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Week 3: Network Externalities

SI 646

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Today:

A Motivating Example: Apple and MS

What are network externalities?

A simple network “model”

Networks and Competition

Case: US v. Microsoft (2000)

Motivating Example:

Apple and Microsoft

- Different business strategies, different outcomes!

What are Network Externalities?

- First, what is an externality?

  An agent benefit or cost arising from another agent's action, e.g. 2nd hand smoking

- Second, what is a network?

  A series of nodes connected by links, where nodes represent users, producers, etc.

- So a network externality arises when user utility is (in)directly increasing in the number of other consumers using the same "network".

Some examples:

- “direct” network effects occur in

  communication networks (telecom, facebook, e-mail, etc.), software file sharing, etc.

- “indirect” network effects (i.e. a secondary result of many people adopting the same standard or system) occur with :

  Media formats (CDs, DVDs, etc.), software variety

  (Note: compatibility between complementary components is implied here, e.g. compatible operating systems and software).

So far we have discussed situations in which information *technology*, not information *per se*, is subject to network effects.

What about Markets for *Information Goods*?

Markets for Information Goods

- Markets for Information refers to markets in which information goods or products are exchanged.
- Information goods ("IGs") are typically characterized by high "first copy" costs and relatively low reproduction and distribution costs.
- Examples include text, music, video, data, etc.

A Contradiction?

- But IGs do not usually exhibit demand-side network effects (NEs)!
- Consumer utility from reading a newspaper or listening to music is not (primarily) related to total demand for the IG.
- Rather, demand-side NEs normally arise from the use of *infrastructure*, e.g. AT&T's array of landlines.
- Of course, information is communicated over a telecom network, but the NEs are not related to this fact.

- Note – software exhibits IG-like production costs *and* generates NEs

Only a semantic distinction?

- No!
- Although many infrastructure-based demand-side NEs affect markets for IGs – and deserve attention (e.g. see Shapiro and Varian)…
- …recognition of the distinction between infrastructure and IGs helps us identify *another type* of NE.

SNE ∩ IG = SNIG*

- supply-based network effect or *SNE*.
- supply-based networked information good or *SNIG*.
- A SNE exists when the value of some product X (typically an IG) to any single user ↑ as the number of *producers* creating X ↑.

* not to be confused with the Australian verb “snig”: to drag (a felled log) by a chain or cable

Some examples…

- Several classic cases: scientific journals, print encyclopedias (Britannica) and newspapers, weather data, etc., where producer = author/observer.

- More recent, web 2.0-enabled examples: Wikipedia, Digg, Slashdot, Amazon book reviews, Yahoo! Answers, Google

- (these various cases can be modeled as “2-sided” markets in which a platform mediates the flow of externalities *between* each side of the market, but not *within* each side of the market)

Not all IGs are SNIGs, etc.

- There are many IGs that do not (yet) exhibit SNEs, e.g. music, most books, film, etc.
- May want to distinguish between direct and indirect SNEs.
- An indirect SNE arises when a SNIG is created that complements some other pre-existing IG, e.g. user-contributed book reviews at Amazon complement consumption of books, music, DVDs, etc.

A Simple Network Model

Communications Network
(Rohlfs 1974)

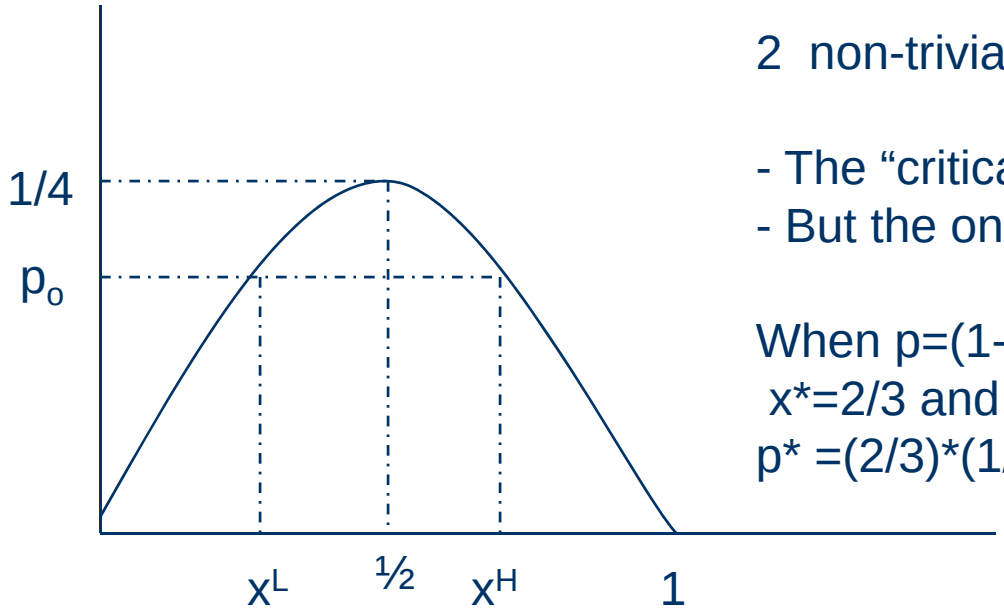
- A Single (monopoly) Supplier
- Consumer willingness to pay (wtp) is modeled as function of a user's location on a "unit interval" of length 1; consumers are distributed uniformly on this interval.
- Suppose wtp is x; thus, users located closer to x=1 have the highest wtp.
- Net user utility is nx – p where n is the fraction of "networked" consumers and p is the access fee charged by the monopolist

Communications Network, II

- The *marginal* consumer will be indifferent between using and not using this network, so for this person we know that $0 = nx - p$
- Since the fraction of consumers, n, is given by 1-x, we have $0 = (1-x)x - p$

  or $p = (1-x)x$.

Communications Network, III



2 non-trivial equilibria at p_o

- The “critical mass” equilibrium at x^L
- But the only stable equilibrium is x^H.

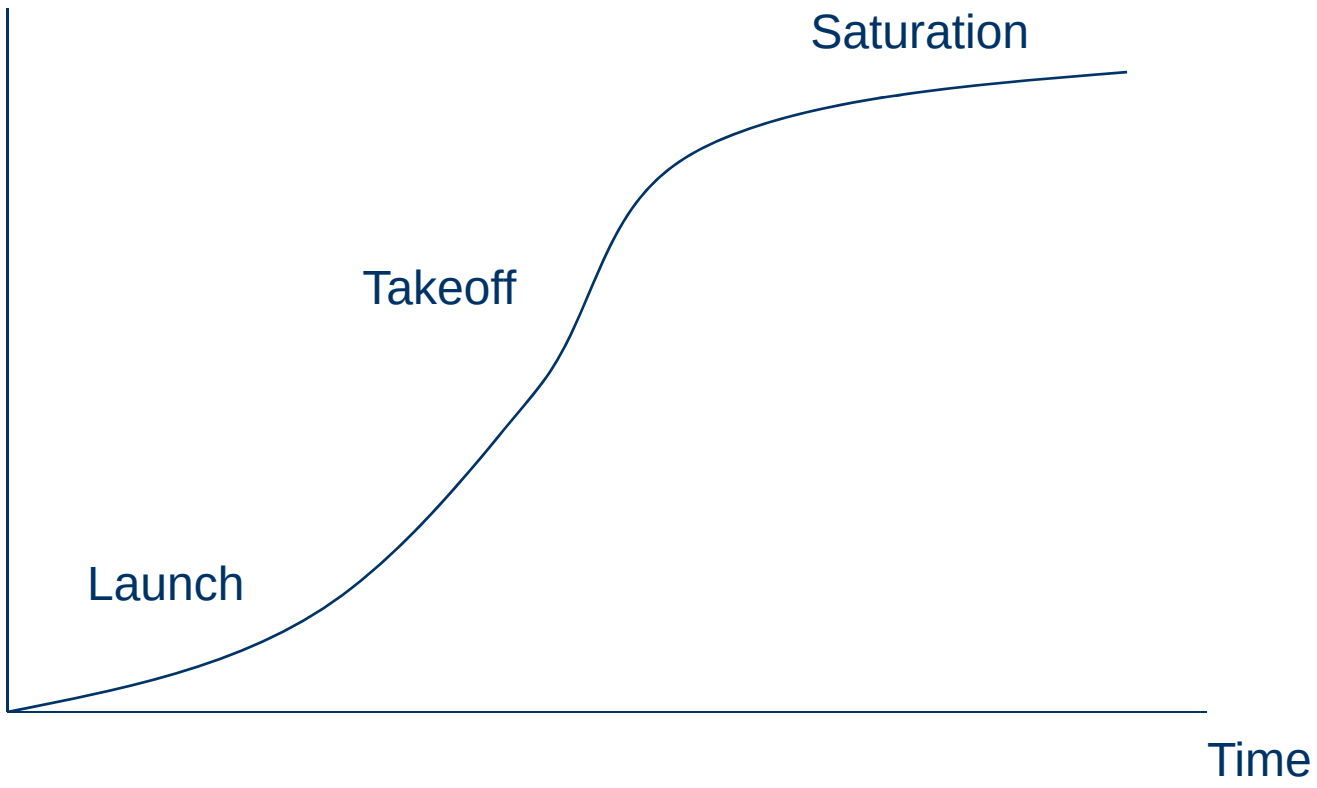
When p=(1-x)x, and mc=0
x*=2/3 and
p* =(2/3)*(1/3)= 0.222

Networks and Competition

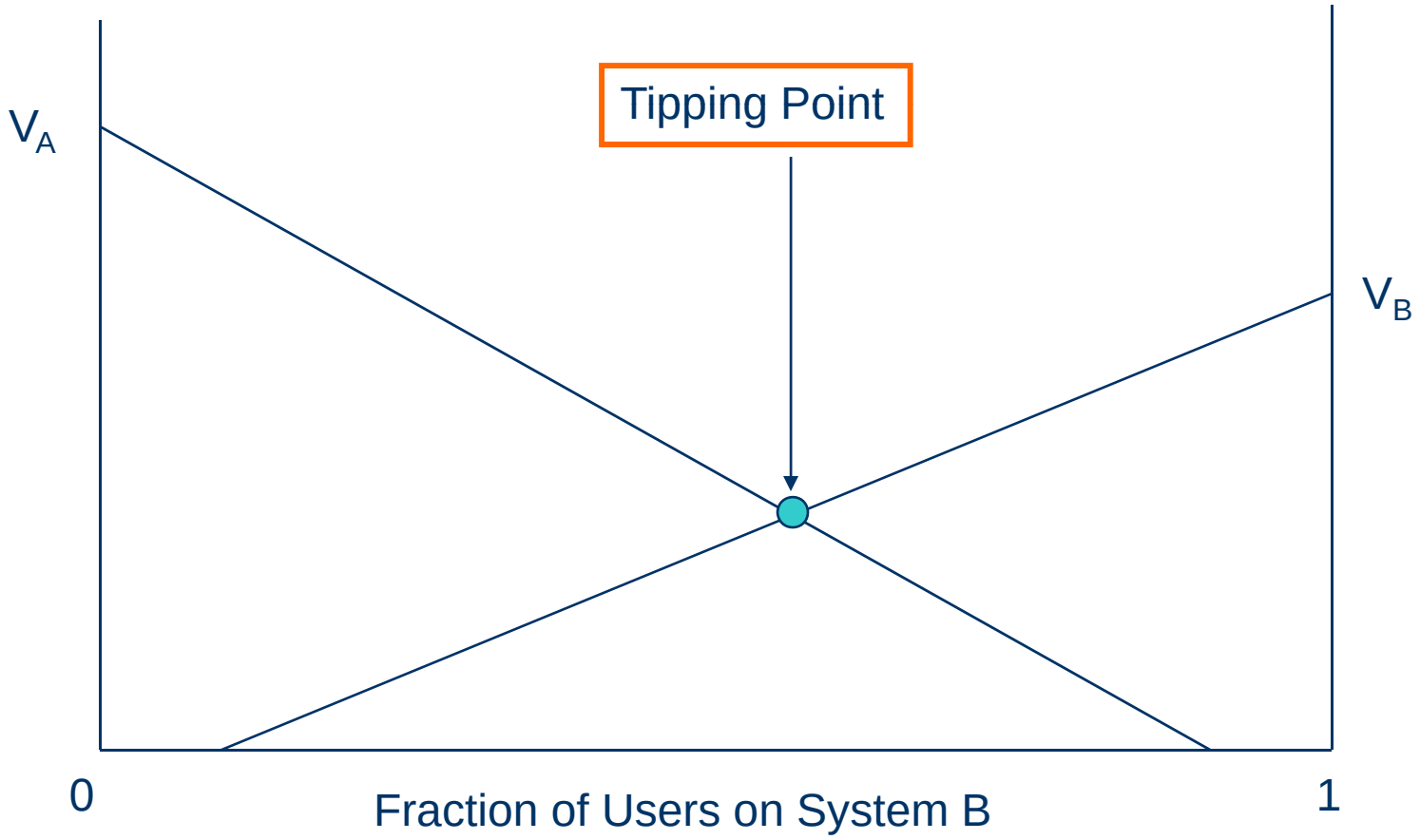
Metcalfe's Law

- Metcalfe's Law: "The value of a network goes up as the square of the number of users."
- Named after Bob Metcalfe, inventor of Ethernet
- Suppose there are N people on a network, and the value to each is proportional to the number of other users. Then the total value of the network to all users is proportional to N(N-1)

Typical Adoption Curve



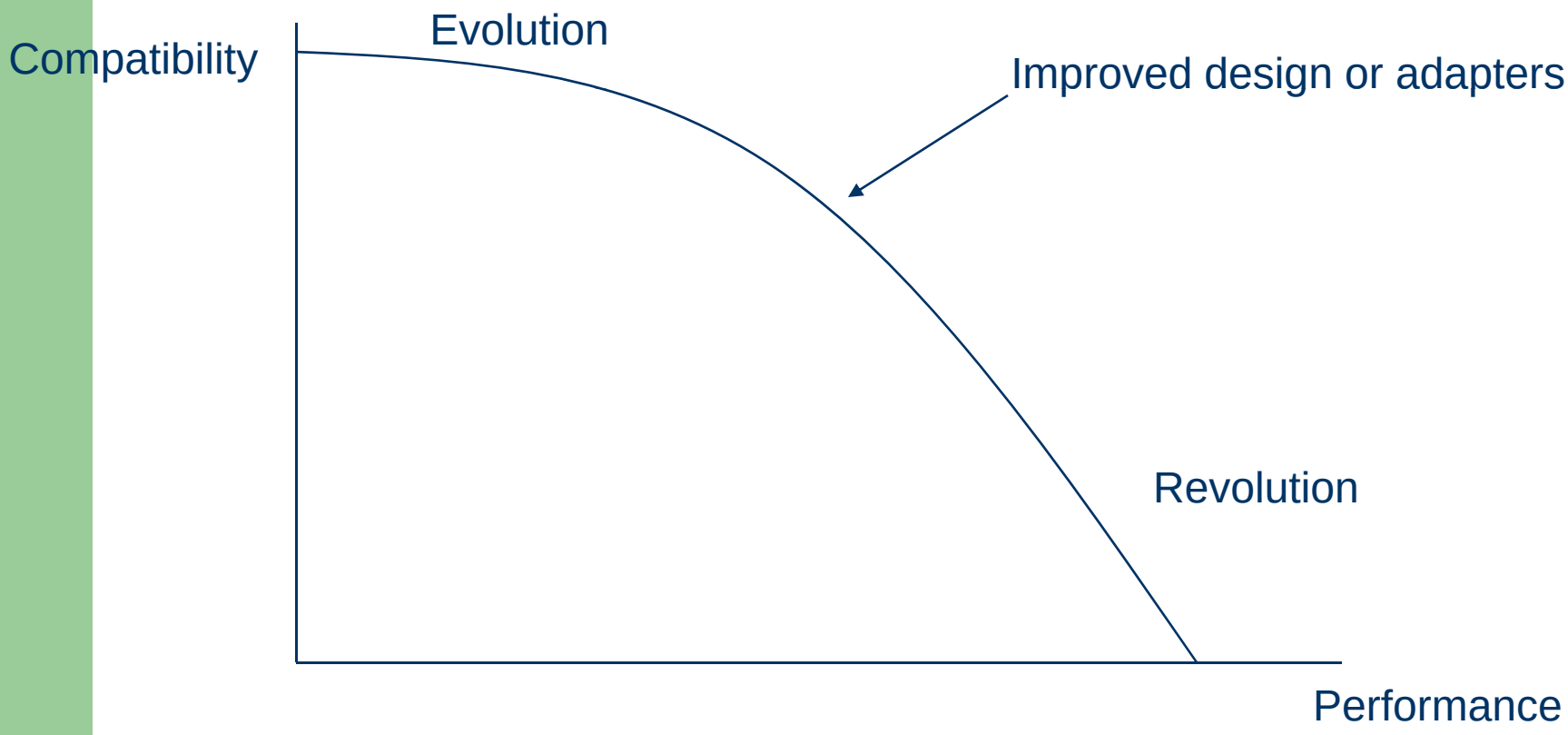
Tipping and Lock-In



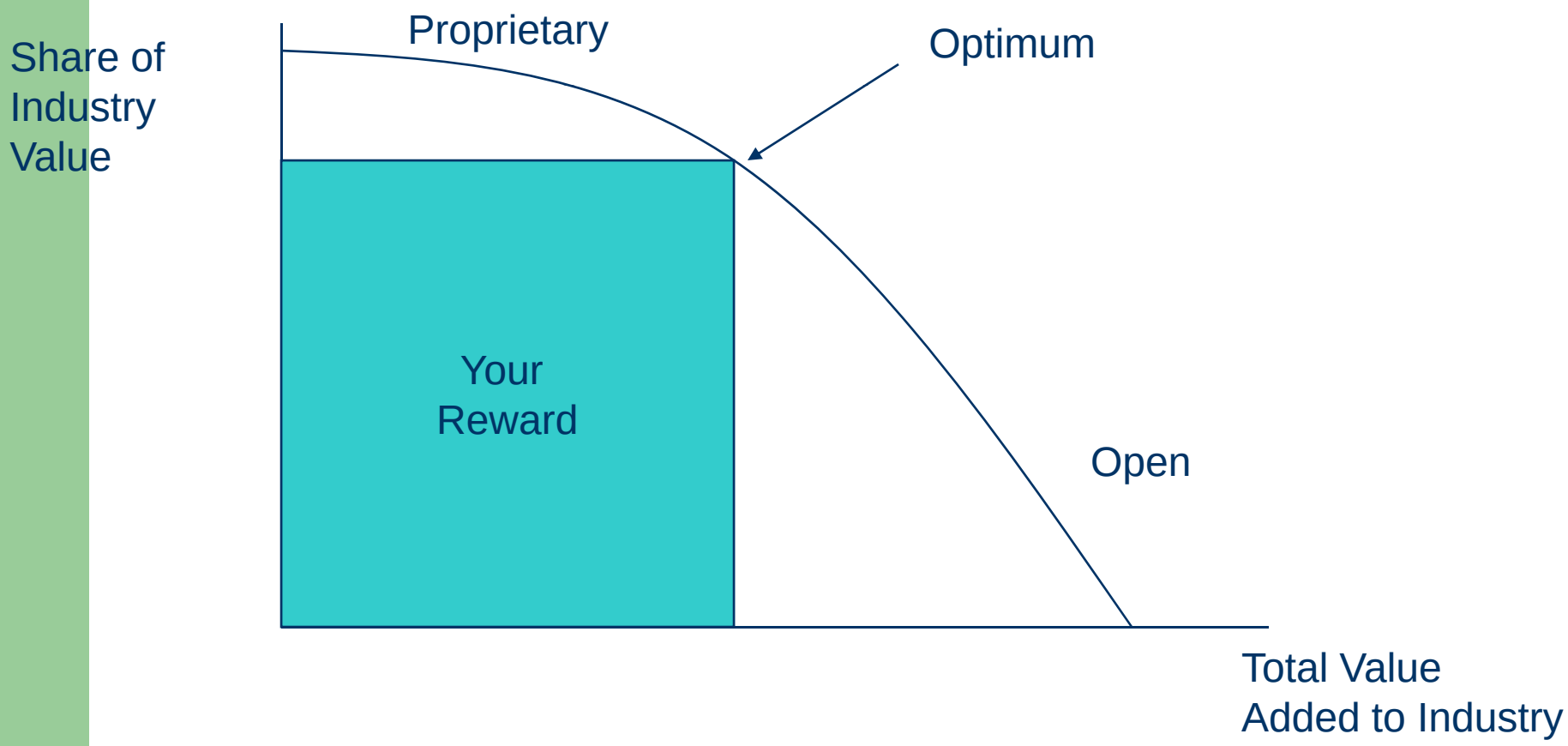
Expectations, Coordination, and Compatibility

- Expectations
  - Consumers adopt new technologies based in part on expectations about which will become dominant
  - Thus, corporate marketing strategies that convey a sense of inevitability can be very valuable
- Coordination and Lock-In
  - Even if collective switching costs are low enough to justify changing to a new technology, it may not occur without coordination across users
- Compatibility
  - Firms make a strategic decision to make their new technologies compatible with existing ones or not

Evolution vs. Revolution



Openness vs. Control



Generic Network Strategies

	Control	**Openness**
Compatibility	Controlled Migration	Open Migration
Performance	Performance Play	Discontinuity

Performance Play

- Characteristics
  - New, incompatible technology
  - Vendor retains strong proprietary control
- Used by Nintendo Entertainment in mid-80s, USR for Palm Pilot in 1990s, RIM in 2002
- Works best for outsiders with no installed base to cannibalize

Controlled Migration

- “Upgrade” strategy
- Characteristics
  - New technology is compatible with existing ones
  - Vendor retains control
- Examples:
  - Windows 98, Intel Pentium II, Turbotax, Windows CE/Pocket PC

Open Migration

- Characteristics
  - New technology is compatible w/old one
  - Low switching costs, little proprietary control
- Examples
  - Modems, fax machines, HP
- Makes most sense when your advantage is based on manufacturing capabilities
  - You gain from expanding the market

Discontinuity

- Characteristics
  - Incompatible new technology
  - Offered by multiple suppliers
- Examples
  - CD audio system, 3.5” floppy disks
- Favors efficient manufacturers (hardware) or firms with value-added services (software)

Network Competition

- Two key questions:
  - Should a firm compete “for the market” or “in the market?”
  - Is it possible to topple the existing standard?

Will a Given Market Tip?

	Low Economies of Scale	High Economies of Scale
Low demand for variety	Unlikely	Highly likely
High demand for variety	Low	It depends

“For the Market” or “In the Market?”

- Monopoly in a smaller market may be more valuable than competing as a small player in a large market
- It is critical to attract early adopters
- Without a common standard (or at least a sufficiently large installed base), complementary products may not be forthcoming

“For the Market” or “In the Market?”

- To enlist manufacturers of complementary products, share value-added with them
- If the standards war gets too costly, agree on a common standard
- (Battle of the Sexes)

Fighting a Dominant Standard Successfully

- Installed base gives the incumbent the edge
- The challenger must offer superior quality (Sony vs. Nintendo, RIM vs. Palm?). 10X?!
- Should be able to tap into the complementary goods market (Microsoft Pocket PC and Outlook)

Summary

- Information markets often exhibit network effects, which can create a powerful first-mover advantage. Yet breakthrough innovations can create a “successive monopolies” competition.
- Such markets create opportunities for interesting competitive tactics, including expectations management, user coordination, and compatibility choices.