CS 775
Spring 2026
Online

Course Description: The purpose of this seminar course is to provide a solid foundation for the network professional. While CS 535 and CS 625 introduce the basic networking concepts, this course provides the deep understanding that an engineer involved in developing Internet products or services or involved in network operations will need to keep current with. This course goes into much greater depth with the topics that tend to be counter-intuitive or plagued with myths such as naming and addressing, synchronization, congestion management and resource allocation (routing) and how these topics are important in different environments, such as datacenters and mobile networks. This is a seminar course using assigned readings from the literature. It requires considerable class participation, both in presenting material and discussing it. The topics will provide a strong foundation in networking and Internet architecture; the nature of data transfer protocols, including TCP, SCTP, QUIC, and IPv6; a deep look at network traffic management with an emphasis on protocol-independent hardware for Deep Packet Inspection (DPI) and congestion management. The course will also go into some detail in how these topics are applied to datacenters and clouds, which have very different requirements, as does mobility.

Prerequisite: CS 575, CS 535 or CS 625.

Office Hours: Contact by email to arrange a time. Zoom is available.

Read and familiarize yourself with this whole document, not just the schedule.

Schedule (none of this cast in concrete, if we want to take longer on a topic we will.)

Topic 1 – Introduction, Architecture and Principles *(2 weeks)*
22 Jan
29 Jan

Topic 2 – Data Transfer Protocols and Naming and Addressing *(3 weeks)*
05 Feb
12 Feb
17 Feb NO CLASS?

Topic 3 – Congestion Management *(2 weeks)*
26 Feb
05 Mar
12 Mar No Class Spring Break

Topic 4 – Resource Allocation *(Sizing Buffers, Programmable Forwarding, etc. (2 weeks)*
19 Mar
26 Mar

Topic 5 – DataCenters and Clouds *(2 weeks)*
02 Apr
09 Apr

Topic 6 – **Mobility** *(2 weeks)*
16 Apr
23 Apr

Project Presentations – Wrap-up
30 Apr

With a small class attendance is essentially mandatory. Other than getting things started and covering material some may not have been exposed to, this will be a seminar course, not a lecture course. Online sessions will not be recorded.

Textbooks
There is no textbook for this course. There will be readings taken from the literature, which are posted on Blackboard.

Course Mechanics

- Grading: The grade in this course will be derived from Class Participation and Student Critiques of the Studied Papers, Class Project, and possibly a Final Exam.

- Assignments: There will be approximately six assignments to analyze the assigned papers in each Topic. Late assignments will be penalized as appropriate. You are encouraged to use the discussion board in Blackboard to ask questions and discuss the topics. With such a small number class participation is going to be very important.

Projects
By the end of Topic 3, we will have discussed the common structures in protocols and developed a general model of a layer. For a project, it is preferred that you chose a topic close to the topics in this course. For example, a protocol or group of protocols from the lower layers that identify and document the mechanisms and policies in the protocol, what aspects are error and flow control and what aspects are relaying and multiplexing, does this protocol follow the structure outlined in class? If not, how does it differ, why does it differ, and should it? Does your example contradict the theory? Is the protocol wrong or is the theory wrong? If you choose a protocol that was discussed in class, then you must go well-beyond what was covered, e.g., actually defining the policies that the

protocol uses. I can provide a list of the policies. There are a raft of issues in IPv6 to discuss.

Possible topics might include:
Various protocols, such as 802.11, SCTP, QUIC, IPv6, Segment Routing, Bluetooth, X.25, HDLC, Ethernet and its LLCs, Transaction Processing, MPLS, etc. A specific aspect of networking: error detection/correction, flow control, multiplexing, re-transmission strategies, routing, congestion control, wireless protocol performance, distributed algorithms, updating multiple copies, problems found in specific environments, such as datacenters, clouds, process control, real time environments, etc. The impact of Watson's result on any of these, especially selective ack.

Projects on security tend to be discouraged. Many of you will be pursuing a security concentration. You will be taking other of security courses. Use those ideas for a project there. This is an opportunity to broaden your knowledge, use it! ;-) However, there are security projects that would be interesting for the class, so run the idea by me.

The project paper should be a minimum of 10-pages *single-spaced not counting a cover page, abstract, or a table of contents.* A 10-page paper with any of these will lose points. (A table of contents for a 10-page paper is ridiculous!) If you use an AI tool, cite it as a reference. Also, the project will include a presentation to the class of 20 minutes or so of the major points of the project. The project is graded on its content, not its appearance and how well concepts from the course have been applied. While figures can be useful and even necessary, the use of content free figures to take up space is discouraged. Generating an outline is key, not only to organize your thoughts but I might be able to suggest sources.

Administration
Email: You should periodically check your BU email for unexpected occurrences like errors in assignments, cancellations, etc. If you normally use a different email address, it is probably wise to configure your BU email to forward to that email Check blackboard frequently as well. Questions via email are always good. If the question/answer has general interest, I will answer you but probably ask you to bring it up in class; if the solution is very involved, we may need to go over it in person.

Blackboard Ultra: We will use Blackboard (learn.bu.edu). I will use it to post class notes, lab and homework assignments, homework solutions, and other course information.

- **Incompletes**: Incompletes will only be granted in accordance with university policy, which (broadly) requires a major crisis near the end of the semester.

- **Academic Honesty**: Please read the university academic code of conduct. If something is not clear, then ask. In particular, plagiarism is regarded as a serious offence and students engaging in this activity will be reported. If you use a source, cite it. (Not related to academic Honesty, but germane. I do not consider wikipedia an authoritative

source on any subject and certainly not ChatGPT or similar LLM. It may be used to find more primary sources or cite it to illustrate opinions. But it cannot be considered definitive.)

- **Instructer Errosr**: Don't be shy! If you see me make a mistake, please let me know right away. If you are not sure, that's even better – it will give me a chance to clarify something. Class lecture is a test to see if you are listening. ;-)

Keys to Success in this (and most other) Course(s)

Do the readings*!* Work out the examples as you read. If you do not believe that you completely understand something, try inventing and solving your own problems. If that doesn't work, come see me! And we will figure it out.

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How do you know that you know the material**?** A good metric is whether you would feel comfortable standing in front of a class explaining it. Another is whether you think that you could explain it to a job interviewer!