Northeastern University

TELE 5360 – Internet Protocols and Architectures

Fall 2024

<u>Syllabus</u>

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Office Hours:	Sat 12 pm – 1 pm (online), or by appointment

Lecture Information: Sat 1 pm – 4:30 pm (NUFlex, 005 SL)

TAs: TBA approximately 2nd week of the semester

Course Description

This course provides an in-depth treatment of protocols used in the Internet, wireless access and enterprise networks. Topics covered include protocols for network layer QoS (including DiffServ, ECN, RSVP, MPLS); protocols for security, including both access control and network level security (e.g. X.509, SSL/TLS, IPSec, IKE, EAP); protocols for inter-domain routing (BGP); protocols to support multicast, broadcast and streaming applications; protocols to support host mobility, large server deployments, content distribution and enterprise networks (VLANs etc); and protocols to support IPv6 (e.g. address assignment) and its interoperability with IPv4. Also covers network design architectures for cloud computing, data centers, content distribution, layer 2 networks, storage networking, etc.; and discussion of general scaling issues for large networks.

The course identifies and studies common architectural components, protocol mechanisms, and design/implementation principles and trade-offs based on scaling, performance, and security considerations. In addition, we study – as required – Bash / Linux scripting and Linux tools, and provisioning of public cloud computing infrastructures using automation and scripting techniques.

The format is based on in-class lectures, readings, study/analysis of technologies, and active project work, all of which require active student participation. In-class study is reinforced through hands-on assignments and projects involving design, simulation, and packet analysis using networking tools, and case studies. Students will also make summary/analysis presentations based on topics selected from the syllabus.

Students who enroll in this course should already have completed a graduate course in data networking. Students must be prepared to work in teams on projects to research, analyze and make in-class presentations. Performance on homework assignments, projects, assigned study and classroom participation will serve as the basis for final grade.

Prerequisites

TELE 5330 with a minimum grade of B, plus permission of instructor and program director.

Prescribed Text

There is no single prescribed text for this course. The course is taught using a variety of assigned readings which will be provided by the instructor. Please refer to the TELE 5330 textbook for the modules on security and multimedia networking.

Course Layout

This semester, the course will run as a new series of modules, each 1-2 weeks long. Modules may include topics such as:

- Multimedia Applications – video streaming, VoIP, RTP, support for QoS, DiffServ/IntServ, ECN
- Network Security - encryption, integrity, authentication protocols, key mgmt, SSL/TLS, IPsec, 802.11i
- Large Scale Switched and Routed Networks
- Data Center Networking Architectures and Protocols
- Networking for virtualization
- Basics of SDN – generalized forwarding, SDN controllers & OpenFlow (there's a semester-long course on SDN is you want to explore this topic in depth)
- Interdomain routing – BGP; multicast addressing & routing
- Enterprise networking and security - MPLS, VPNs;
- Linux scripting for automation and administration
- Cloud computing infrastructure provisioning and automation
- Storage Networking technologies – FCoE, ISCSI, SMB/CIFS

Each module will be accompanied by assignments, and/or projects or analysis work, as appropriate. These, along with midterm and final exams, will serve as the basis for the overall course grade.

Grading

Regular homework assignments, projects, exams, and presentations/term paper will serve as the basis for grades assigned in this course. Homework will be due at the end of the lecture during the week for which it is due. The evaluation criteria are (tentatively):

Assignments and Projects	45%
Presentations and Analyses	20%
Quizzes and Exams	35%

Class Participation is important. Though a percentage of your grade is not directly attributed, it is taken into account as appropriate.
Note also that, beginning Fall 2024, we are using Qwizly to take class attendance. Your regular attendance in class is paramount. Please refer to program policy for further details.

Course Website

The Northeastern Canvas course environment, accessible at https://canvas.northeastern.edu/login serves as the conduit for class prep material, discussions, and assignments/submissions. In addition, we might use tools like Teams, Slack and Piazza for communication between instructor, TAs and students.

Academic Integrity

A commitment to the principles of academic integrity is essential to the mission of Northeastern University. The promotion of independent and original scholarship ensures that students derive the most from their educational experience and their pursuit of knowledge. Academic dishonesty violates the most fundamental values of an intellectual community and undermines the achievements of the entire University.

As members of the academic community, students must become familiar with their rights and responsibilities. In each course, they are responsible for knowing the requirements and restrictions regarding research and writing, examinations of whatever kind, collaborative work, the use of study aids, the appropriateness of assistance, and other issues. Students are responsible for learning the conventions of documentation and acknowledgment of sources in their fields. Northeastern University expects students to complete all examinations, tests, papers, creative projects, and assignments of any kind according to the highest ethical standards, as set forth either explicitly or implicitly in this Code or by the direction of instructors. Go to http://www.northeastern.edu/osccr/academic-integrity-policy/ to access the academic integrity policy.

Student Accommodations

Northeastern University and the Disability Resource Center (DRC) are committed to providing disability services that enable students who qualify under Section 504 of the Rehabilitation Act and the Americans with Disabilities Act Amendments Act (ADAAA) to participate fully in the activities of the university. To receive accommodations through the DRC, students must provide appropriate documentation that demonstrates a current substantially limiting disability. For more information, visit http://www.northeastern.edu/drc/getting-started-with-the-drc/.

Diversity and Inclusion

Northeastern University is committed to equal opportunity, affirmative action, diversity and social justice while building a climate of inclusion on and beyond campus. In the classroom, members of the University community work to cultivate an inclusive environment that denounces discrimination through innovation, collaboration and an awareness of global perspectives on social justice.
Please visit http://www.northeastern.edu/oidi/ for complete information on Diversity and Inclusion.

Title IX

Title IX of the Education Amendments of 1972 protects individuals from sex or gender-based discrimination, including discrimination based on gender-identity, in educational programs and activities that receive federal financial assistance. Please visit www.northeastern.edu/titleix for a complete list of reporting options and resources both on- and off-campus.

Northeastern's Title IX Policy prohibits Prohibited Offenses, which are defined as sexual harassment, sexual assault, relationship or domestic violence, and stalking. The Title IX Policy applies to the entire community, including male, female, transgender students, faculty and staff. In case of an emergency, please call 911.

Student Responsibilities

- **This is a highly hands-on, practically driven course covering advanced topics for which there are no convenient textbook materials or references. Topics that I present and discuss in some detail in class require even further focus from you outside class, including both study and hands-on work.** You are responsible for studying all material covered in class, in assigned reading and through external assignments, whether formally or informally assigned. You are also responsible for doing the associated study and hands-on work outside class as mentioned above.
- Reviewing, in advance, material to be covered in each lecture, and being prepared to participate in discussions about the material in class.
- Checking Canvas regularly and frequently (preferably morning and evening) to receive communication about the course, including assignments etc.
- A quick word about e-mail correspondence: I receive a lot of e-mail every day. Your correspondence is important to me. To ensure that I notice your e-mail quickly and also to reduce the chances of your e-mail being marked as spam and mistakenly deleted, please prefix 'TELE5360:' to the subject line of your message.

Safety and Health

During this unique time, there are some additional points regarding safety and health that must be clear.   We follow federal, state and university guidance, which may change with time.
- If you feel unwell, please stay home. I will do my utmost to support your learning in cases where someone needs to attend remotely.
- Please let me know if you are unable to come to a lecture. If you're missing the lecture because of an interview or other non-health related concern, please do let me know. If you're going to miss the lecture because you're not feeling well, you don't need to give me (or anyone else other than the medical staff at Northeastern) any details about the medical issue.

- We'll discuss this more in class, and we can adjust our mode of teaching and learning as warranted.