

FIT1047 Applied Session Week 7

NETWORKS: LAYER MODEL AND APPLICATION LAYER

OBJECTIVES

- The purpose of this applied session is getting to know (i) Network layers and protocols, (ii) Addresses at various layers and (iii) some of the networking tools.

INSTRUCTIONS

- For some of the questions, you may have to refer to the pre-class video and associated slides available in the Moodle.
- You may work in a small group.
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Activity 1: Basic Knowledge

Briefly explain the following terms:

1. Bit Rate and Bandwidth
2. Latency
3. Networks Layers
4. Protocol Data Unit (PDU), Encapsulation

Sample Solution:

1. Bit Rate and Bandwidth

Bit rate: the numbers of bits that can be transmitted over a data communications channel per time unit, usually measured in bits per second (or kilobits, megabits, gigabits per second).

Bandwidth: strictly speaking, the width of a range of frequencies (i.e. highest minus lowest frequency). e.g. each channel in WiFi has a bandwidth of 20 MHz. But it's often used as a synonym for bit rate.

2. Latency

The time it takes for a message from being sent to being received. Note that a network can have a very high bit rate but still feel slow: e.g. consider using a satellite connection for a video conference: you can stream very high quality video over the satellite connection, but due to the high latency, you could experience a delay of several seconds, which makes the connection almost unusable for real-time communication. This is also often a problem when playing real-time online video games.

3. Networks layers, PDU, encapsulation

The network layer is the third level of the five layer architecture (TCP/IP Model) and the layer that provides data routing paths for network communication. Data is transferred in the form of packets via logical network paths in an ordered format controlled by the network layer. PDU: Short for Protocol Data Unit. The term is used to describe data as it moves from one layer of the TCP/IP model to another. In this reference, PDU is often used synonymously with packet. Encapsulation is the process of taking data from one layer protocol and translating it into another layer protocol, so the data can continue across a network. For example, a TCP/IP packet contained within an ATM frame is a form of encapsulation.

Activity 2: Using Wireshark

A packet analyser (sometimes also called “packet sniffer”) is a program that can log all packets that are received and transmitted over a network interface. We will be using Wireshark, a very popular open-source tool for packet analysis. You can download it on your own computer from www.wireshark.org, or follow the link provided in the FIT1047 Moodle page (Unit Resources).

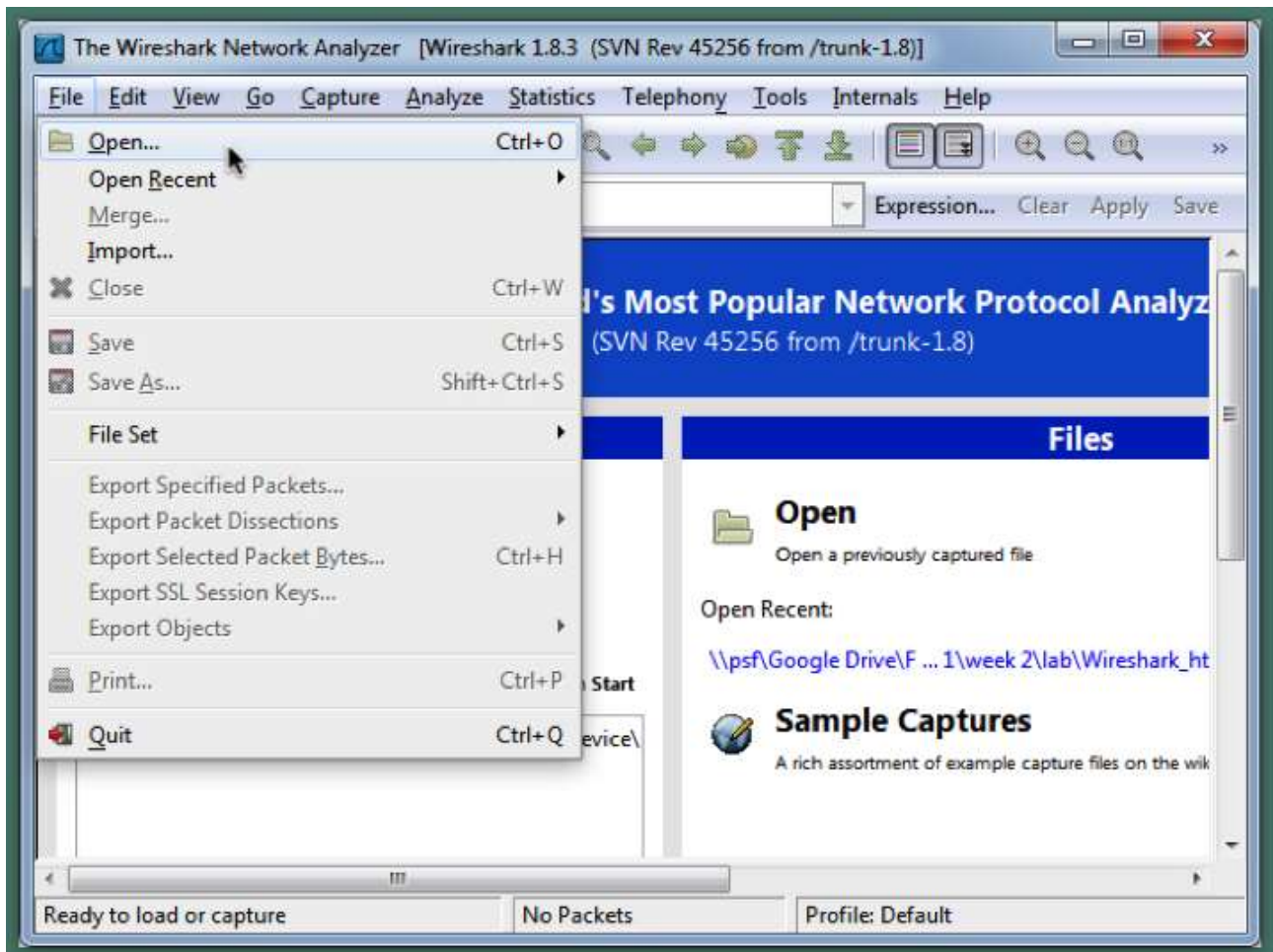


Figure 1: Wireshark File Menu

The packet list pane displays a summary of each packet captured. When you click on a packet here, the other two panes are updated with the details for that packet.

- The packet details pane below shows information about the selected packet.
- The packet bytes pane displays the raw data for the selected packet. It highlights the data for the field that is selected in the packet details pane.

Navigate between the panes and explore the relationships between the displayed pieces of information.

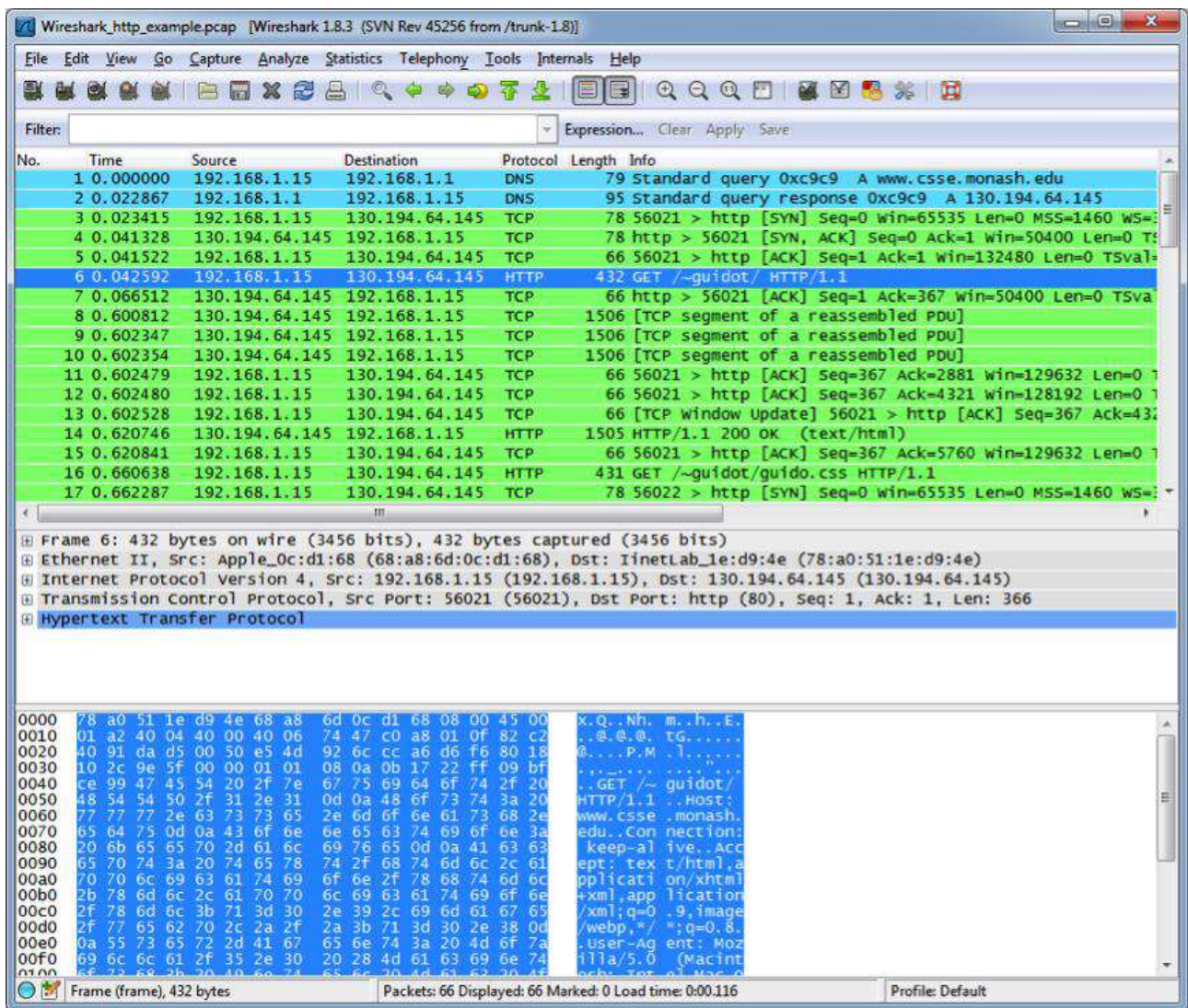


Figure 2: Wireshark Main Window

Activity 3: Analyzing Packets in Wireshark

In this activity, we will analyse a sequence of packets captured on Guido's network at home. You can download the log file that Wireshark produced from the FIT1047 Moodle site (week 7). The file is called "Wireshark_http_example.pcap". The diagram in Figure 3 explains how Guido's computer is connected to the Monash web server.

1. Start Wireshark and load the capture file. After opening the file, the main window should look like the one in Fig. 2.
2. Select "frame" number 6 (as in Fig. 2). This frame shows a request sent from Guido's home computer to the web server at www.csse.monash.edu, requesting his homepage.
3. Familiarise yourself with the three main sections (panes) of the Wireshark window:

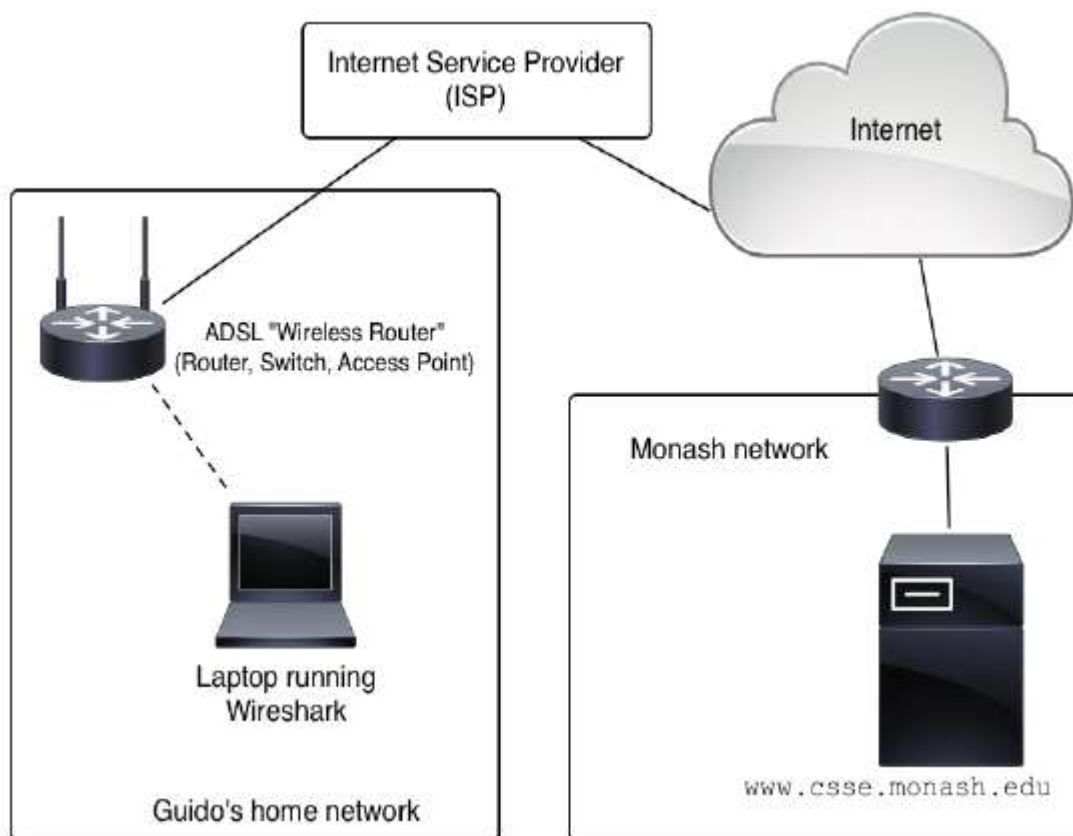


Figure 3: The network where the traffic was captured

4. Click on frame 6.
 - a) How long is this frame in bytes?
 - b) Which application layer protocol does it use?
5. There are five lines in the packet details pane for frame 6, each of which can be expanded by clicking on the "+" or ">" symbol.
 - a) Can you identify what each line they stand for?
 - b) Which protocols are being used?
 - c) What are the names of the PDUs for each protocol?
 - d) Recall that each protocol layer encapsulates the message from the layer above and adds a header. What are the sizes of the headers for each PDU used in frame 6?

Sample Solution:

4. Click on frame 6.

a) How long is this frame in bytes?

Answer: 432 Bytes

b) Which application layer protocol does it use?

Answer: HyperText Transfer Protocol (HTTP)

5. There are five lines in the packet details pane for frame 6, each of which can be expanded by clicking on the "+" or ">" symbol.

a) Can you identify what each line they stand for?

Answer: From top to bottom:

Line 1: the entire frame captured by Wireshark;

Line 2: the data link layer;

Line 3: the network layer;

Line 4: the transport layer;

Line 5: the application layer.

b) Which protocols are being used?

Answer: From top to bottom:

Line 2: Ethernet;

Line 3: IPv4;

Line 4: TCP;

Line 5: HTTP.

c) What are the names of the PDUs for each protocol?

Answer: From top to bottom:

Line 2: Ethernet: frame;

Line 3: IP: packet;

Line 4: TCP: segment;

Line 5: HTTP: message.

d) Recall that each protocol layer encapsulates the message from the layer above and adds a header. What are the sizes of the headers for each PDU used in frame 6?

Answer: You can find the size by clicking on the relevant protocol line and counting the number of bytes highlighted in the bottom pane. Some protocols also tell you the size when you open the details view. Ethernet: 14 bytes; IP: 20 bytes; 32 bytes; HTTP: we can consider the entire contents to be the actual message, there are no additional headers (such as the ones for TCP or IP).