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 debates, e.g., Net Neutrality, in which engineering and economics are intertwined. 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. The goal of the course is to obtain a fundamental understanding of major issues of current interest by drawing on knowledge of networks and micro-economics, as well as industry structure. 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 revenue allocations in network coalitions, related game theory concepts, ISP settlements, network externalities, two-sided markets and their ubiquitous presence in the Internet. Next, economic principles in networking and network design, decentralized vs. centralized resource allocation, “price of anarchy”, “tragedy of the commons”, and congestion control. Also, applications of economic principles to environmental policy and the power industry. Societal and industry implications of Internet evolution. Students do case studies of topical industry and Internet issues. The course concludes with a review of approaches taken by governments, regulators around the world.

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: Topics in Internet Engineering
Week 9: Students’ presentations on Case Studies
Week 10 - 11: Societal, Industry and Network Issues in Net Neutrality
Week 12: Net Neutrality Surveys
Week 13: Industry Structure, Regulators’ Approaches

Grading policy:
15% active participation
25% homework
20% mid-term paper
20% project and oral presentation
20% 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 the Internet

(i) Is Zero-Rating a sly approach to undercut Net Neutrality or is it a useful business tactic to encourage growth of data services and usage?

(ii) Is Google anti-competitive?

(iii) Is there excessive concentration of market power in broadband access in the USA today?

(iv) Last mile unbundling, “open access” regulation and municipal Internet access networks have been implemented in many parts of the world with impressive societal benefits. Should it also be adopted widely in the USA?

(v) 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 life, etc., which poses a growing problem in the areas of privacy, discrimination, and competition? Does the problem call for accelerated public scrutiny, government oversight and new laws on data monopolies?

(vi) Is the Sharing Economy good for Society?

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

Societal, Industry and Network Issues in Network Neutrality


Network Neutrality: Surveys


Background: Industry Structure, Regulators’ Approaches

“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
