Lecture Note I-7
Networks and Positive Feedback

- Positive feedback
- Network Externality
- Evolution VS Revolution
- Openness VS Control

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Positive Feedback

- Positive feedback
  - The stronger get stronger, the weaker get weaker
  - market dominated by a single firm or technology
- Negative feedback
  - The stronger get weaker, the weaker get stronger
  - Market in oligopoly
  - Stabilizing (competitive and balanced equilibrium)
- Positive feedback market
  - Makes a market "tippy": "Winner take all markets"
  - Examples: VHS v. Beta (1980), Wintel v. Apple (1990)
  - A more potent force in the network economy or market for information infrastructure

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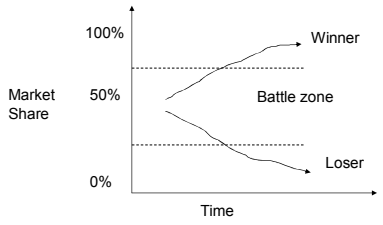
Positive Feedback



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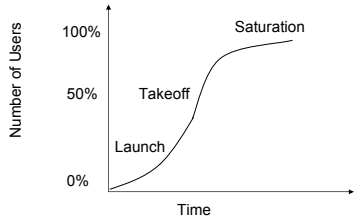
Adoption Dynamics



Adoption of new technologies: S-shape curve
(CD, color TV, video game machine, email, Internet, etc.)

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Sources of Positive Feedback

- Supply side economies of scale
  - Declining average cost
  - Marginal cost less than average cost
  - Example: information goods
- Demand side economies of scale
  - Network effects
  - In general: fax, email, Web
  - In particular: Sony v. Beta, Wintel v. Apple

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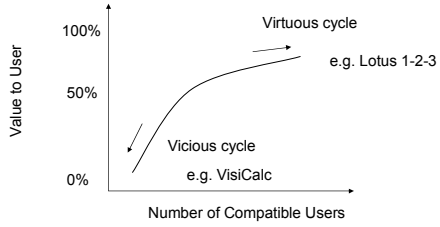
Demand Side Economies of Scale



Implication: success and failure are driven by the consumer expectation and the underlying value of product

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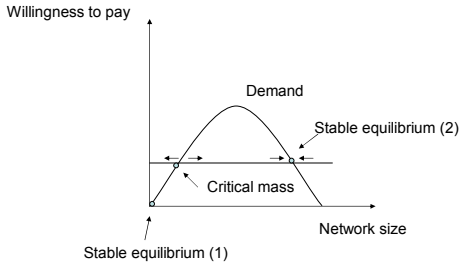
Demand Side Economies of Scale



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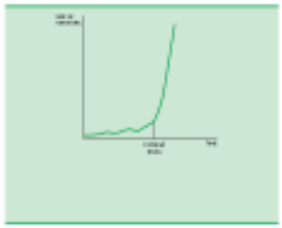
Critical Mass



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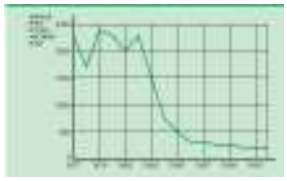
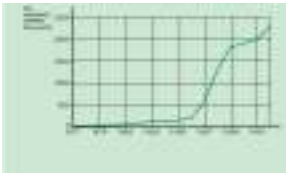
Example: Fax





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Network Externalities

- Networks
  - Real networks
    - Communications, transportation
  - Virtual networks
    - Like "Mac network"
- Externality
  - Externality arise when one market participant affects others without compensation being paid
- Value of Network
  - Metcalfe's Law:
    Value of network of size n proportional to n^2

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Laws of growth

- Sarnoff's Law - content
  - Radio and television networks
  - The value pf broadcast networks is proportionate to the number of views
- Morre's Law (microprocessor investor)-innovation
  - Hyper-evolution of electronics, computers, and networks
  - The number of elements that could be packed into the same amount of space on microchip double very year
- Metcalfe's Law (Ethernet inventor)- communication
  - Growth of value in networks
  - The total value of a network where each node can reach every other node grows with the square of the number of the nodes
- Reed's Law - community
  - Links between computer networks and social networks
  - Email, BBS
  - The value of online social networks grows proportionately to users exponentially

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Lock-In and Switching Costs

- Network effects lead to substantial *collective switching costs*
  - *The combined costs of all users*
  - *Nonlinear*
  - Even worse than individual lock-in
  - Due to coordination costs
- Example:
  - QWERTY (1870) vs AOEUIDHTNS (1932)

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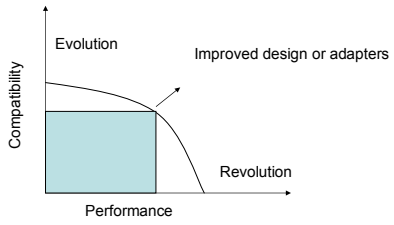
Igniting Positive Feedback

- Evolution (compatibility)
  - Give up some performance to ensure compatibility, thus easing consumer adoption
- Revolution (performance)
  - Wipe the slate clean and come up with the best product possible

Tradeoff of Compatibility and Performance



Evolution

- Offer migration paths to new technologies
- Examples
  - Microsoft, Intel
- Build new network by links to old one
  - One way compatibility
- Problems: technical and legal

Strategies of Evolution

- Technical obstacles
  - Use creative design
  - Think in terms of system
  - Converters and bridge technologies
- Legal obstacles
  - Need IP licensing
  - Example: Sony and Philips CDs (pay patent license fee)

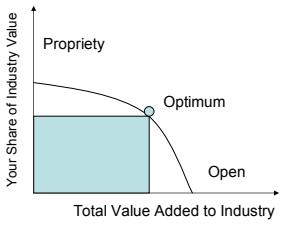
Revolution

- Performance: Groves's law: "10X rule"
- Success
  - depend on switching costs, critical mass
  - Market is growing rapidly, lock-in is mild, performance loom larger than backward compatibility
- Example: Game video
  - Lower switch cost for ten-year-boys
  - Sega vs Nintendo

Openness v. Control

- Your reward = [Total value added to industry] x [Your share]
  - Total value added to industry
    - Depends on product *and*
    - Size of network
  - Your share
    - Depends on how open

Tradeoff of Openness and Control



Openness vs. Control

- Openness
  - Full openness
    - Anybody can make the product
  - Alliance
    - Only members of alliance can use
- Control
  - Control standard and go it alone
    - If several try this strategy, may lead to standards wars

Generic Strategies

Company's market share Total industry's value

		Control	Open
Compatibility	Compatible	Controlled Migration ②	Open Migration ③
Performance	Incompatible	Performance Play ①	Discontinuity ④

Generic Strategies (cont')

- (1)Performance Play
  - Introduce new, incompatible technology
  - Examples: Palm Pilot, Iomega Zip
- (2)Controlled Migration
  - Compatible, but proprietary
  - Examples: Windows 98, Pentium
- (3)Open Migration
  - Many vendors, compatible technology
  - Examples: Fax machines, some modems
- (4)Discontinuity
  - Many vendors, new technology
  - Examples: CD audio, 3 1/2" disks

Historical Examples of Positive Feedback

- Railroad Gauges….
- Battle of the Systems: AC v. DC….
- Telephone networks and Interconnection….
- Color Television….
- High-Definition Television (HDTV)….

Summary

- Positive feedback means strong get stronger and weak get weaker
- Consumers value size of network
- Adoption dynamics follows an S-shape growth path
- Positive feedback works for large networks, against small ones
- Consumer expectations are critical
- Fundamental tradeoffs: (performance and compatibility), (openness and control)
- Generic strategies
  - Performance play, Controlled Migration, Open Migration, Discontinuity