Management Information Systems MIS 310

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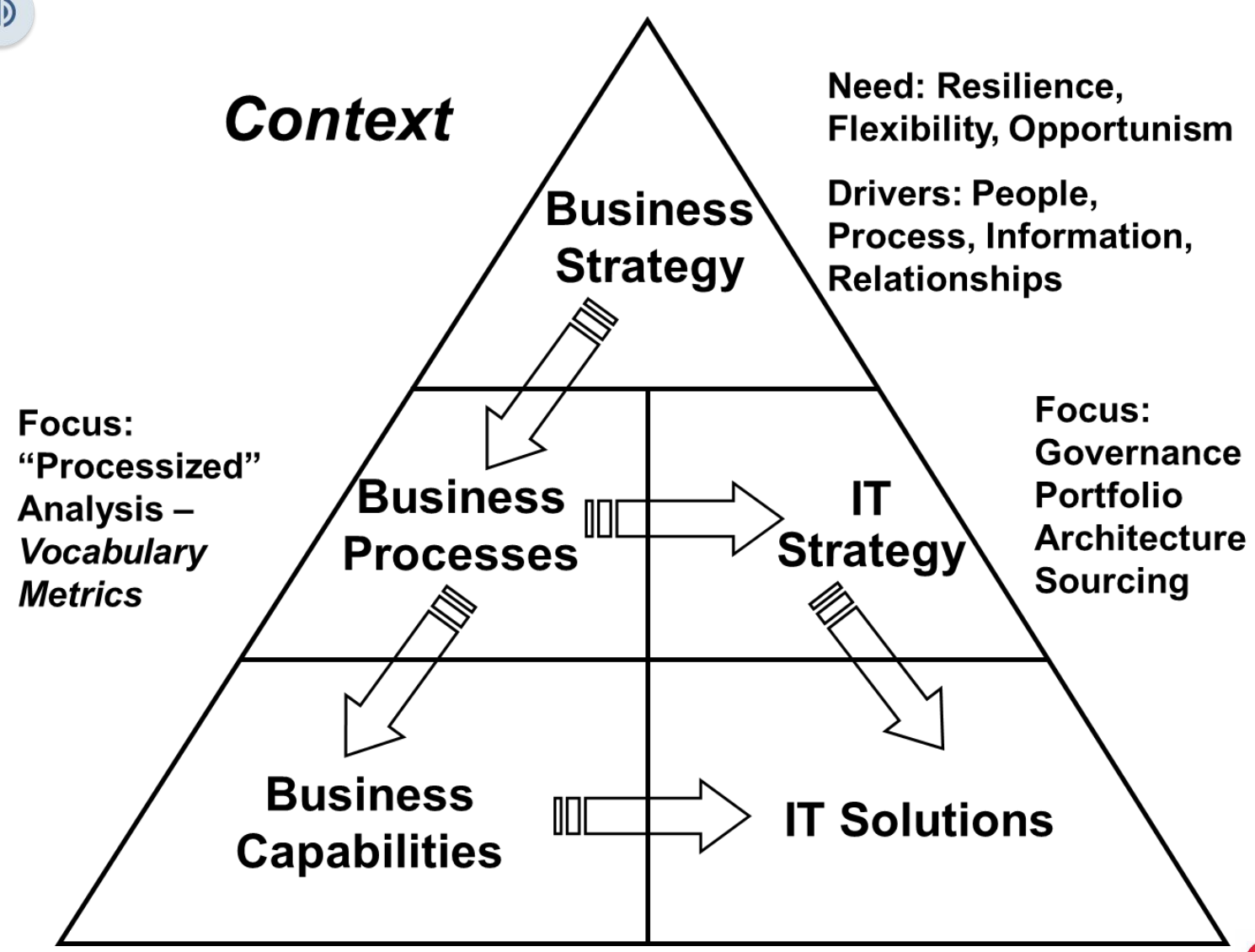
Enterprise Architecture and IS Infrastructure

Enterprise Architecture

- **Enterprise Architecture** (EA) is a well-defined practice for conducting enterprise analysis, design, planning, and implementation, using a holistic approach at all times, for the successful development and execution of strategy.

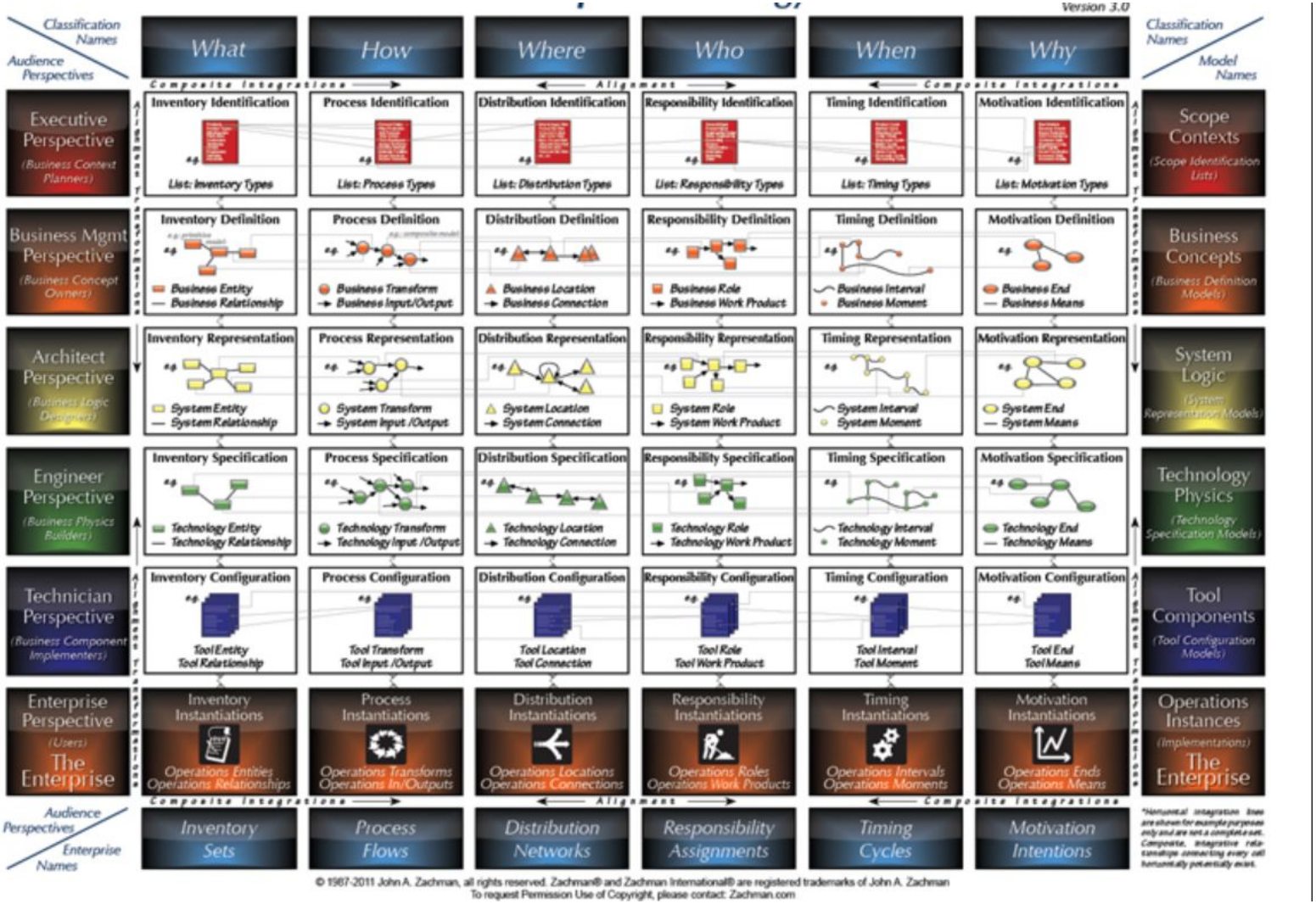
https://en.wikipedia.org/wiki/**Enterprise_architecture**

Enterprise Architecture: Big Picture



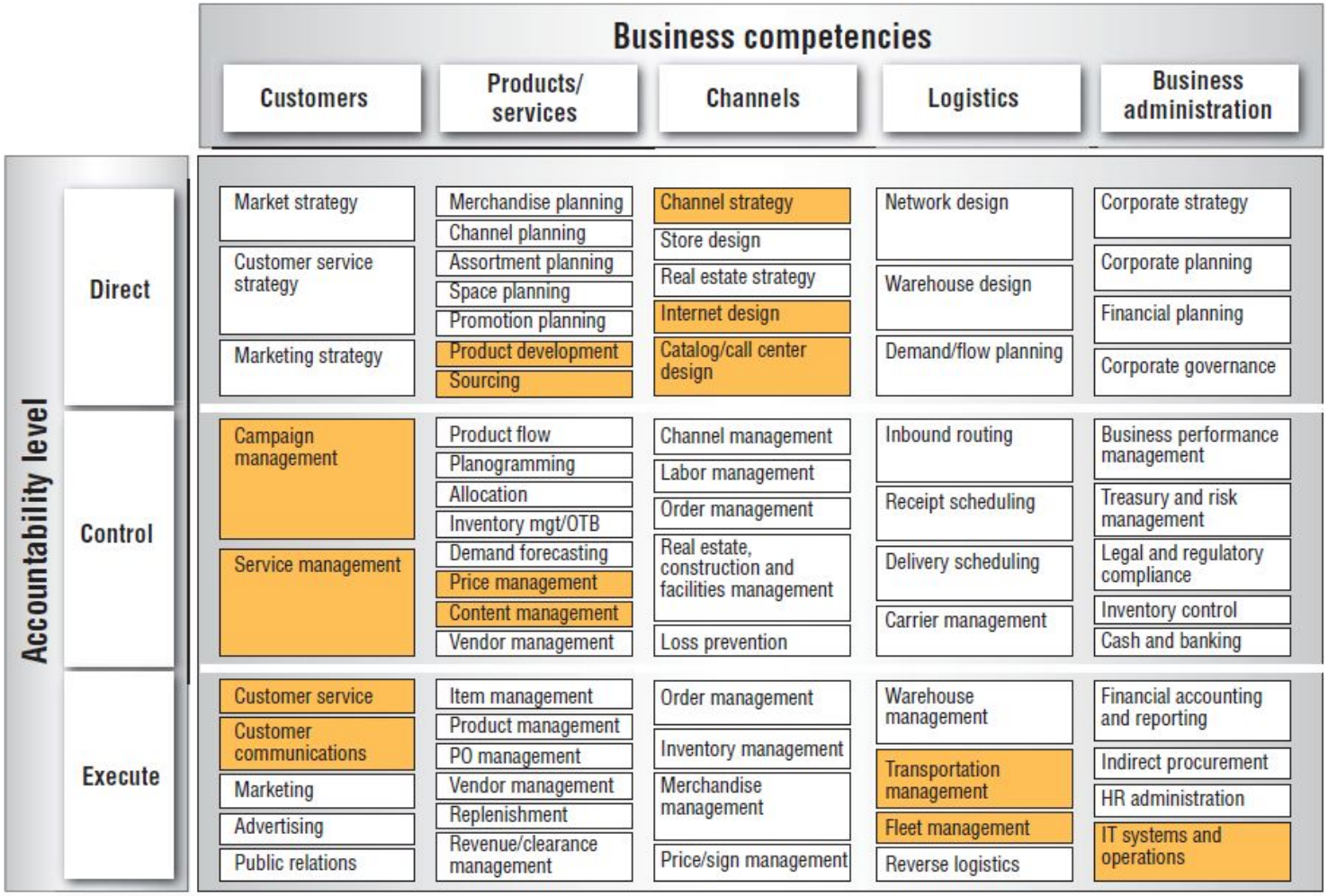
EA: Zachman Framework

- Proactive business tool, which is used to model an organization's existing functions, elements, and processes while helping manage business change



https://zachman-feac.com/zachman/about-the-zachman-framework

EA: Heat Map Framework



Source: IBM Business Consulting Services.

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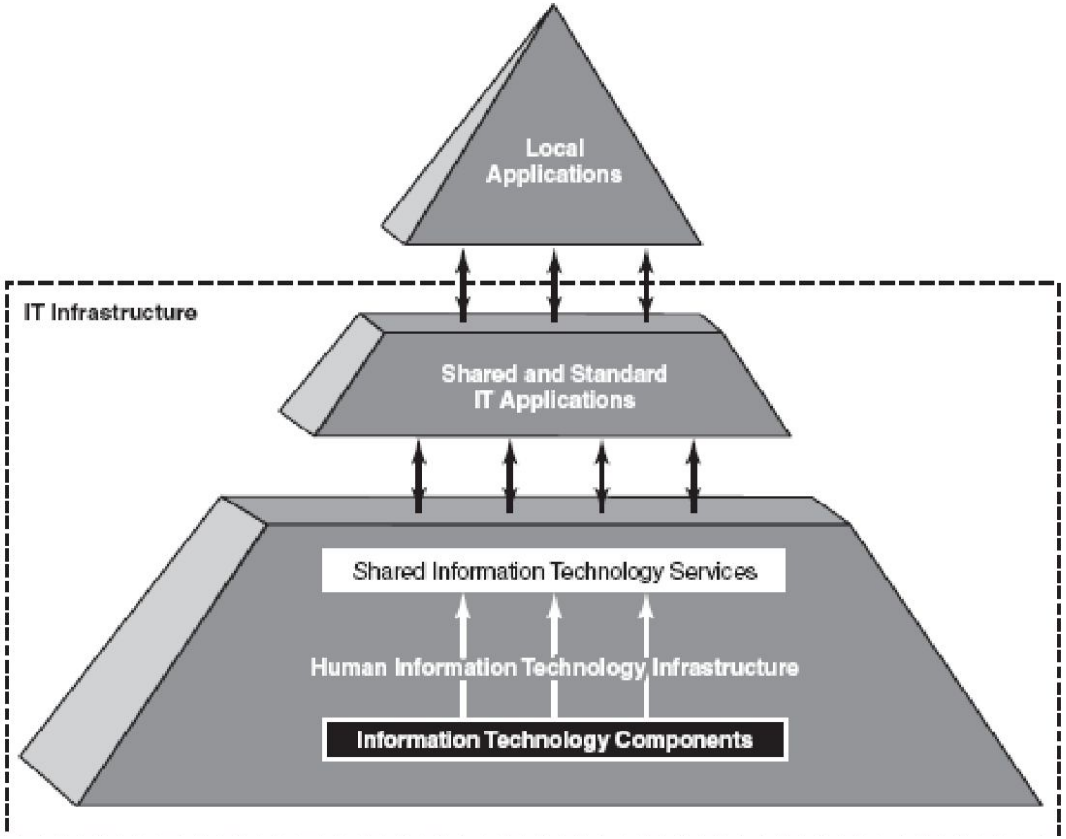
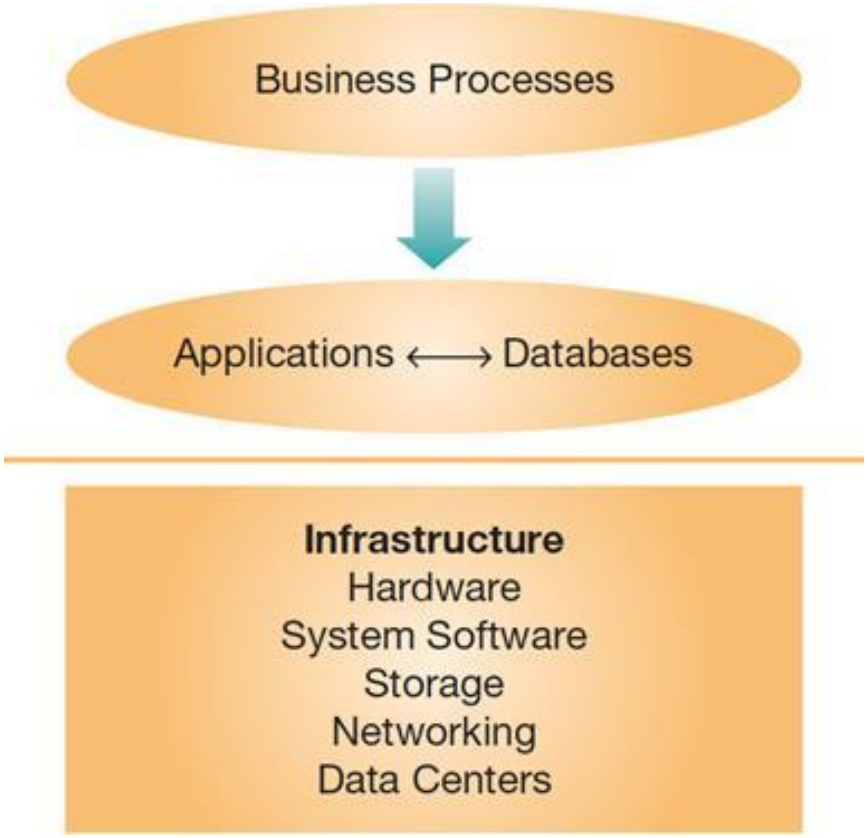
The IS Infrastructure

- "The hardware, software, and telecommunication/ networking systems or equipment together provide the underlying foundation to support the organization's goals."



IS Infrastructure Components

- Hardware
- Software
  - System
  - Application
    - Databases
- Storage
- Networking
- Data Centers



IS Infrastructure Components: Hardware

Type of Computer	Number of Simultaneous Users	Physical Size	Typical Use	Random Access Memory	Typical Cost (in US$)
Supercomputer	One to many	Like an automobile to as large as multiple rooms	Scientific research	5,000+ GB	Up to $100 million
Mainframe	1,000+	Like a refrigerator	Transaction processing, enterprise-wide applications	Up to 3,000 GB	Up to $10 million
Server	10,000+	Like a DVD player and mounted in a rack to fitting on a desktop	Providing websites or access to databases, applications or files	Up to 512 GB	Up to $50,000
Workstation	Typically one	Fitting on a desk-top to the size of a file cabinet	Engineering, medical, graphic design	Up to 512 GB	Up to $100,000
Personal computer	One	Fitting on a desk-top	Personal productivity	512 MB to 32 G B	Up to $5,000
Mobile device	One	Handheld	Personal productivity	512 MB to 2 GB	Up to $750

Evolution of IT Infrastructure: Hardware

Mainframe/Mini Computers

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Personal Computer

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Client/Server Computing

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Web-based enterprise applications

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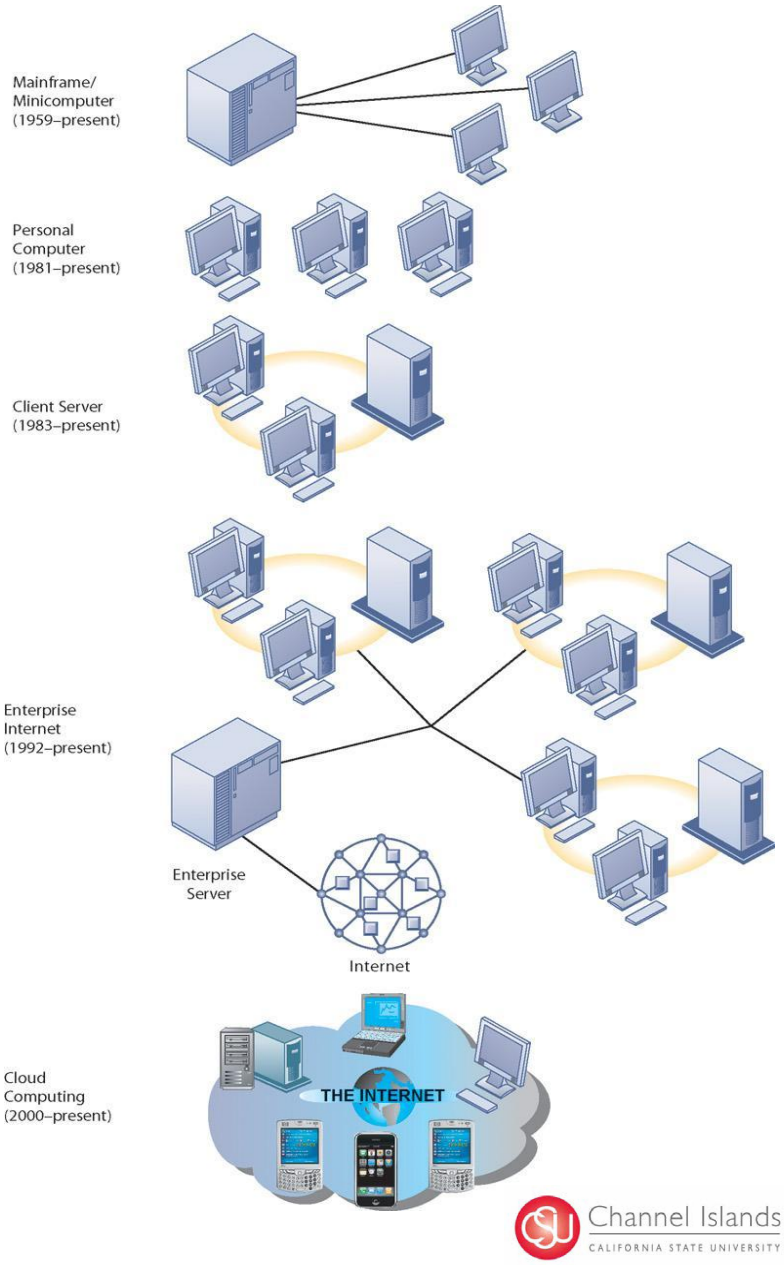
Cloud Computing/mobile device BYOD (Bring Your Own Devices)

↓

Pervasive computing



IS Infrastructure Components: System Software

- Controls computer hardware operations
- Operating systems
  - Examples: Windows, OS X, Ubuntu, Linux
  - Manages hard drives and storage
  - Manages keyboard, mouse, monitor, and printers
  - Coordinates application access to computing resources

IS Infrastructure Components: Software

- Application Software
  - Software tools used to complete the work required to operate and manage an organization
    - Process automation
    - Decision support
    - Other business and user needs
- Databases
  - Collections of data
  - Organized to facilitate data searches

IS Infrastructure Components: Storage

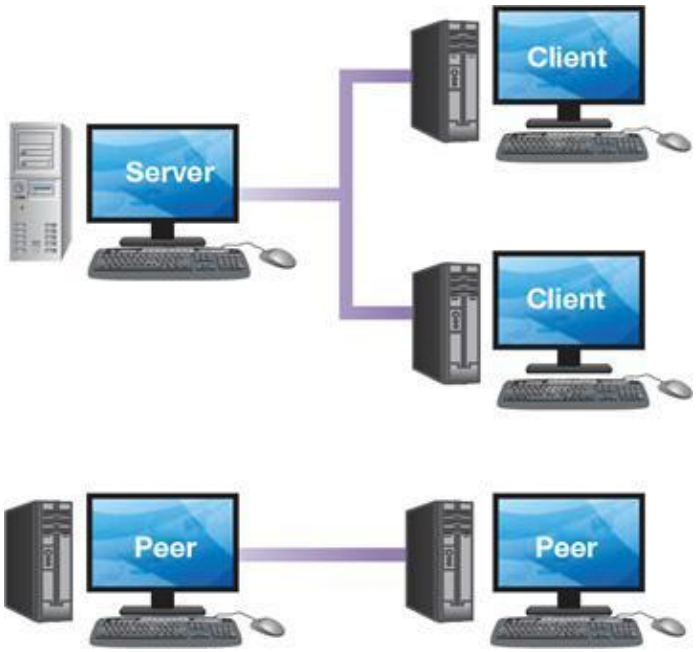
Storage Type	Purpose
Operational	For processing transactions or for data analysis
Backup	Short-term copies of organizational data, used to recover from system related disaster (Backup data are frequently overwritten with newer backups
Archival data	Long-term copies of organizational data, often used for compliance and reporting purposes

IS Infrastructure Components: Networking

- Both human and computer communication involve senders, a message to share, and receivers.
- Network requires:
  - Sender and receiver
  - Transmission pathway
  - Rules/protocols for communication

IS Infrastructure Components: Servers, Clients, and Peers

- Servers
  - Host (serve up) data, databases, files applications, Web sites, video, and other content for access over the network
- Clients
  - Consume hosted resources
- Peers (P2P)
  - Serve and consume resources, both a server and a client interacting with similar computers



IS Infrastructure Components: Types of Networks

Type	Usage	Size
Personal area network (PAN)	Wireless communication between devices (Bluetooth)	Under 10 meters
Local area network (LAN)	Sharing of data, software applications, or other resources between several users	Typically within a building
Wide area network (WAN/Wi-Fi)	Connect multiple LANs, often with distributed ownership and management	Large physical distance spanning multiple buildings or the area of a city to worldwide (Internet)

IS Infrastructure Components: Data Centers

- Large amounts of data to be managed
- Dedicated space for infrastructure components such as data centers
- Data center centralization facilitates
  - Management
  - Repairs
  - Upgrades
  - Security

Review Questions

- What is the Zachman Framework used for?
- What is difference between operating and application software?
- What is the main function of a server computer?
- What is the function that could be performed by a peer computer but not by a client computer?

IS Infrastructure Evolution: Moore's Law

- Dr. Gordon Moore
  - Co-founder of Intel
  - Theorized that the number of transistors on a chip would double every two years
    - Computing power would double every two years
    - Has been relatively accurate to this date
      - ✔ First CPU had 2,200 transistors
      - ✔ The latest CPUs have over 10 billion transistors
  - Contrary factors: Heat dissipation needs, power consumption concerns
  - Nanotechnology: May shrink size of transistors to width of several atoms.

https://www.intel.com/content/www/us/en/silicon-innovations/moores-law-technology.html

IS Infrastructure Evolution: Moore's Law

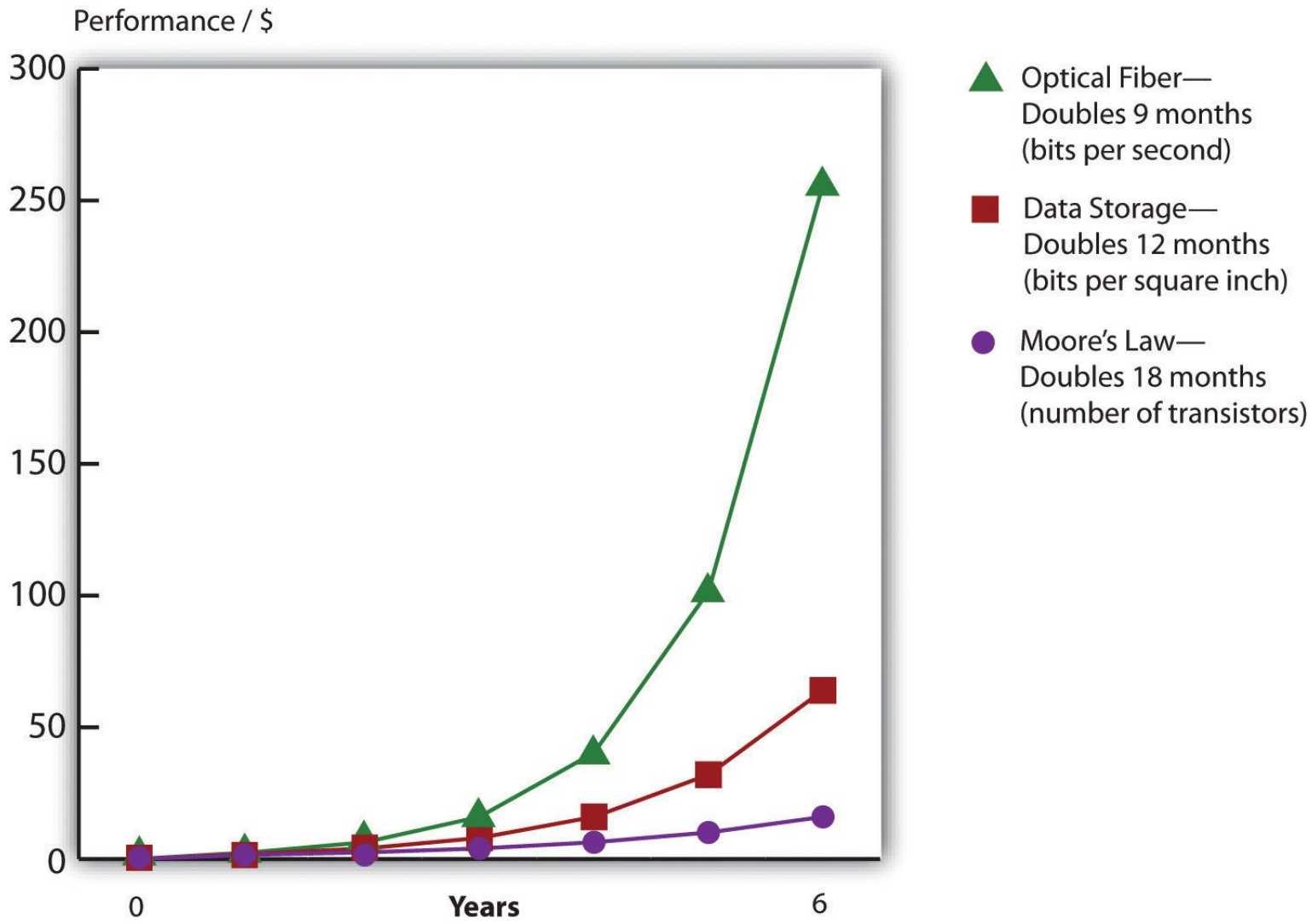
- Moore's Law and related price/performance trends are behind the price decreases across a wide variety of tech products and services.

Amazon Kindle		Apple	
First Generation	Fourth Generation	iPod	iCloud
250 MB	2 GB	5 GB	5 GB
November 2007	September 2011	October 2001	October 2011
$399	$79	$399	Free

IS Infrastructure Evolution: Moore's Law

- 20 years of mergers and acquisitions — 1993 to 2013

Advancing Rates of Technology



Source: Adopted from Shareholder Presentation by Jeff Bezos, Amazon.com, 2006.

Technology Drivers of IS Infrastructure Evolution

- Moore's law and micro-processing power
- Law of Mass Digital Storage
  - The amount of data being stored each year doubles
- Metcalfe's Law and Network Economy
  - Value or power of a network grows exponentially as a function of the number of network members
    - a network's value is proportional to the square of the number of nodes in the network.
  - As network members increase, more people want to use it (demand for network access increases)
  - Downside to network effects
    - exponentially growing networks become harder to control, coordinate or curate.

The Network Effects of Uber

Review Questions

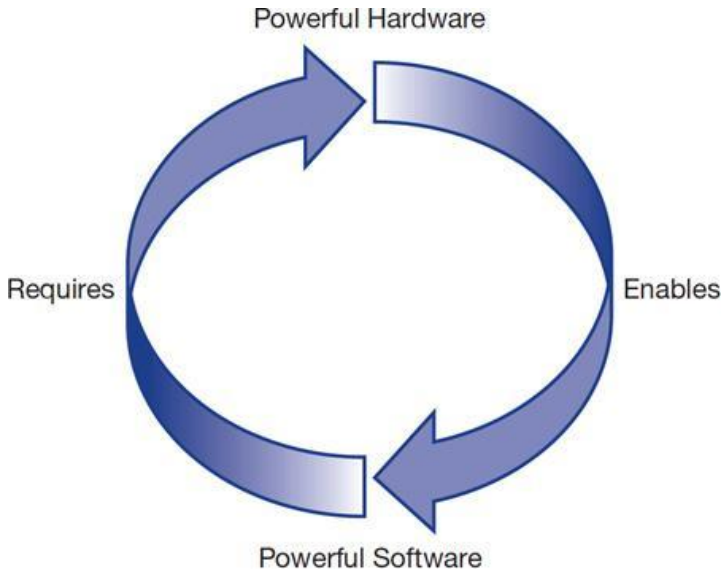
- What does Moore's law tell us?
- How has Moore's law impacted the economy?
- What is network effect?
- Does network value increase linearly or exponentially? What law predicts it?

IS Infrastructure: Issues

- Rapid Obsolescence and Shorter IT Cycles
- Big Data and Rapidly Increasing Storage Needs
- Demand Fluctuations
- Increasing Energy Needs

IT Cycles and Obsolescence

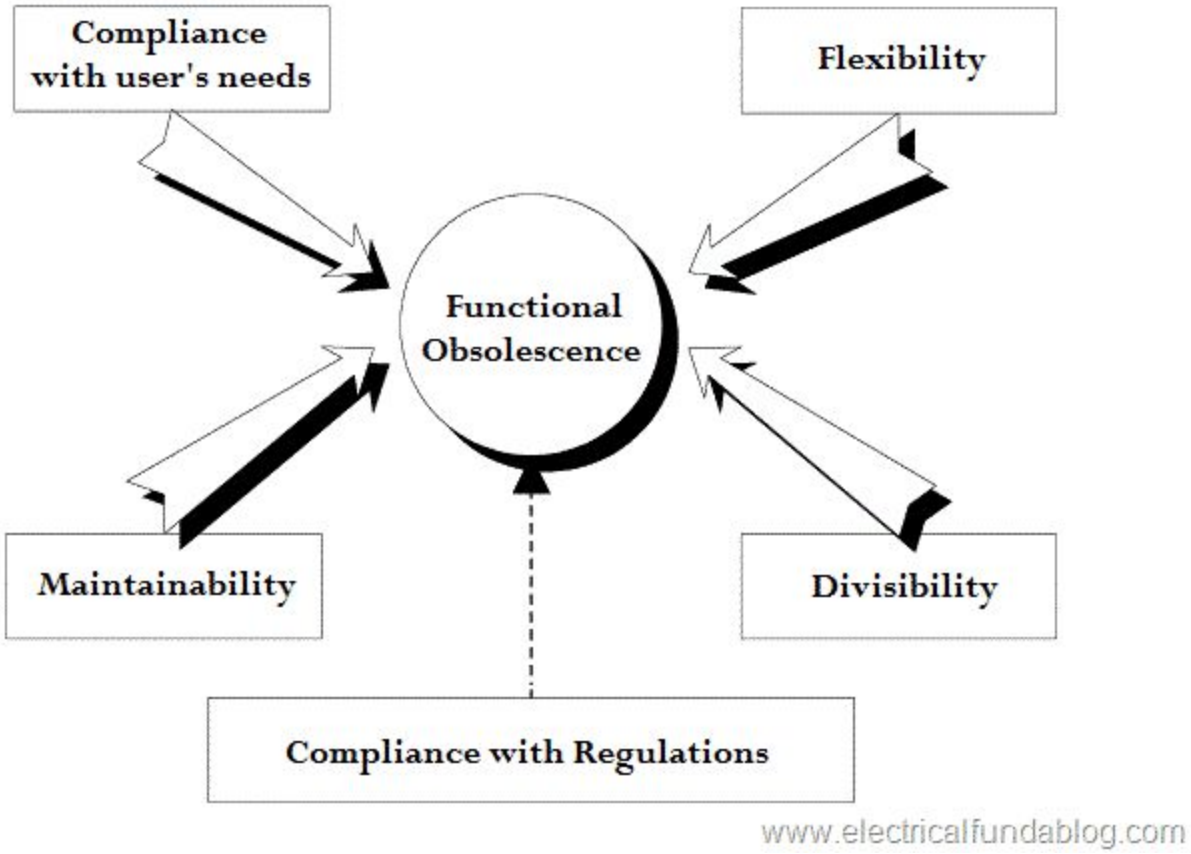
- Powerful computers enable new applications
- New applications drive efficiencies
- New applications often make old hardware obsolete
- Obsolete hardware requires replacement



IT Cycles and Obsolescence

- An upgraded product or a superior technology overtakes its predecessor.

IT Cycles and Obsolescence



- Functional Obsolescence
  - System is not able to perform its intended function and it becomes costly to maintain it for high/ optimum performance

IT Cycles and Obsolescence

- Planned Obsolescence
  - It is deliberately designing a product not to long last.

Big Data and Rapidly Increasing Storage Needs

- Firms collect unprecedented levels of data
  - Business intelligence
  - Legal compliance (e.g., Sarbanes-Oxley)
- Unprecedented levels of data require unprecedented infrastructure capabilities
  - More storage space, powerful hardware, and database management
  - Ever-increasing Internet bandwidth
  - Vicious cycle: enhanced capacity drives new applications, requiring even more capacity

Demand Fluctuations

- Many companies face demand fluctuations
  - Seasonal fluctuations (e.g., December holidays)
  - Monthly fluctuations (month-end spikes)
- Demand fluctuations create inefficiencies
  - Up to 70% of IS capacity only used 20% of the time
  - IS infrastructure is typically not readily scalable
    - Changing internal capacity takes time
    - Cloud computing (next section) may be the answer

Increasing Energy Needs

- Computing can require a lot of power
  - Hardware draws power, which generates heat
  - Heat requires cooling, which requires more power
- Data centers can use large amounts of power
  - 15 to 17 kilowatts per rack
  - Large data centers have hundreds of server racks
  - More power is required for cooling and lost through other inefficiencies

Discussion Questions

- Of the four primary components of an information system (technology component, data, people, organization), which do you think is the most important to the success of a business organization? Support your answer with an example from your personal experience.
- Why is Moore's Law important for managers? How does it influence managerial thinking? Explain what impact does Moore's Law have on a specific business. Use real-world examples.
- What's special about falling chip prices compared to price drops for other products like food? Use real-world examples that best support your answer.
- How are switching costs and network effects related to each other? How do they affect competition? Support your answers with specific examples.
- How does hardware and software obsolescence affect your life? Give examples of experiences with outdated hardware or software. How did you deal with these situations?

Sources:
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John Gallaugher, Information Systems: A Manager's Guide to Harnessing Technology, v. 7.0
Minder Chen,Ph.D., Management Information Systems Lectures