

# The Business of Social and Other Networks

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Spring 2015

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<http://www.stern.nyu.edu/networks/>

### Preliminary Outline

This course analyzes the business of *network industries*, which include traditional networks such as the Internet, telecom, and credit card networks, as well as industries with significant complementarities, such as between computer or mobile phones operating systems and applications, games and game consoles, organic and paid search, ebooks and platform format, etc. We develop a general theory of *platform competition*, where the platform may be an operating system such as the iOS, Android, or Windows or a network such as Facebook. We examine how networks are formed from the perspective/incentives of users, the network (platform) operator, and the applications providers that are complementary to the network. We identify key features of networks including: (i) higher value to users from networks of larger size; (ii) very significant inequalities in market share, profits, and (often) prices; (iii) the extent of incentives for interoperability and interconnection between networks; and (iv) importance of key network nodes that are “central” or “influential” in the creation and stability of networks.

We discuss two-sided markets, where two sides/parties wish to interact, and their interactions must go through an intermediary/platform/network. Examples:

- Two sides: advertisers and readers. Intermediary: periodical, Yellow Pages, Internet search engine.
- Two sides: Internet message sender and receiver. Intermediary: Internet Service Provider(s).
- Two sides: consumers and merchants. Intermediary: payment network (e.g., Visa, MasterCard, American Express).
- Two sides: gamers and game designers. Intermediary: game-console manufacturer.

We observe that sometimes both sides pay (game-console manufacturers charge both gamers and game designers), sometimes there is a zero price to one side (Google doesn't charge consumers but charges advertisers) and sometimes one side is subsidized (credit-card companies charge merchants, but often subsidize consumers with cash and bonus points or miles). We explain why charges vary across the types of examples above, and apply it to the current controversial issue the abolition of “network neutrality,” if telephone and cable companies are allowed to impose additional charges to originators of content on the Internet.

We will discuss network platforms of importance including (i) mobile “smart” phones such as iPhone and Android ones; (ii) audio and video distribution networks; (iii) digital books distribution networks; (iv) the PC operating systems market; and (v) the payments

systems networks (credit cards) platforms. We will also discuss in detail the structure of the Internet, the Internet search and advertising markets/platforms and network neutrality.

**Requirements:** This course is for students who have completed the core Microeconomics course. Students are expected to participate in class. There will be an in-class midterm. Instead of a final, students will form groups and each group will write an original paper on a topic relevant to the course, subject to the instructor's approval. Student groups are expected to make presentations on their topics two to three weeks before the end of classes. The papers will be submitted electronically in the last week of classes.

### **Invited Speakers**

- [Vint Cerf](#), Google
- [Bob Lee](#), Square
- Chris Meyers, Microsoft

**Readings.** There are no required textbooks. We will rely on class notes (PPT) available to download. The following books will also be put on reserve at the library.

- Chris Anderson, *The Long Tail*, Hyperion, New York, 2006.
- John Battelle, *The Search*, Penguin, New York, 2005.
- Brock, Gerald, *The Telecommunications Industry: The Dynamics of Market Structure*, Harvard University Press, 1981.
- Carlton, Dennis, and Jeff Perloff, *Modern Industrial Organization*, Harper Collins.
- Crandall, Robert, *After the Breakup: US Telecommunications in a More Competitive Era*, The Brookings Institute, Washington, D.C., 1991.
- [Easley, David](#), and [Jon Kleinberg](#), *Networks, Crowds, and Markets: Reasoning About a Highly Connected World*, Cambridge University Press, 2010
- Goyal, Sanjeev, *Connections*, Princeton University Press, 2007.
- Laffont, Jean-Jacques, and Jean Tirole, *Competition in Telecommunications*, MIT Press, 2002.
- Mitchell, Bridger M., and Ingo Vogelsang, *Telecommunications Pricing: Theory and Practice*. Cambridge University Press, 1991.
- Owen, Bruce, and Steve Wildman, *Video Economics*, Harvard University Press, 1992.
- Pindyck, Robert and Daniel Rubinfeld, *Microeconomics*.
- Shapiro, Carl, and Hal Varian, *Information Rules*, Harvard Business School Press, 1999.

## **1. Introduction; Summary of Basic Economics and Elementary Game Theory (week 1-2)**

Readings:

- [Class notes/PPT](#).
- Pindyck and Rubinfeld, *Microeconomics*.

## 2. Nature and Types of Networks (week 3)

- Nature and types of networks
- Features
- Network creation/expansion/formation; benefits; costs
- Measures of importance of specific nodes and links
- Degrees of separation; homophily
- Superimposition of various networks

### Readings:

- [Easley and Kleinberg](http://www.stern.nyu.edu/networks/E&K/networks-book-ch01.pdf). See <http://www.stern.nyu.edu/networks/E&K/networks-book-ch01.pdf> to -ch24.pdf
- [Class notes/PPT](#).
- Sanjeev Goyal, *Connections*, Princeton University Press, 2007, chapter 2.

## 3. Internet Basics (week 4)

- Basics of the Internet
  1. Creation; History; Arpanet, NSF, Commercialization
  2. Structure, infrastructure, transmission
  3. Basic structure; protocols; functionality
  4. Internet backbone
    - a. Pricing: transit and peering
    - b. Merger of MCI with WCOM; Failed merger of MCI/WCOM with Sprint
    - c. Present industry structure
  5. Last mile Internet; congestion?
    - a. Preliminaries on wo-sided pricing and network neutrality.
  6. The Internet search and advertising markets
  7. Cybersecurity; A driver's license to access the Internet?
  8. Privacy, anonymity. Market for privacy?
- Invited speaker: TBA

### Readings:

- [Class notes/PPT](#).
- Economides, Nicholas, [The Economics of Networks](#), *International Journal of Industrial Organization*, vol. 16, no. 4, pp. 673-699 (October 1996).
- Economides, Nicholas, and Charles Himmelberg, (1995), [Critical Mass and Network Evolution in Telecommunications](#), in Gerard Brock (ed.), *Telecommunications Policy Research Conference Selected Papers 1995*.
- Shapiro and Varian chapter 7.
- Economides, Nicholas (2007), [The Economics of the Internet](#), in *The New Palgrave Dictionary of Economics*, London: Macmillan.

- Economides, Nicholas (2006), [The Economics of the Internet Backbone](#), in *Handbook of Telecommunications*. Amsterdam: Elsevier Publishers.
- [Easley and Kleinberg](#), ch. 13, 14, 15.
- Shapiro and Varian chapter 7.

#### 4. Cybersecurity and Privacy (week 4)

- Security on the Internet very poor because of its design
- Security of computing devices very poor because manufacturers place ease and convenience above security
- Evidence that 1% of the 1 bil Internet devices (i.e., 10 mil) are infected zombies, able to attack other hosts
- However, largest reported attack is of about 10,000 coordinated devices
- How can we create incentives for manufacturers, ISPs and users to increase security?

##### Readings:

- [Class notes/PPT](#).
- Nicholas Economides *et al.* (2010), [Toward Better Usability, Security, and Privacy of Information Technology](#), Committee Report, National Academies of Sciences.

#### 5. Network Structures and Platforms; Two-sided Pricing (week 5)

- Network properties
- Platforms
- Two-sided pricing

##### Readings:

- [Class notes/PPT](#).

#### 6. Network Effects Under Compatibility (weeks 5-6)

- Complementarity and compatibility
- Network effects; higher value to a user from a network of larger size
- Sources of network effects
- Network effects under compatibility and perfect competition
- Demand can slope upwards
- Critical mass; fast expansion of new networks compared with non-network innovations
- Multiplicity of Equilibria
- Efficiency
- Are network effects internalized?
- Importance of key network nodes that are “central” or “influential” in the creation and stability of networks.

Readings:

- [Class notes/PPT](#).
- Economides, Nicholas [The Economics of Networks](#), *International Journal of Industrial Organization*, vol. 16, no. 4, pp. 673-699 (October 1996).
- Economides, Nicholas, and Charles Himmelberg, (1995), [Critical Mass and Network Evolution in Telecommunications](#), in Gerard Brock (ed.), *Telecommunications Policy Research Conference Selected Papers 1995*.
- Shapiro and Varian chapter 7.
- [Story in Wired magazine on Microsoft's proposal for Apple allow clones](#)

**7. Technical Standards Competition and the Compatibility Decision (weeks 7-8)**

- Technical standards competition; standards' wars
- The incentive for compatibility/incompatibility; incentives for interoperability and interconnection between networks
- Strategic choices of technical standards and compatibility in network industries
- “Winner-takes-most” markets; very significant inequalities in market share, profits, and (often) prices
- Monopoly/Dominant platforms.
  - Windows and applications.
- Competing platforms
  - Mobile “smart” phones: iOS, Android, Windows 7, Nokia
    - a. Competition and pricing of OS, apps, carriers, handset manufacturer.
  - Incentives for incompatibility; Betamax vs. VHS; Blu-Ray vs. HD DVD; Windows vs. OS10 vs. Linux.
  - Incentives for compatibility; the agreement on the DVD format.

Readings:

- [Class notes/PPT](#).
- Paul David and Shane Greenstein (1990), [The Economics of Compatibility Standards](#).
- Nicholas Economides and Fredrick Flyer (1998), [Compatibility and Market Structure for Network Goods](#), Discussion Paper EC-98-02, Stern School of Business, NYU.

**8. Bottlenecks and Interconnection Pricing (week 8)**

- One-sided bottlenecks
- Leveraging of market power across markets
- Vertical Price Squeeze
- Two-sided bottlenecks
- Dynamic efficiency issues
- Innovation issues
- Regulation?

Readings:

- [Class notes/PPT](#).
- Nicholas Economides, Giuseppe Lopomo and Glenn Woroch, [Strategic Commitments and the Principle of Reciprocity in Interconnection Pricing](#), chapter 5 (pp. 62-99), in Gary Madden (ed.) *The Economics of Digital Markets*, Edward Elgar (2009).
- Nicholas Economides, Giuseppe Lopomo and Glenn Woroch, [Regulatory Pricing Policies to Neutralize Network Dominance](#), *Industrial and Corporate Change*, vol. 5, no. 4, pp. 1013-1028, (1996).

**9. Taxi Cabs as a Two-Sided Network (week 9)**

- Hailed vs. arranged pickups
- Regulated vs. unregulated cars

Readings:

- [Class notes/PPT](#).

**10. Electric Cars as a Two-Sided Network (week 9)**

- Electric cars need a network of battery stations
- Lessons from electric cars in the early 19<sup>th</sup> century

Readings:

- [Class notes/PPT](#).

**11. Credit Cards and Payment Systems Networks (week 9)**

- Network Structure; Visa and MasterCard networks compared to the Amex and Discover networks.
- Three-party networks (users, bank, merchants) vs. four-party networks (users, issuing bank, acquiring bank, merchants).
- Who pays whom and why. Interchange fee in four-party networks.
- Government interventions: Australia, EU, USA.

Readings:

- [Class notes/PPT](#).
- Nicholas Economides (2009), [Competition Policy Issues in the Consumer Payments Industry](#), in Robert E. Litan and Martin Neil Bailly, eds., *Moving Money: The Future of Consumer Payment* Brookings Institution.
- Alan S. Frankel and Allan L. Shampine, [The Economic Effects of Interchange Fees](#), *Antitrust Law Journal* 73, no. 3: 627–73.
- [US Department of Justice, Settlement with Visa and MasterCard; Suit against Amex. Final judgment](#). United States v. American Express.

- Nicholas Economides and David Henriques (2011), [To Surcharge or Not to Surcharge? A Two-Sided Market Perspective of the No-Surcharge Rule](#), NET Institute Working paper #11-03.

## 12. Mobile Banking in Africa and Other Developing Areas (week 10)

- Phones used as bank accounts
- Incompatibility across networks results in loss of total surplus

### Readings:

- [Class notes/PPT](#).

## 13. The Digital Books Market (week 10)

- Device-based distribution.
  - i. Kindle, iPad, etc.
  - ii. The role of formats.
  - iii. Competition; pricing of devices; pricing of books; pricing by retailer vs. “agency model.”
- Google books
  - i. What it is; How it was done; Why Microsoft stopped doing it.
  - ii. Benefits to Google from book scanning.
  - iii. Settlement between Google and publishers rejected on antitrust grounds.
- The long tail of the sales distribution of digital goods.
- Google books settlement; District Court Decision rejecting settlement.
- DOJ suit against Apple and publishers on eBook pricing
- Wholesale/retail pricing vs. agency model
- Imposition of agency model on Amazon; price fixing
- Apple found liable in conspiracy with publishers
- Invited Speaker: TBA

### Readings:

- [Class notes/PPT](#).
- The long tail: [Long Tail, The Revised and Updated Edition: Why the Future of Business is Selling Less of More](#) by Chris Anderson.

## 14. Two-sided Pricing and Network Neutrality (weeks 11)

- Two-sided pricing in markets with network effects
- Complex price discrimination schemes in networks
- Network neutrality
- Policy positions of Obama, the FCC, and the EU
- Model without congestion in the last mile

- Model with congestion

Readings:

- [Class notes/PPT.](#)
- Economides & Tag, [Network Neutrality on the Internet: A Two-sided Market Analysis](#), *Information Economics and Policy* (2012).
- Economides and Hermalin (2012), [The Economics of Network Neutrality](#), *Rand Journal of Economics*.
- Jay Pil Choi and Byung-Cheol Kim (2010), [Net neutrality and investment incentives](#), *Rand Journal of Economics*.

**15. Antitrust in Networks Industries (week 12)**

US Microsoft case

- Dominant market share of Microsoft in operating systems for PCs (over 90%).
- US alleged monopolization of OS market, attempt to monopolize the market for browsers, and bundling of Internet Explorer with Windows.
- Why is Microsoft selling Windows at a low price?
- District Court finds Microsoft liable and orders breaking the company in two pieces.
- Appeals Court keeps monopolization liability, reverses in all other respects.
- US and Microsoft settle; settlement terms; role of States.

EU Windows Media Player case

- Competing audio platforms on PC; MP3, WMA, iTunes, RealAudio, etc.; competing video platforms (MPEG, AVI, WMV, FLV, etc.).
- Piracy; Peer to peer; Napster and Torrent.
- Distribution through downloads vs. through the old Netflix model.
- EU suit against Microsoft for bundling Windows Media Player with Windows; settlement forced Microsoft to sell in Europe a version of Windows without Windows Media Player.

EU browsers' case

- EU alleged illegal bundling of Internet Explorer with Windows.
- Settlement forced Microsoft to help distribute rivals' browsers.
- Investigations of Google

Readings:

- [Class notes/PPT.](#)
- [The Microsoft Antitrust Case For MBA Students](#)
- [NYU conference on US v. MS, including streaming video of all presentations featuring \(among others\) Assistant Attorney General for Antitrust Doug Melamed, NY Assistant Attorney General for Antitrust Harry First, Microsoft counsel Rick Rule and Former Solicitor General Boyden Gray](#)

- [Discussion on US v. MS on PBS TV with host Jim Goodale, Prof. Nicholas Economides, and Prof. Eleanor Fox, in streaming video, first broadcast on November 16, 2000](#)
- [Story in Wired magazine on Microsoft's proposal for Apple allow clones](#)
- Nicholas Economides & Ioannis Lianos, [A Critical Appraisal of Remedies in the EU Microsoft Cases](#), *Columbia Business Law Review* 2010/2:346-420 (2010).
- Nicholas Economides & Ioannis Lianos, [The Quest for Appropriate Remedies in the Microsoft Antitrust EU Cases: A Comparative Appraisal](#), *Microsoft on Trial: Legal and Economic Analysis of a Transatlantic Antitrust Case*, Luca Rubini (ed.). Edward Elgar (2010).
- Nicholas Economides & Ioannis Lianos, [The Elusive Antitrust Standard on Bundling in Europe and in the United States at the Aftermath of the Microsoft Cases](#), *Antitrust Law Journal* 76/3:483-567 (2009).

## **16. Bank Networks Formation and Systemic Risk (week 12)**

### Readings:

- [Class notes/PPT.](#)

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