Overview

The course **Protocols and Communication Networks** deals with networking as it appears to professionals in the 21st century. The lectures combine theory and practical examples, with the goal of understanding the contemporary picture.

The course is divided into six chapters:

1. **Engineering Overview of Computer Networking**: Review of basic concepts in networking from the point of view of telecommunication engineering. The order of topics follows the OSI model from the physical layer up to the application layer. Unlike a course in Internet programming, the emphasis is on layers that belong to the operating system.
2. **Access Networks**: Access networks connect the user to the global Internet. To most users, "the network" refers to the immediate access network and the service provided by a remote server. In this chapter, we discuss the aspects of access networks relevant to users at various levels.
3. **IPv6**: Version 6 of the Internet Protocol (IP) was designed to solve various problems associated with version 4 and provides an essential basis for providing advanced networking services.
4. **Basics of Wireless Networking**: For over 25 years wireless networks are part of our day-to-day experience and the basis for mobile communication that has changed many patterns of behavior. Despite the simplicity of using mobile telephones and tablets, the technology behind mobile communication is more complex by several orders of magnitude. This chapter presents a simplified introduction to radio communication and the two principle forms of wireless mobile networking — WiFi and cellular. We will pay particular attention to the common features of the two contexts — the local and global networks.
5. **Congestion and Flow Control in TCP**: Congestion and flow control are basic and essential functions for reliable transport, and for most use cases are implemented in the TCP protocol. These functions add overhead to network operation and in many circumstances degrades the transmission throughput unnecessarily.
6. **TCP over Wireless**: The TCP protocol was designed many years before the introduction of WiFi and cellular networking, and its methods of congestion and flow control are based on assumptions relevant to wired transmission. In this chapter we discuss the implications of TCP for wireless and mobile networks.

The course material combines presentations with full-text written lectures. The presentations provide explanations, illustrations, and basic definitions in short accessible form. Viewing the slides is not a substitute for reading the lectures and doing the exercises. Attempting to learn from just the presentations is not recommended.

Recommendations for self-study

As seen on the syllabus, the course is designed according to weekly subjects and related exercises. An online course is based on the expectation that students at an advanced stage will be familiar with the methods of study that work best for them, can apply the self-discipline required to study at an even pace, and will submit the exercises on their due dates. However, experience shows that the temptation to put off the study of an online course is strong (in the worst case, until the very end of the semester). Giving in to this temptation does not lead to positive results.

At first glance, it appears that there may be **too many topics** to learn in one semester. The impression that no one can acquire full mastery of all the material in each presentation is entirely correct. And there is no expectation of full mastery. The expectation is similar to a course on Java programming, in which the emphasis is on presentation of a general framework and not on memorizing every syntactic structure in every package. After successfully completing the course, students will be able to discuss the significance of each subject and locate the details required for each discussion, in the course material or in external sources. By studying at an even pace and absorbing the material slowly, one comes to see that advanced networking involves a small number of basic ideas with many specific examples. The exercises and old exams provide a reasonable picture of the level of understanding expected in the course.

For each topic, it is recommended to go over the presentations with the lectures open, keeping an eye on the exercise intended to complete the presentation. Some of the topics are easy to grasp from the presentations alone, and in others it is important to read the associated text to understand the context and details.

If anything in the course remains unclear, feel free to email me at martin@hac.ac.il and I will make every effort to answer within 24 hours.