COMP-4621 Course Syllabus

March 24, 2026

1 Course Information

Course Name	COMP 4621: Computer Networking
Prerequisites	COMP-3006
Required Textbook	No textbook required

2 Course Description

Computer networks are pervasive in our every day lives and in particular, the building of the Internet has been one of the most significant events in our technological history. In this course, you will be introduced to the fundamental principles of computer networking. Using the Internet as a primary example of a large-scale network, topics including the design of the Internet, application and transport protocols, congestion control, routing protocols, packet switching and link-level protocols are covered in this course.

Today's networking cannot be considered without examining security issues surrounding it. Thus we will touch on topics of security in order to better understand the implications for networks.

In addition to understanding the principles of networking, in this course you will learn network programming by implementing substantial programs using Python or C/C++. For the low-level network programming we'll be doing, whether you use Python, C or C++ does not make much of a difference.

Finally, please note that this course is not a network administration course. Network administration is fairly trivial once you understand the fundamental computer science taught in this course, but as with all commercial applications, network administration is very dependent on the software and hardware used.

3 Textbook and Materials

For lectures, we will use the following textbook:

Computer Networking: A Top-Down Approach, 8th Edition, by James F. Kurose and Keith W. Ross, Addison Wesley, 2020, ISBN-13: 9780135928615

You may be able to get by with an older version of this book (7th or even 6th edition), but there is new material in the latest book edition. For any homework assignments or labs,

I will provide the questions, so you don't need to worry about getting the questions from the book.

You will need a good internet connection and a laptop that meets DU specifications. (See `https://www.du.edu/it/support/how-to/students/laptops`). For technical support in using Canvas, please go to `http://otl.du.edu/knowledgebase/canvas`

3.1 Other Stuff

- Reliable access to a computer and the Internet. If you are online you can turn your homework in from wherever in the world you are!
- Wireshark, which is freely available. You will need to install this and make sure it's working on your computer. I'm assuming as computer science or computer engineering majors, you will have the ability to download software and install it without the need for technical support. Seriously, if you can't get the software installed, you're not ready for this course, it's far more advanced than that!
- git: We will be using git, a source code version control system. You will be required to set up and use a git repository to turn in the programming assignments.
- Canvas: We will be using the Canvas platform for most of the course, including course material and communication. Be sure you are able to access Canvas.
- CLion/PyCharm: This is not a requirement, but I will generally be programming in-class examples in the CLion IDE from JetBrains OR the PyCharm IDE from JetBrains. I like the JetBrains IDEs and they are free for you to use if you sign up with your du.edu email address.

4 Course Learning Objectives

By the end of this course, you should be able to:

- Identify and describe the layers of the network stack.
- Describe how the Internet works.
- Explain and calculate sources of delay on a network.
- Design and develop an application-layer protocols appropriate to a particular application.
- Explain application-layer protocols such as HTTP, SMTP, FTP, DNS, and peer-to-peer applications.
- Describe the differences between the transport layer services.
- Choose a particular transport level service based on application needs.

- Calculate parity, checksums and CRCs.
- Explain how reliable transport works and be able to develop a reliable transport service.
- Calculate the performance of a reliable transport protocol.
- Identify sources of congestion and explain the costs of congestion control.
- Describe the services provided at the network level.
- Compare the differences between circuit switching and datagram networks.
- Describe the hardware of a router and explain where queueing occurs.
- Compare and contrast IPv4 and IPv6.
- Calculate the routing tables generated by distance vector and link-state algorithms.
- Explain how BGPv4 works.
- Describe the services that the link layer provides.
- Explain the costs of link-layer protocols for multiple-access links.
- Calculate the timings required for different link-layer protocols and the effects on link distances.
- Explain everything that happens when a simple web-request takes place on the entire network stack.
- Describe how DNS queries and ARP requests work.
- Compare and contrast WiFi and cellular link protocols.
- Describe symmetric and public-key cryptography, message integrity and digital signatures, and how SSL and PGP secure TCP and email respectively.

5 Course Outcomes

The high level objectives of this course are as follows:

1. Give students a thorough understanding of computer networking and computer networks.
2. Students will be able to write networking clients and servers utilizing both TCP and UDP, in a reasonably low-level language (Python or C).
3. Provide the foundations for network security, understanding the networking stack from the bottom up, and be familiar with tools for analyzing network traffic (e.g., Wireshark and/or tcpdump, etc.)

6 Program Level Goals

Courses in the cyber security MS program, including this one, should contribute to overall program level outcomes for students. This course contributes to the following program level goals:

1. **Understand how modern operating systems work (with a leaning towards Unix style OSes).** Be familiar with their security components (identification, authentication, access controls, auditing) and how to configure them.
2. Utilize and comprehend at least one compiled programming language (C/C++) and **two or more interpreted/scripting languages (Bash, PowerShell)**.
3. Demonstrate a **foundational understanding of networking** and network security. **Networking concepts like the 5-layer Internet protocol stack and their components**, and network security concepts including the purposes of firewalls, IDSes and SIEMs are deeply understood.

7 Knowledge Units

This course covers the following NSA cybersecurity Knowledge Units:

1. IT Systems Components (ISC, Foundational CDE)
2. Basic Networking (BNW, Core Technical CDE)
3. Advanced Network Technology and Protocols (ANT, Optional KU)
4. Systems Programming (SPG, Optional KU)

8 Attendance Policy

Regular attendance is expected. Students are responsible for all material covered in class, including announcements and handouts.

9 Academic Integrity

All work submitted for this course must be the student's own original work. Any instance of plagiarism or cheating will be dealt with according to the university's academic integrity policy. Refer to the Student Rights and Responsiblities, as well as the University of Denver Student Honor code, here: `https://studentaffairs.du.edu/student-rights-responsibilities`

10 Disability Services

If you have a disability that may affect your ability to complete the work for this course, please contact the Disability Services office at: `https://studentaffairs.du.edu/disability-services-progr`