Instructor: Prof. Xi Zhang, Department: Electrical & Computer Engineering, E-mail: xizhang@ece.tamu.edu, Telephone: 979-458-1416

Class meeting time/room: Tue. & Thur.: 02:20PM-03:35PM ZACH 322

Prerequisite: This course is open to all engineering or other disciplinary graduate students who are interested in Internet protocols and modeling. Desirable prerequisites of the course are basic knowledge of Computer Networks and computer programming, or consent of the instructor.

Course Description: Today's Internet represents a new information technology revolution. This course aims at equipping graduate students with not only a wide spectrum of Internet protocols that make it work, but also the analytical capabilities to evaluate the performance of complex Internet protocols. It will focus on two important, and also closely related, aspects of the Internet protocols - (1) principles, design, and implementations, and (2) performance modeling and analysis. Specifically, this course will cover the core components of Internet protocols, such as transport (TCP, UDP), network and routing (IP, RIP, OSPF, EGP, BGP-4, etc.). Advanced topics include QoS architectures for the Internet (Diff-Serv, RSVP, MPLS, RTP) and TCP-Friendly Rate-Based Flow Control for Continuous Media (CM); Queuing theory and delay and loss modeling; TCP over wireless networks and Mobile IP; Multicast Delivery: SRM, IGMP, PIM, MBONE; Flow/Error Control for Multimedia Streaming and Data Dissemination; Multicast Flow/Error-Control Signaling Retransmission-Scoping; Channel-coding (RS & LDPC codes) based multicast flow/error control over wireless networks. Complementing the descriptions of Internet protocols, this course will also introduce a number of emerging performance-modeling and analysis techniques to quantitatively characterize the Internet protocols, including the deterministic, stochastic, and optimization-based approaches. The emphasis is on how to draw the tractable mathematical models from the complex Internet protocols. While these analytical techniques are developed for Internet protocols, they are also applicable to evaluating other dynamic systems.

Course Contents Outline:
Overviews of Internet and its fundamental architectures
Internet protocol stack and UDP, IP, RIP, OSPF, EGP, BGP-4
Principles of TCP/IP protocols including TCP-Vegas/Reno, etc
Rate-based versus window-based flow control and AQM
Coupled versus decoupled flow and error control
Fluid analysis of rate-based flow control scheme
Fluid analysis of error control scheme and modeling
TCP-friendliness and compatibility, fairness, and modeling
Queuing theory and network delay and loss modeling
Wireless Internet over fading channel modeling
Multimedia quality of service (QoS) provisions over wired/wireless networks
Multiple Protocol Label Switching (MPLS) based QoS
Channel-coding (RS & LDPC) based multicast flow/error control
Multicast service over mobile wireless networks & Internet Mbone
Optimization based flow control and modeling --- duality principles
Grading Policy:
Examinations: One Midterm Exam (20%); 
One Final Exam (20%)
Other Assignments: Homework (20%),
Projects (40%)

Course Textbooks: I will use multiple books as references for this course. A partial list of 
references is listed below. Handouts and classical & recent journal/conferences papers will also be 
distributed to serve as course references.

2) “Communication networks, fundamental concepts and key architectures”, by Leon-Garcia & 

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Honor System. Students will be required to state their commitment on examinations, research papers, and 
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“On my honor, as an Aggie, I have neither given nor received unauthorized aid on this 
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