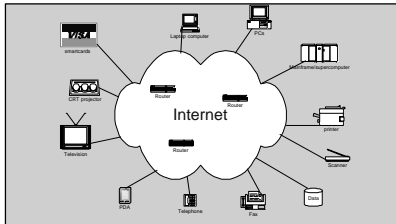


## Roundup: Economics of the Internet



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- Information and the Internet
- Economics:
  - Laws of IT
  - Cost structure,
  - Economics of attention,
    - Standards, lock-in, innovation,
  - Networks of relationships: gorilla
- Roundup

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## I: Information, Computers, Networks

- **Information**: anything that is represented in **bits**
  - *Form vs substance*
- Properties:
  - Infinitely replicable
  - Computers can **"manipulate"** information
  - Networks create **"access"** to information
- Potential of networking:
  - **Break the space barrier for information**
- IT governed by fundamental trends: Moore's law, Metcalfe's law, Gilder's law

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## T: Technology

- Technology is a **"glue"**:
  - Ties land, labor, and capital (economic inputs) together to produce economic output.
- As technology advances, it affects:
  - **time-scales** of product life-cycles
  - **proportions** of land/labor/capital (i.e. **cost-structures**)
- Provides the **incentive for new competition** and commoditizes low-end goods

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## Information Technology (IT)

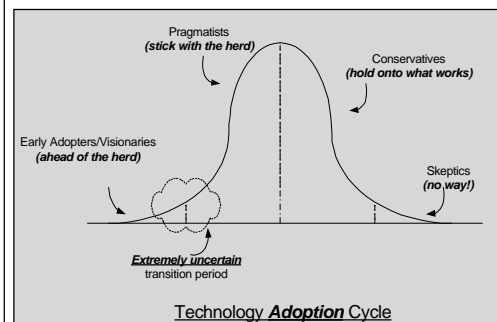
- **Rules of thumb**:
  - Convert more matter (atoms) into information (bits)
  - Leverage the powerful laws of IT to gain **efficiency** => invest in appropriate IT
  - **Innovate** using by human resources, i.e. by applying technology to change the business
  - Technology cannot innovate by itself

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## Technology Adoption



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### Effect of the Internet: analogy

- Chips connected by networks similar to *neurons*
- In biological evolution, without neurons, the sphere was the only form of multi-cellular life
  - Proximity was necessary to coordinate functions.
- The neuron enabled cells to communicate over the distance. Then it was possible to arrange cells into almost any shape, size and function.  
Eg: butterflies, orchids and kangaroos.
- Internet enables "dynamic relationships" between people, chips or software

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### IT Laws: Moore's law

- Pack double the number of transistors in the same area at the same cost every 12-18 months
  - Governs the explosion of computing, memory and storage
- Microcosm of Silicon: Faster, cheaper, smaller
- Implications for producers:
  - Invent things faster than they are commoditized
  - Drive for large scale.
- Implications for consumers:
  - Chips = sliver of intelligence - small and cheap enough to fit every object we use.

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### IT Laws: Metcalfe's law

- The value of the network is proportional to N-squared where N is the number of components
  - Number of potential relationships possible
  - N can include people, applications, and information appliances. It is not just people or hosts connected.
- Impact of Metcalfe's Law: **network effects**
  - With N components in the network, **another O(N) components are attracted into the network.**

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### IT Laws: Gilder's Law

- Optical bandwidth growing at a factor of 4 every 18 months, keeping costs roughly constant
  - Faster than Moore's law
- Dimensions:
  - More miles of fiber (400 fibers between PoPs)
  - More  $\lambda$ s per fiber (100s-1000s)
  - Higher speed per  $\lambda$  (10-40 Gbps)
  - Longer distance: better fiber, repeater tech.
  - Wider band components
  - More loss-windows
  - All optical switching (femto-second switching) at low power, small form-factors

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### Information cost-structure

- Information goods:
  - Costly to produce
    - Labor-intensive, High fixed/sunk-costs
  - Cheap to manipulate, reproduce and access
    - Marginal cost = 0
  - Almost no capacity limits
    - Infinitely replicable: have cake and eat-it as well
- If the information good is unique, it becomes more valuable. Else it becomes a commodity.
  - Value thru customization, integration, one-click etc!
  - Price based upon value, not marginal cost (0!)
- Large economies-of-scale => global businesses

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### Economics of Attention

- "A wealth of information creates a poverty of attention"
- This economics of attention/focus is important because people face real opportunity costs with their time and attention
- Capturing and retaining attention leads to value
  - Eg 1: Coke brand – loyalty, no switching costs
  - Eg 2: Windows or Playstation 2 platform has real switching costs (lock-in) on users – software compatibility

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## Economics of Attention

- Different types of attention:
  - User's attention: captured by Apple GUI/slick design
  - Developer/partners' attention: captured by Windows platform
  - Market's attention: captured by market leader because support/services easier to get
- Capturing attention can lead to a network of relationships between product, customer and partners (eg: microsoft platform)
  - This creates **network effects** and huge switching costs (lock-in)!

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## What is Attention?



- Eg: Juniper has the most stable, integrated hardware-software router platform
  - Minimizes BGP-related network instability
  - Saves time (attention) of (scarce) skilled network operators!

- Yahoo: integrates a number of free services. The integration and personalization captures the consumer's attention.
- Internet advertising was partly flawed because banner advertising caught only the fringes of user attention and imposed costs upon each click-through

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## Economics of Attention

- In competitive economies, "networks" compete against each other. Eg:
  - Apple vs Windows, Playstation vs Nintendo,
  - Yahoo vs Excite, UUNET vs Sprint,
  - Northwest Worldperks vs American Airlines Advantage
  - Cisco IOS vs Baynetworks proprietary platform

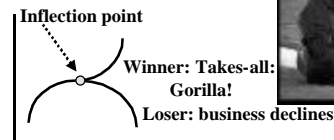
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## Tactics: Critical Mass

- Critical mass: when the *leading value-chain reaches a given size*, its value ( $N^2$ ) is much larger than its competitor ( $M^2$ )
  - Breaks away => inflection point
  - Winner-takes-all => "Gorilla"



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## Tactics: Standards

- Powerful technique: create and orchestrate proprietary architecture/standard. Eg:
  - Intel Processor Architecture
  - Microsoft Windows API
- Customers prefer open standards
  - Quickly builds market acceptance (large pie)
  - Linux OS, Internet standards, XML
  - Producer tries to be first mover and leverage open-standards, doped with proprietary extensions
  - Downside: political posturing/de jure process => long time-scales for standards process
- Semi-open standards: Java, Solaris
  - Leader vested in standard

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## Standards & Partner Networks



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Semi-Open Network



Open Network



Closed Network

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### Tactics: Disruptive Innovation

- Continuous innovation: improvements in current technology driven by current customers
- Disruptive innovation: Eg:
  - PC vs minicomputer vs mainframe
  - palmtop vs laptop vs PC
- Performance characteristics in terms of conventional metrics **actually worse!**
  - Lower margins, unclear markets
  - New performance dimensions of value
  - Capture attention of completely new customer sets => don't listen to current customers!
- The powerful laws of IT make disruptive innovations **more frequent!**

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### Disruptive Innovation?



Why or why not ?

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### Disruptive Innovation?



Why or why not ?

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### Tactics: Waste Bandwidth?

- Design rule: tradeoff cheaper resources to optimize costlier resources.
  - Cheap resources: bandwidth, computation, storage
  - Expensive resources: Attention (time), Space (eg: ISP PoPs), Money ?
- Eg: ASPs, Managed Svc Providers, Outsourcers
  - Let businesses focus on their core
- Caveat: When money is tight (high interest rates), customers prefer continuous innovation over disruptive innovations. Why ?

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### Relationships

- The internet allows several types of relationships:
  - Asynchronous: email, ftp, mp3
  - Point-to-point relationship: email, chat, instant messaging, file-transfer, peer-to-peer (napster), ip telephony, multimedia conf.
  - Content-to-customer relationship: yahoo, b2c ecommerce (amazon), e-bay, internet TV etc
  - B2B relationships: marketplaces, auctions, customer/partner portals, VPNs/extranets etc
- The relationships which will survive are the ones the parties in the relationship really care about!
  - Will lead to network effects per Metcalfe's law.
  - Point-to-point & asynchronous dominate!

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### Summary: New economy characteristics

- 1. Global
  - **Understanding how networks grow and prosper**
    - Effect of Moore and Metcalfe laws
    - Standards, innovation, critical mass...
- 2. Favors intangible things - ideas, knowledge, relationships
  - **How interfaces control attention:** Economics of attention

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### Summary (contd)

- Information cost-structure, Nature of intangibles
- Control of interfaces around which a value-chain is created leads to a gorilla (Microsoft, Cisco, Intel)
- **3. Value is intensely interlinked (networked)**
  - ***Plentitude (not scarcity) drives value***
  - Value in the network, not in components!
  - Develop partner, user networks!