15.561

Information Systems: *From Information Infrastructure to the Networked Corporation*

15.566

Information Technology as an Integrating Force in Manufacturing

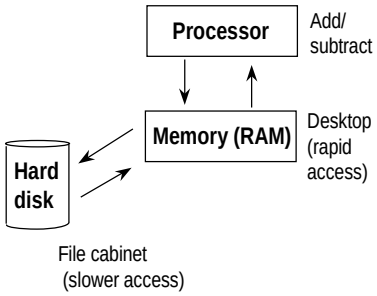
Session 3
Faster World

FASTER WORLD

- **Faster technology world**
  - Computers
  - Communications
- **Faster business world**
  - Agile enterprise
  - Agile manufacturing

FASTER TECHNOLOGY WORLD-COMPUTERS

- **Processors**
  - Speed (MHz; MIPS, MFLOPS)
  - Density (6.5 μ ⟶ 0.5 μ)
  - Complexity
  - Parallelism
  - Data paths
    4 bit (4040), 8 bit (8080), 16 bit (286), 32 bit (386/486), 64 bit



- **Main Memory = RAM (Speed?)**
  - Single chip capacity
    1 M ⟶ 4M ⟶ 16M bits ⇢ 1 GB chips
  - New unit of measure (1 EB ≅ 1 GB)
- **Secondary Storage = Hard disk (Speed?)**
  - Typical capacities:
    1-2 GB⇢ 18TB (=18,000 EB's) (e.g., local video storage)

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FASTER TECHNOLOGY WORLD-COMMUNICATIONS

- **Capacity:** 1956 transatlantic cable (50 voice channels)
  1990's cable (85,000 voice channels)
- **Raw bandwidth - today**
  Typical modem = ?
  ISDN basic line = 64K or 128K bps
  T1 = 1.544 M bps ("high speed" Internet link)
  T3 = 45 M bps (current Internet backbone)
- **Near-term potential bandwidth**
  - 1 G bps ≅ 1000 * T1 (1 EB ≅ 10 seconds)
  - Experiments: 10 - 300 G bps (9000 km - 150 km)
  - Laboratory: 1 T bps (1 EB≅ .01 seconds)
- **Major trends: ISDN & ATM**

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FASTER BUSINESS WORLD

- **Notions of**
  - How to do things
  - How much time it takes to do things
- **Example: Time to build a house**

- **Issues:**
  - Organization and planning
  - Technology
  - Team work

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Dell-ocity Strategy

- Internet Web ordering ($1M/day) - both general public and corporate accounts
- Payments via credit card or electronic payment
- Build to order
- Supplier warehouses within 15 minutes of factory (regional suppliers)
- Dell billed when parts leave warehouse
- Monitor separately shipped directly to buyer
- "Shape demand" via telephone sales agents

	Dell	Compaq
Inventory (in days)		
III '95	37	76
IV '96	13	25
From Order to Cash (days)	1	35
Profitability (return on invested capital)	50%	20%

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ACCELERATED ACTIVITIES IN BUSINESS (TIME-TO-?)

- **Time-to-design (Concurrent engineering)**
- **Time-to-market (R&D → Manufacturing)**
- **Time-to-order respond (Sale → Manufacture → Distribution)**
- **Time-to-service**
- **Just-in-time**
- **Examples**
  - ABB cycle time reduction:
    - Engineering 30%
    - Manufacturing 60%
    - Field work 90%
  - Boeing B-777 paperless design
- **Concept: "Agile Enterprise"**

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SOME CHARACTERISTICS OF "AGILE" ENVIRONMENT

General notions

- **Innovation**
- **Entrepreneurship**
- **Information infrastructure**

Time related characteristics

1. **Assimilate field experience faster**
2. **Concurrency (Concurrent Engineering)**
3. **Continual Change**
4. **Continual modification/Design for evolution**
5. **Mass customization/Smaller lot sizes**
6. **Rapid Response**
7. **Speedy time-to-market**

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AGILE MANUFACTURING

GOVERNMENT SUPPORT

- **Technology Reinvestment Program (TRP)**
  - Agile Manufacturing
  - Information Infrastructure

DRIVING PHILOSOPHY (Personal View)

- **"Next" Paradigm for Manufacturing**
  - Invent it vs. Follow it (e.g., Lean Mfg.)
- **Match to (Perceived) Strengths of USA**
  - Innovation and Entrepreneurship
- **Military: Rapid Response Era**
  - Cold War: Knew enemy and strategy
  - Post Cold War:
    (1) Don't know enemy
    (2) Unlimited possibilities
    (3) Stockpile materials vs. Rapid Mfg.

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CREATING "Just-in-Time Enterprise" Example: Rapid Production of 300,000 Desert Uniforms within 30 days

	INFORMATION	PROCESSES
Resource Discover ***(Locate)*** - Advertise - Find	-Locate components: costs & quantity requirements	-Identify process capabilities
Resource Coordinate ***(Negotiate)*** - Differences - Agreements	-Determine semantic differences -Determine ability to interoperate	-Differences in processes -Determine optimal processes
Resource Link ***(Integrate)*** - Link Operational Systems - Link Management Systems	-Perform efficient information interchange (e.g., order process, MRP, etc.)	-Implement effective process interfaces (e.g., integrated MRP logic)

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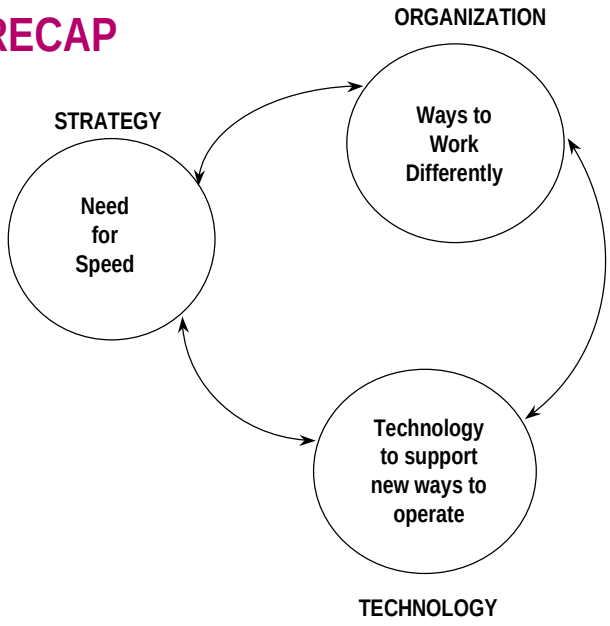
RECAP


ORGANIZATION
Ways to Work Differently
STRATEGY
Need for Speed
Technology to support new ways to operate
TECHNOLOGY

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