ECE 742 – High Speed Networks

Department of Electrical and Computer Engineering
George Mason University, Fall 2020
(tentative syllabus)

Class meetings: Wednesdays 4:30 – 7:10 pm in Enterprise Hall 173

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Course Description: The exponential growth in the Internet and its expansion towards the Internet of Things and tactile Internet has accelerated the emergence and deployment of high speed network architectures and protocols over both wired and wireless transmission media. High speed network networks have evolved in their capability to provide high bandwidth and low latency performance to multimedia applications from end-to-end across heterogeneous wired/wireless networks. This course focuses on the study of state-of-the-art in high-speed network architectures, protocols and algorithms. The main goals of the course are:

- to provide in-depth understanding of the key issues in the design and performance of architectures, protocols, and algorithms for high speed networks;
- to provide broad exposure to cutting-edge technologies and research on high speed networks.

Topics include optical network architectures, switch and router architectures, traffic management, network resource allocation, congestion control and routing, quality-of-service provisioning, network performance evaluation, network management, software-defined networking (SDN) and network function virtualization (NVF), cloud and edge computing, high speed wireless networks including 5G and beyond, tactile Internet, quantum networks and the quantum Internet. The Mininet network emulator platform (see `http://mininet.org`) will be used to provide students with hands-on experience in the implementation of network architecture principles.

Course website: Log in to your account on `http://blackboard.gmu.edu`

- Log into Blackboard using your GMU email account credentials.
- Assignments, solutions, announcements, and other course materials will be posted on Blackboard.
- We will be using Piazza for online class discussion. The system is highly catered to getting you help fast and efficiently from classmates and myself.

Textbook: No textbook is required. Class notes and supplementary material will be made available to students via Blackboard.

Recommended Prerequisites: Students should have a background in computer networks at the level of ECE 542. Knowledge of probability at the level of ECE 528 will be helpful for topics related to network performance evaluation. A basic knowledge of computer programming in a high-level language will be helpful for working with the Mininet network emulator.

Grading (tentative):

- Homework/Class Participation = 10%, Mininet Labs = 15%, Term Project = 25%, Midterm Exam = 20%, Final Exam = 30%.

Homework Assignments

- Homework problems related to the lecture material will be assigned weekly.

Mininet Lab Assignments

- Several lab-type assignments using the Mininet network emulator will be given.

Term Project

- The term project can be done individually or in a group of 2-3 students on a topic related to high speed networks.
- The term project deliverables consist of a report and a class presentation.
- The term project can be used to fulfill the M.S. Scholarly Paper requirement (ECE 797), but must be done individually in this case.

Midterm Exam: Wednesday, Oct. 28, 2020 (in-class, 1.5 – 2 hours).

Final Exam: TBD

Course Schedule:

Week 1:	Aug. 26	Overview of High Speed Networks
Week 2:	Sep. 9	Optical Network Architectures
Week 3:	Sep. 16	Optical Network Architectures
Week 4:	Sep. 23	Software-Defined Networking
Week 5:	Sep. 30	Software-Defined Networking
Week 6:	Oct. 7	Switch and Router Architectures
Week 7:	Oct. 14	Traffic Management and Resource Allocation
Week 8:	Oct. 21	Congestion Control and Routing
Week 9:	Oct. 28	Midterm Exam (in-class) Network Performance Evaluation
Week 10:	Nov. 4	Cloud and Edge Computing
Week 11:	Nov. 11	High Speed Wireless Networks and Tactile Internet
Week 12:	Nov. 18	Quantum Networks and Quantum Internet
Week 13:	Nov. 25	No Class (Thanksgiving Recess)
Week 14:	Dec. 2	Term Project Presentations