**. As the name suggests, a packet sniffer captures ("sniffs") messages being sent/received from/by your computer; it will also typically store and/or display the contents of the various protocol fields in these captured messages. A packet sniffer itself is passive. It observes messages being sent and received by applications and protocols running on your computer, but never sends packets itself. Similarly, received packets are never explicitly addressed to the packet sniffer. Instead, a packet sniffer

receives a *copy* of packets that are sent/received from/by application and protocols executing on your machine.

Figure 1 shows the structure of a packet sniffer. At the right of Figure 1 are the protocols (in this case, Internet protocols) and applications (such as a web browser or ftp client) that normally run on your computer. The packet sniffer, shown within the dashed rectangle in Figure 1 is an addition to the usual software in your computer, and consists of two parts. The **packet capture library** receives a copy of every link-layer frame that is sent from or received by your computer. Recall from the discussion from section 1.5 in the text (Figure 1.24[1]) that messages exchanged by higher layer protocols such as HTTP, FTP, TCP, UDP, DNS, or IP all are eventually encapsulated in link-layer frames that are transmitted over physical media such as an Ethernet cable. In Figure 1, the assumed physical media is an Ethernet, and so all upper-layer protocols are eventually encapsulated within an Ethernet frame. Capturing all link-layer frames thus gives you all messages sent/received from/by all protocols and applications executing in your computer.

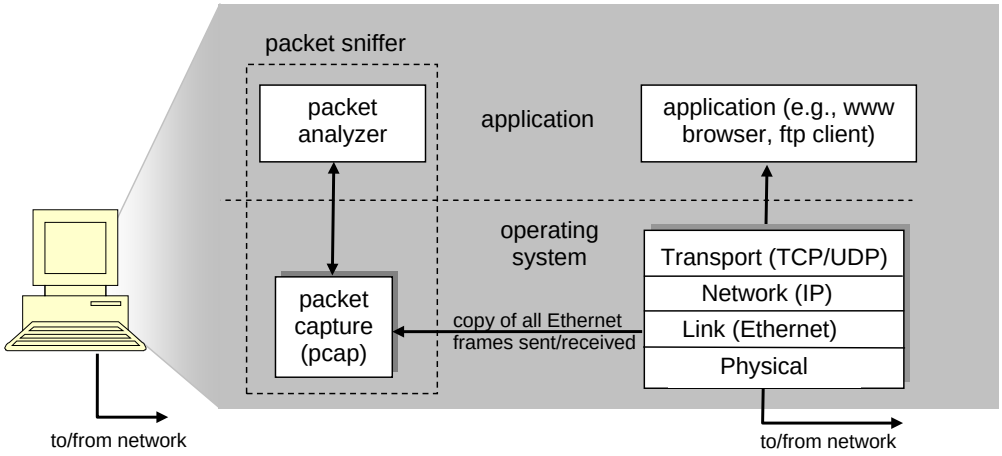

Figure 1: Packet sniffer structure

The second component of a packet sniffer is the **packet analyzer**, which displays the contents of all fields within a protocol message. In order to do so, the packet analyzer must "understand" the structure of all messages exchanged by protocols. For example, suppose we are interested in displaying the various fields in messages exchanged by the HTTP protocol in Figure 1. The packet analyzer understands the format of Ethernet frames, and so can identify the IP datagram within an Ethernet frame. It also understands the IP datagram format, so that it can extract the TCP segment within the IP datagram. Finally, it understands the TCP segment structure, so it can extract the HTTP message contained in the TCP segment. Finally, it understands the HTTP protocol and so, for example, knows that the first bytes of an HTTP message will contain the string "GET," "POST," or "HEAD," as shown in Figure 2.8 in the text.

[1] References to figures and sections are for the 6th edition of our text, *Computer Networks, A Top-down Approach, 6th ed., J.F. Kurose and K.W. Ross, Addison-Wesley/Pearson, 2012.*

We will be using the Wireshark packet sniffer [http://www.wireshark.org/] for these labs, allowing us to display the contents of messages being sent/received from/by protocols at different levels of the protocol stack. (Technically speaking, Wireshark is a packet analyzer that uses a packet capture library in your computer). Wireshark is a free network protocol analyzer that runs on Windows, Linux/Unix, and Mac computers. It's an ideal packet analyzer for our labs – it is stable, has a large user base and well-documented support that includes a user-guide (http://www.wireshark.org/docs/wsug_html_chunked/), man pages (http://www.wireshark.org/docs/man-pages/), and a detailed FAQ (http://www.wireshark.org/faq.html), rich functionality that includes the capability to analyze hundreds of protocols, and a well-designed user interface. It operates in computers using Ethernet, serial (PPP and SLIP), 802.11 wireless LANs, and many other link-layer technologies (if the OS on which it's running allows Wireshark to do so).

Getting Wireshark

In order to run Wireshark, you will need to have access to a computer that supports both Wireshark and the *libpcap* or *WinPCap* packet capture library. The *libpcap* software will be installed for you, if it is not installed within your operating system, when you install Wireshark. See http://www.wireshark.org/download.html for a list of supported operating systems and download sites.

Wireshark has been installed on the CSEE Linux servers and in the ECEN Labs and may be used there, or you may download and install it on your own computer.

To download and install the Wireshark software on your own computer:

- Go to http://www.wireshark.org/download.html and download and install the Wireshark binary for your computer.

The Wireshark FAQ has a number of helpful hints and interesting tidbits of information, particularly if you have trouble installing or running Wireshark.

Running Wireshark

On the CSEE Linux servers, type "wireshark" or "wireshark &" to start it when using a tool such as MobaXterm on Windows® or XQuartz on macOS.

You will be unable to capture traces while using Wireshark on the CSEE Linux servers. You may take traces on your own computer or on systems in the ECEN labs.

When you run the Wireshark program, you'll get a startup screen, as shown below:

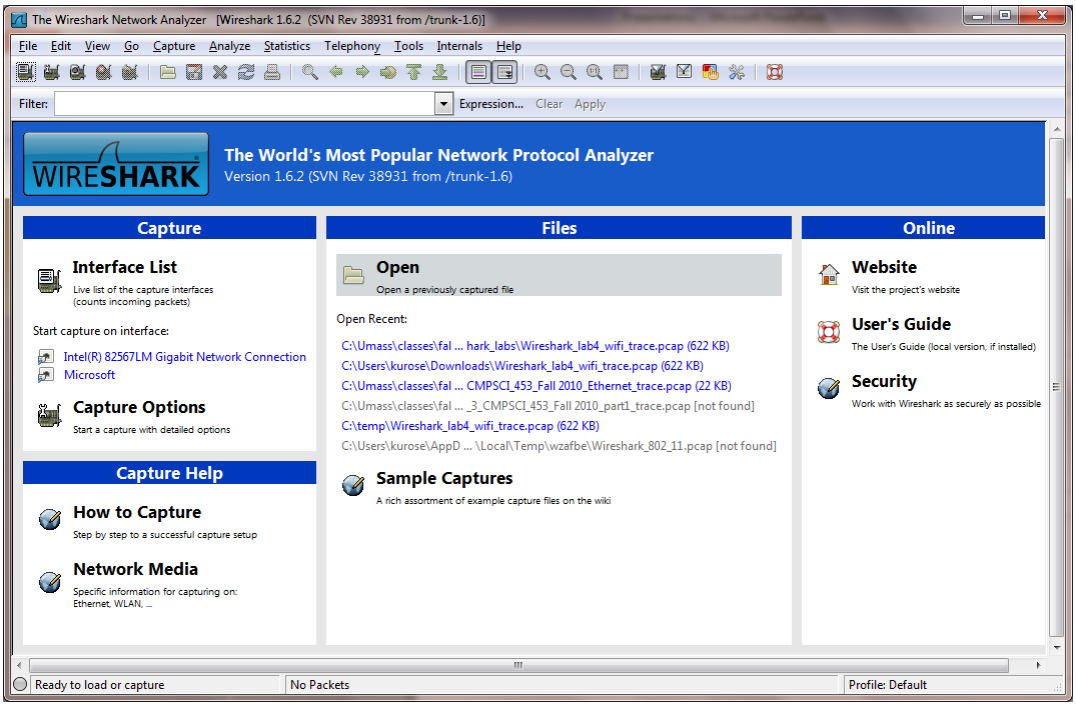

Figure 2: Initial Wireshark Screen

Take a look at the upper left hand side of the screen – you'll see an "Interface list". This is the list of network interfaces on your computer. Once you choose an interface, Wireshark will capture all packets on that interface. In the example above, there is an Ethernet interface (Gigabit network Connection) and a wireless interface ("Microsoft").

If you click on one of these interfaces to start packet capture (i.e., for Wireshark to begin capturing all packets being sent to/from that interface, on a computer that allows you to do so), a screen like the one below will be displayed, showing information about the packets being captured. Once you start packet capture, you can stop it by using the Capture pull down menu and selecting Stop.

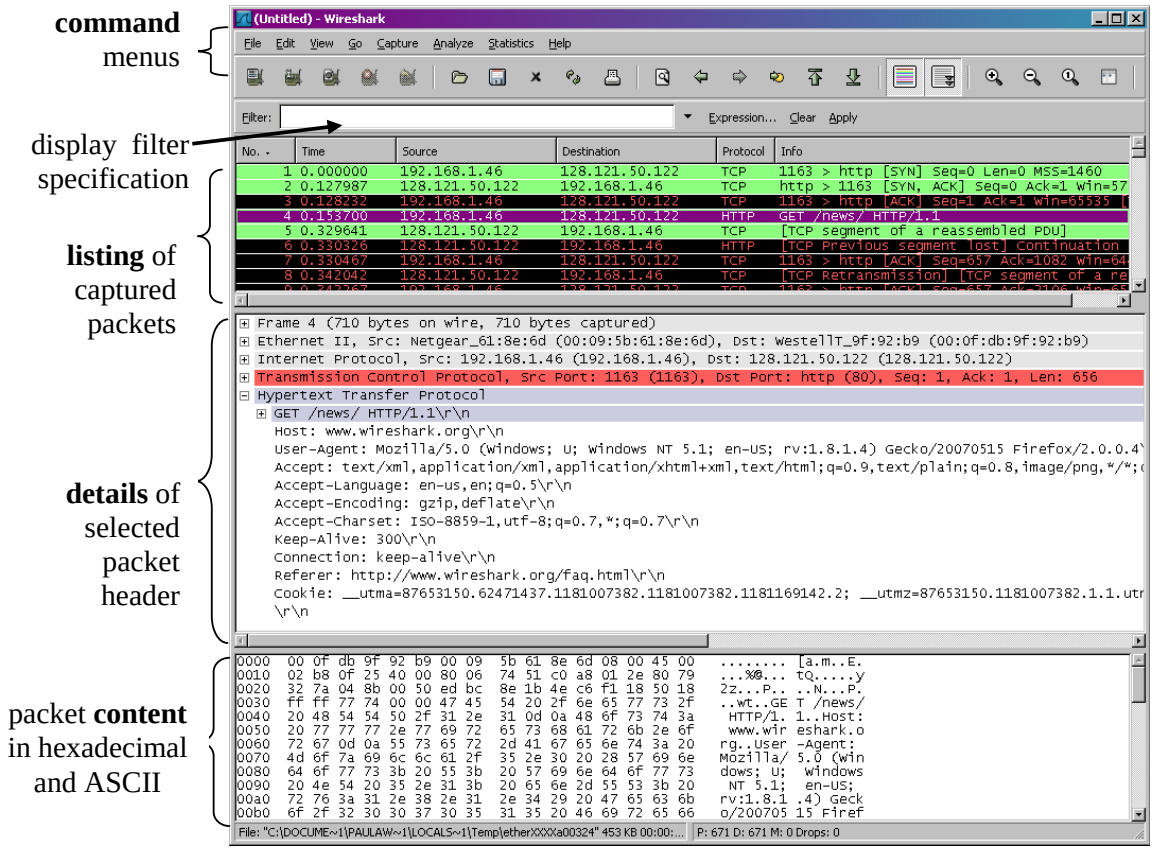

Figure 3: Wireshark Graphical User Interface, during packet capture and analysis

The Wireshark interface has five major components:

- The **command menus** are standard pulldown menus located at the top of the window. Of interest to us now are the File and Capture menus. The File menu allows you to save captured packet data or open a file containing previously captured packet data, and exit the Wireshark application. The Capture menu allows you to begin packet capture.
- The **packet-listing window** displays a one-line summary for each packet captured, including the packet number (assigned by Wireshark; this is *not* a packet number contained in any protocol's header), the time at which the packet was captured, the packet's source and destination addresses, the protocol type, and protocol-specific information contained in the packet. The packet listing can be sorted according to any of these categories by clicking on a column name. The protocol type field lists the highest-level protocol that sent or received this packet, i.e., the protocol that is the source or ultimate sink for this packet.
- The **packet-header details window** provides details about the packet selected (highlighted) in the packet-listing window. (To select a packet in the packet-listing window, place the cursor over the packet's one-line summary in the packet-listing window and click with the left mouse button.). These details include information about the Ethernet frame (assuming the packet was sent/received over an Ethernet interface) and IP datagram that contains this packet. The amount of Ethernet and IP-layer detail displayed can be expanded or

minimized by clicking on the plus minus boxes to the left of the Ethernet frame or IP datagram line in the packet details window. If the packet has been carried over TCP or UDP, TCP or UDP details will also be displayed, which can similarly be expanded or minimized. Finally, details about the highest-level protocol that sent or received this packet are also provided.

- The **packet-contents window** displays the entire contents of the captured frame, in both ASCII and hexadecimal format.
- Towards the top of the Wireshark graphical user interface, is the **packet display filter field,** into which a protocol name or other information can be entered in order to filter the information displayed in the packet-listing window (and hence the packet-header and packet-contents windows). In the example below, we'll use the packet-display filter field to have Wireshark hide (not display) packets except those that correspond to HTTP messages.

Taking Wireshark for a Test Run

Note: For the most part, you will use trace files for the Wireshark assignments. If you are interested in the original Kurose and Ross instructions for 'Taking Wireshark for a Test Run' that includes taking your own trace, see: http://www-net.cs.umass.edu/wireshark-labs/.

1. Download the "gettingstarted_trace" from I-Learn, if you are not running Wireshark on the CSEE Linux servers. (The gettingstarted_trace is also in a zip file with other Wireshark traces that is available on I-Learn). Once the trace is downloaded, save it. Open the downloaded trace in Wireshark by using File -> Open.

   If you are running Wireshark on the CSEE Linux servers, you may load the trace from /home/cs460/Wireshark_traces/GettingStarted_trace.

   To see all the packets in the trace, you may need to clear any filter selection you have may made if you were already experimenting with Wireshark.

2. Take the I-Learn "**Wireshark Getting Started Assignment"** assessment following the instructions in the assessment.

3. Exit I-Learn and Wireshark.