

15.566
**Information Technology as an Integrating
Force in Manufacturing**

Session 1 of 25

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Sloan School of Management

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(*) Some of the transparencies used in these sessions are based on slides used by the IT group in previous years

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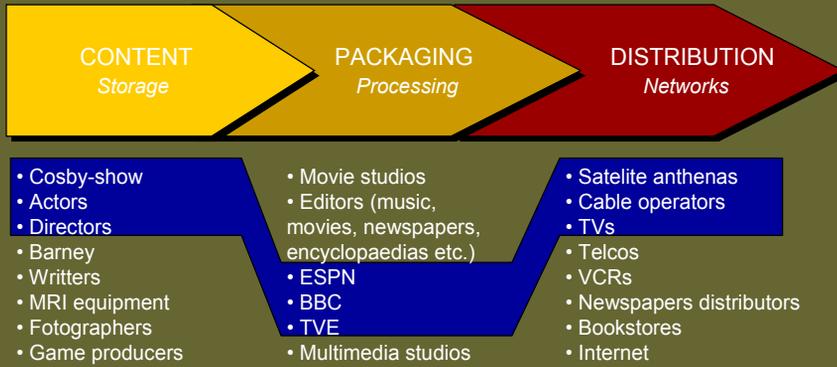
RETURN ON INVESTMENT OF TECHNOLOGY

In manufacturing, computer capital ROI is 10 times bigger than other capital ROI

- Manufacturing
 - Computer capital 54.2%
 - Other capital 4.1%
- Manufacturing and service
 - Computer capital 68.7%
 - Other capital 6.9%

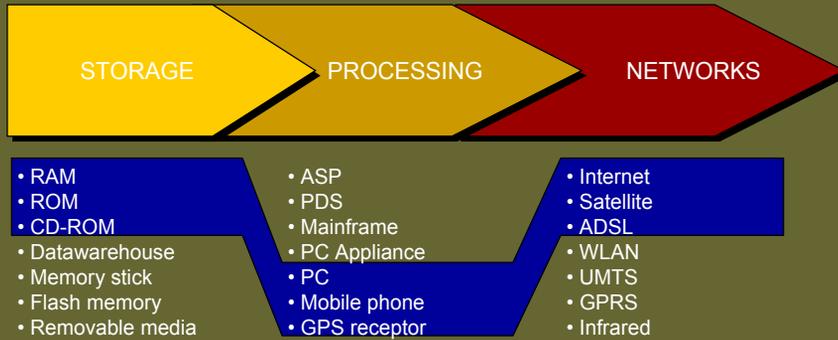
Source: Study by Brynjolfsson over a four year period

The information value chain Business Perspective



The information value chain

Technical Perspective

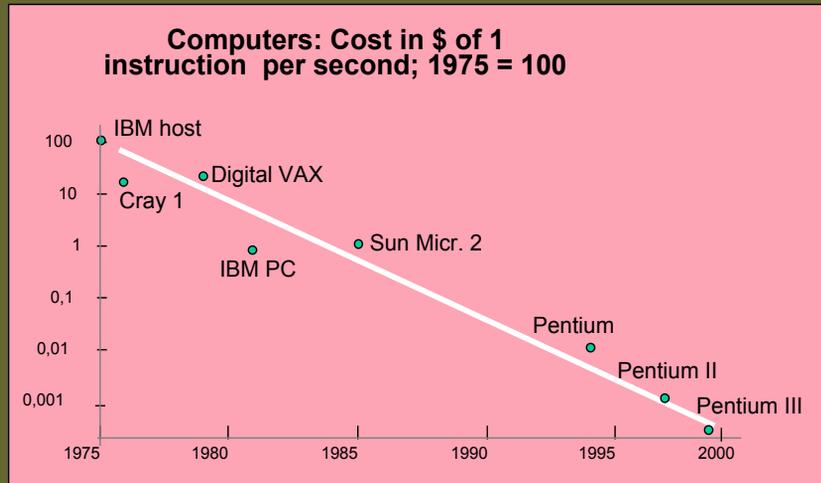


The information value chain Business Perspective Expanded



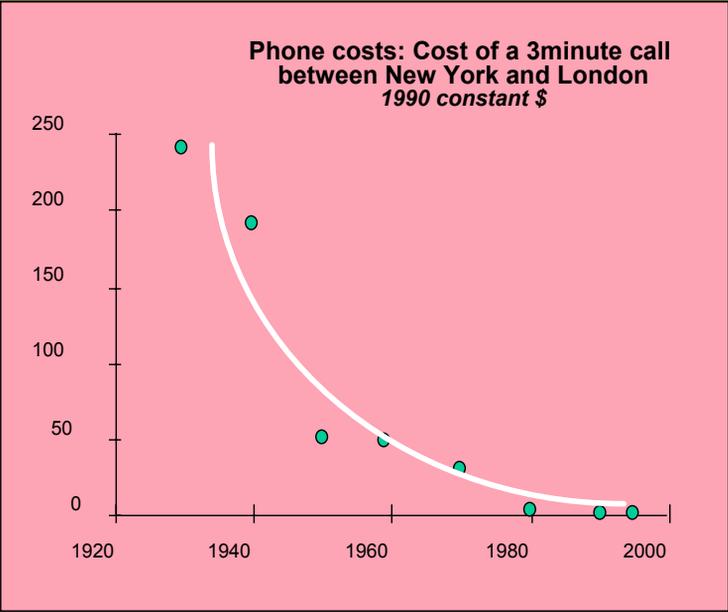
New Technologies change very rapidly (cont.)

“Moore’s Law”



Expressing Memory Capacity

- Measured in bytes (=groups of 8 bits)
- Each byte can store a binary number from 00000000 to 11111111 ($2^8 = 256$)
- More generally: n binary digits can store numbers from 0 to $2^n - 1$
- Frequently used multiples:
 - Kilobyte (KB) = 1,024 (2^{10}) bytes
 - Megabyte (MB) = 1,024 KB = 1,048,576 (2^{20}) bytes
 - Gigabyte (GB) = 1,024 MB ~ 1 billion (2^{30}) bytes



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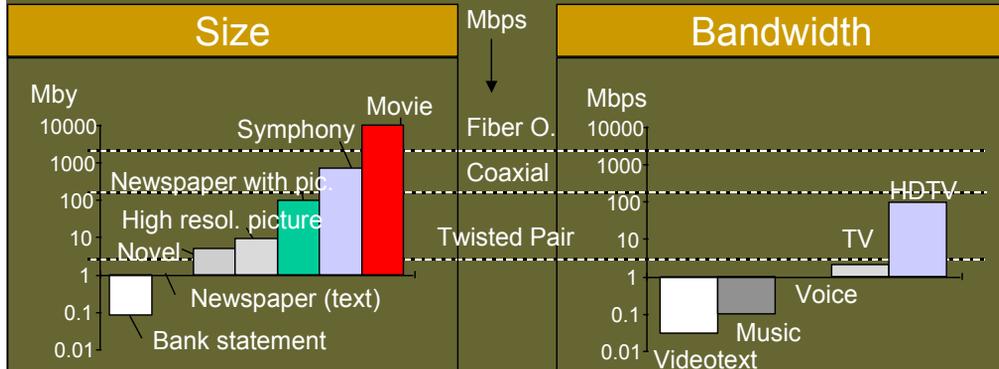
Growth in Internet Host Computers and Major E-Commerce Developments

See: OECD, 1998

Evolution of the Internet

- 60's:
 - DARPA (Defense Advanced Research Projects Agency)
- 1969:
 - ARPANET interconnected 4 large hosts
- Early 80's:
 - 100 hosts in ARPANET. Other networks appear
- 1982:
 - Adoption of the TCP/IP as de facto standard
- 1983:
 - Interconnection of several networks. The Internet is born
- 1986:
 - NSFnet (network from the National Science Foundation) interconnects 5 of the largest supercomputers in the USA not to depend from the Defense Secretary. Use TCP/IP.

Size and Bandwidth for some applications



How much space does your life take?

Storage

Bandwidth

Processing power

In other words, one hour “uses”
 $64\text{Mbytes}/28=2,29\text{Mbytes}$ or
 $2,29\times 8=18,32\text{Mbits}$
(this is similar to a single MP3 song)

Internet Adoption Rates vs. Other Mediums

Internet as Mass Medium — North American Adoption Curves

TECHNOLOGY RATE OF CHANGE – MANUFACTURING PERSPECTIVE

If Rolls-Royce product and manufacturing progress 1950 - 2000 matched computer progress, then a Rolls-Royce would:

- Cost \$4
- Capacity 120,000
- Mileage 40,000,000 Miles Per Gallon
- Maximum speed 400,000 Miles Per Hour
- Size 1 Cubic Foot
- Weight 0.05 Pounds
- Repairs Once every 1000 Years

Difficulties to predict the future

All that can be invented has been invented

Charles Duell, Director U.S. Patent Office, 1899

This craziness for the radio will die soon

Thomas Edison, 1922

There is a world market for about five computers

Thomas Watson, IBM chairman, 1943

In the future, computers will not weight more than 1,5 tons

Popular Mechanics, 1949

There is no reason for anyone to have a computer at home

Ken Olsen, president of Digital, 1977

64K will be enough for anybody

Bill Gates, president of Microsoft, 1981