General Course Information:

ELEN E6767x or y: INTERNET ECONOMICS, ENGINEERING AND THE IMPLICATIONS FOR SOCIETY

Instructor Information

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Prerequisites

Recommended preparation: CSEE W4119 or E6761, ability to comprehend and track the development of sophisticated mathematical models and analyses of economic and network interdependencies in the Internet and industry. Knowledge of basic microeconomics and communication network engineering, including models, their analyses and optimizations. A keen interest and desire to learn about the economics of markets enabled by the Internet, applications of economic principles in communications, industry and regulations.

Course Description

The Internet has become an integral part of modern life. The goal of the course is to provide fundamental understanding of the workings of the Internet and its societal impact, and this requires combining elements of economics, engineering, and the theory of organizations. Course topics include various models of the communications industry, market structures in which subscribers, service and content providers are players, network engineering, and regulation. Mathematical models and analyses are used extensively as tools for understanding. Future research directions and open problems are highlighted.

The course starts with basic microeconomics of pricing, market structures, i.e., competitive, oligopoly and monopoly, social welfare maximization and the theory underlying regulations of large firms with special attention to the Internet. This is followed by game theory concepts, revenue allocations in network coalitions, ISP settlements, and network externalities, which lead up to the role of the Internet in two-sided markets, i.e., platform economics, that are ubiquitous today. Also covered are economic principles in networking and network design, which includes decentralized vs. centralized resource allocation, “price of anarchy”, and the “tragedy of the commons”. Models are developed and analyzed to understand organizational inter-working in content delivery networks, environment protection and the deregulated electric power industry. Students do projects researching and applying concepts learnt in the course to topical issues, such as the regulation of Big Tech, privacy protection and the societal impact of automation. A review of approaches taken by governments and regulators around the world concludes the course.

Course requirements: Two papers; project with oral presentation; homework
Approximate schedule:
Weeks 1-3: Basic Economics, including Pricing, Fairness, Efficiency, and Stability; Market Models; Natural Monopoly and Regulation
Weeks 4-6: Internet - Fundamental Models, Relations and Structures: Network Externalities; Two-Sided (Platform) Market Economics
Weeks 7-8: Applications of Economic Principles in Networking (e.g., Coalitions, Core of the Game, Shapley Value, Network Control), Environmental Policy, Deregulation in Electric Power Industry
Week 9-10: Students’ presentations on projects
Week 11: Topics in Economic Principles in Internet Engineering (e.g., Content Delivery)
Week 12: Societal, Industry and Network Issues in Net Neutrality
Week 13: Approaches to Internet Governance from around the world

Grading policy:
10% active participation
20% homework
20% mid-term paper
25% project and oral presentation
25% final exam paper
For CVN students, the “active participation” component is eliminated, and its percentage is distributed equally over the remaining components.

Reading:
Basic Communication Network Economics, Pricing & Regulation

Review of basic economic concepts: utility, demand, consumer’s surplus, social welfare, monopoly behavior, price discrimination


Impact of Monopolies and Regulations


Network Coalitions, Cooperation and Revenue-Sharing Concepts from Game Theory

M.O. Jackson, “Allocating the Value”, Sec 12.1.2 in “Social and Economic Networks”, Princeton University Press


Internet Models: Network Externalities, Two-Sided Markets


Economic Principles in Networking, Environmental Policy, Power Industry, the Internet


D. Autor, “Externalities, the Coase Theorem and Market Remedies”, MIT, 2010


D. Mitra and A. Sridhar, ”Consortiums of ISP-Content Providers Formed by Nash Bargaining for Internet Content Delivery”, Proc. IEEE INFOCOM 2019

Projects Concerning Society and the Internet

(i) Is wealth inequality a grave social problem, and, if so, what remedial actions should be taken?
(ii) Is the impact on society and the workforce of automation and AI going to be severe, and, if so, what action should be taken in the short and long terms?

(iii) Should the balance of environment protection be tilted more towards market-based mechanisms or by rules and regulations set by Congress and government agencies?

(iv) Do anti-trust laws and regulations need to be updated to address societal interests with the growth of Big Tech?

(v) Do the nation’s laws governing social media require updating?

(vi) As AI and Big Data become more prevalent in society, should the ethics of AI theory and practice be examined more closely, and, if so, where should the priorities lie?

Societal, Industry and Network Issues in Network Neutrality


Industry Structure, Approaches from Around the World

“Next Generation Connectivity: A review of broadband Internet transitions and policy from around the world”, Berkman Center, Harvard University, Feb 2010

Stokab, “Stockholm IT-Infrastructure”, 2012