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. Interest in the economics of markets, applications of economic principles in policy and regulations for the Internet, environment and industry, and their societal impact.

Course Description

The Internet has become an integral part of modern life and also an essential enabler of technological innovations. Its future is the subject of intense public interest, e.g., Net Neutrality, in which engineering and economics are intertwined. The goal of the course is to obtain a fundamental understanding of major issues involving the Internet, and also related societal topics, by combining knowledge of economics, networks, and industry structure. Course topics include pricing for various models of the communication industry, market structures in which subscribers, bandwidth providers and content providers are players, network engineering, regulation and also longer-term issues, such as investments in the infrastructure of the future Internet. Mathematical models and their analyses are basic tools. Future research directions and open problems are highlighted.

The course starts with basic microeconomics of pricing, market structures, e.g., competition and monopoly, and reviews of past regulatory approaches to monopolies in the communications industry. This is followed by game theory concepts, methods and analyses of revenue allocations in network coalitions, ISP settlements, network externalities, two-sided markets and their ubiquitous presence in the Internet. Also covered are economic principles in networking and network design, decentralized vs. centralized resource allocation, “price of anarchy”, “tragedy of the commons”, and congestion control. The methodology developed is examined in case studies of environmental policy and the deregulated electric power industry. Societal and industry implications of future Internet evolution are examined. Students do projects researching topical issues, such as Net Neutrality, that concern the Internet, and their societal impact. A review of approaches taken by governments and regulators around the world concludes the course.
Course requirements: Two papers; project and oral presentation; homework

Approximate schedule:
Weeks 1-3: Basic Economics, including Pricing, Fairness, Efficiency, and Stability; Market Models; Natural Monopoly and Regulation  
Weeks 4 - 5.5: Internet - Fundamental Models, Relations and Structures: Network Externalities; Two-Sided (Platform) Market Economics  
Weeks 5.5 - 7: Economic Principles in Networks (e.g., Coalitions, Core of the Game, Shapley Value, Routing, Centralized vs. Distributed Control), Environmental Policy, Power Industry  
Week 8 - 9: Students’ presentations on projects  
Week 10: Topics in Internet Engineering (e.g., content delivery)  
Week 11 - 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

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


M. Armstrong, “Competition in Two-Sided Markets”, May 2005


Economic Principles in Networking, Environmental Policy, Power Industry


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


Topics in Internet Engineering


Case Studies Concerning Society and the Internet

(i) Should “Congestion Pricing” be introduced in New York, as has been proposed? It has been implemented in some mega-cities, such as London.

(ii) Are corporate incentives, such as the multi-billion dollar tax break offered by New York to Amazon, and by Wisconsin to Foxconn, beneficial to local society?

(iii) Should the advertising-based model for “free” search (e.g. Google) and social media (e.g., Facebook) be scrapped, and replaced by subscription-based models?

(iv) With the rapid growth of big data, there are now Internet companies holding massive amounts of data and information on citizens’ preferences, activities, way of living, etc., which poses a growing problem in the areas of privacy, discrimination, and competition. Is there a need for accelerated public scrutiny, government oversight and new laws on data monopolies? Should economic instruments have a policy role?

(v) Should our environment be protected by market-based mechanisms or by rules and regulations set by Congress and the government agencies?

(vi) The impact of automation and AI will lead to a sharp reduction on the size, and on the makeup of the future workforce. How should society react?

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
