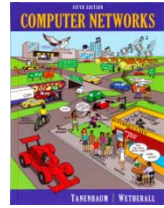


CN5E Labs – Instructor README



Dear Instructor:

These labs provide hands-on exercises to deepen students' understanding of the Internet protocols covered in a networking course. The Instructor version of the lab bundle contains the following files:

1. Instructor REAME [README-instructor.pdf]. This handout of key information to read first.
2. Lab Handouts for various protocols [lab-xxx.pdf]. The lab handouts for students.
3. Traces for various protocols [trace-xxx.{pcap|txt}]. A standard set of traces and associated text files that you may supply to students to let them complete the lab.
4. Solution Handouts for the labs [solutions-xxx.pdf]. The solution handout for each lab.
5. Source for the lab handouts [lab-xxx.docx]. To let you customize your class offering.
6. Source for the solution handouts [solutions-xxx.docx]. To let you customize solutions.

We hope you find them a valuable addition to *Computer Networks*. Enjoy!

Suggested Usage

You can use the labs as follows:

- As part of traditional lab or recitation sections. You can have students work through the labs in pairs to gain hands-on experience with real network traffic.
- As part of an instructor demonstration. You can follow selected lab steps yourself to explore network protocol, letting the students follow along via a remote display.
- As part of homework assignments. You can assign the labs or portions of them for students to do on their own platform and network as part of a class assignment.

You must decide whether students will collect their own trace, using the instructions provided in the lab, or load a previously prepared trace; we supply a standard set of traces for this purpose. When it is feasible, we strongly encourage you to let students collect their own packet traces. Doing so provides a more engaging experience because students learn about their own network. You should be able to use this option for any setting in which you have network connectivity and a fairly standard network setup. Alternatively, by using the supplied traces, you can get repeatable results and work without network connectivity. This can be useful as part of a demonstration. Finally, if grading is a consideration, then we suggest that you supply your own trace. The traces are easy to gather (follow the instructions in each lab, and don't forget to save any associated text files as well as packet traces) and changing the trace is an easy way to partly change the answer key for repeat offerings.

In any setting in which students will do the labs, it is important that you or a teaching assistant work through the labs beforehand to ensure a smooth experience. It is not possible for us to find all issues because there are many different network and platform settings that continue to evolve. Fortunately,

working through these labs is quick and easy for teaching staff. Opting to use the traces that we supply will help to reduce student issues, but we still advise you to test beforehand for remaining issues, e.g., due to changes to future versions of Wireshark.

Platforms, Networks, and Tools

The labs are suited for broad use and can be run on Windows, Mac OS, and Linux platforms. They have been tested with Windows 7 (Service Pack 1), Mac OS 10.7 (Lion), and Linux Fedora Core 13. We do not recommend that you perform the labs on a virtual machine without testing; it is certainly possible with attention to the network configuration of the virtual machine, but we have not tested this setting.

The labs target networks with IPv4 connectivity and work whether or not NAT is used to connect the computer to the network. They have not been tested with connectivity via a VPN or IPv6, though you could readily adapt them to these and other network settings if needed.

To work across platforms, the labs make use of tools that are widely-used and either installed as part of the operating system or freely-available as downloads. Inevitably, there are differences between tools on different operating systems, e.g., the `wget` utility for Windows is replaced with the `curl` utility for Mac. We have noted the differences we know about, but you should expect some local variations.

All of the labs use the Wireshark network protocol analyzer to inspect packet traces. Different labs also use different tools depending on their purpose. Each lab begins by listing the tools that it uses, a small number of which you may need to install. The tools include: `wget/curl` and your web browser to fetch web pages; `ping` and `tracert` to probe network paths; operating system utilities such as `ipconfig`, `ifconfig`, `arp`, `netstat` and `route` to check and manipulate the state of your computer's network interface; `telnet` to send and receive interactive traffic; and `dig` to examine the DNS.

Working through the Labs

Each lab covers a different Internet protocol. We suggest you assign them in the following order:

1. Protocol Layers. Text §1.3 and §1.4. This is the introductory lab that comes first.
2. Ethernet. Text §4.3.
3. 802.11. Text §4.4.
4. IPv4. Text §5.6.1 to §5.6.3.
5. ICMP. Text §5.6.4.
6. ARP. Text §5.6.4.
7. DHCP. Text §5.6.4.
8. UDP. Text §6.4.
9. TCP. Text §6.5.
10. DNS. Text §7.1.
11. HTTP. Text §7.2.4.
12. SSL/TLS. Text §8.9.

However, the labs are relatively independent, and you may choose different orderings to suit your situation. Individual labs can be skipped, other than any dependencies noted above. They may also be taken “top down” instead of “bottom up” after the introductory lab.

Most labs can be completed in a single sitting, though they are rather long to read. To help the reader, we divide each lab into a series of steps that build on each other and use these formatting conventions:

- *Actions that must be taken are given in italics.* This is the absolute minimum an experienced lab taker must read.
- Examples of input and command-line programs are given in computer font. These are commands you will enter into a terminal window or text you will enter into a program's user interface.
- Explanatory text that elaborates the instructions in more detail is given as normal text.
- Background material is given in grayed out type. This material includes descriptions of tools and how to use them that is not specific to the lab and may be repeated across labs. Skip it if you are already familiar.

Instructor Support

The instructor version of these labs includes brief solution sheets, and the Word source for handouts.

Neither of these resources is included with the student version of the labs, which contains only the PDF and supplied traces. Our intent is to provide you with added handouts, and to let you customize the lab and solutions as is useful to you solely for the purpose of teaching students in your class offerings.

As you use these resources, we ask that you take care not to make the solutions or the Word source available to students in electronic form.

Feedback

Please send us tips to streamline these labs for future students based on your experiences. We welcome other feedback, whether corrections, constructive suggestions, or ideas for new labs. Send email to David Wetherall (djw@uw.edu).

[END]