Chapter 5
IT INFRASTRUCTURE AND EMERGING TECHNOLOGIES

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Management Information System

Sources

◆ Ken Laudon & Jane Laudon, Prentice Hall

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Cases

◆ Case 1: ESPN.com: Getting to eXtreme Scale On the Web
◆ Case 2: Salesforce.com: Managing by Smartphone
◆ Case 3: Hudson's Bay Company and IBM: Virtual Blade Platform
◆ Instructional Video 1: Google and IBM Produce Cloud Computing
◆ Instructional Video 2: IBM Blue Cloud is Ready-to-Use Computing
◆ Instructional Video 3: What the Hell is Cloud Computing?
◆ Instructional Video 4: What is AJAX and How Does it Work?
◆ Instructional Video 5 : Yahoo's FireEagle Geolocation Service

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Learning Objectives

◆ Define IT infrastructure and describe its components.
◆ Identify and describe the stages and technology drivers of IT infrastructure evolution.
◆ Assess contemporary computer hardware platform trends.
◆ Assess contemporary software platform trends.
◆ Evaluate the challenges of managing IT infrastructure and management solutions.

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BART Speeds Up with a New IT Infrastructure

◆ Problem: Aging systems no longer able to provide information rapidly enough for timely decisions; too unreliable for 24/7 operations

◆ Solutions: Replaced and upgraded hardware and software and used leading-edge technology
- Grid computing
- Virtualization
- Blade servers

◆ Demonstrates IT's role in using resources more efficiently; reducing computing energy usage, modernizing services

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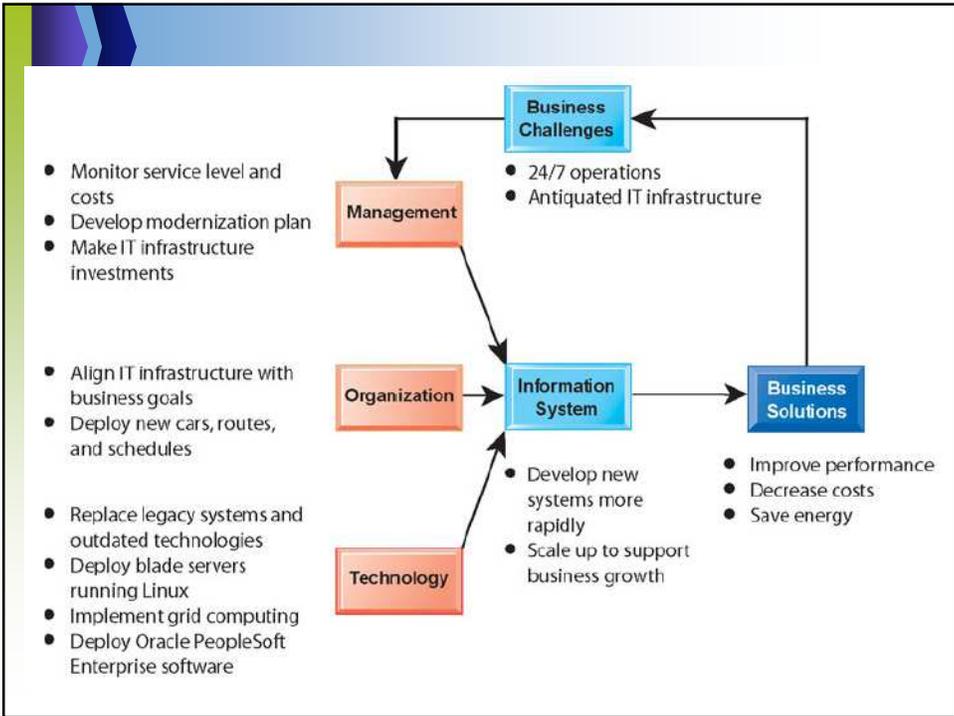
IT Infrastructure

◆**Evolution of IT infrastructure**

- General-purpose mainframe & minicomputer era: 1959 to present
  - 1958 IBM first mainframes introduced
  - 1965 Less expensive DEC minicomputers introduced
- Personal computer era: 1981 to present
  - 1981 Introduction of IBM PC
  - Proliferation in 80s, 90s resulted in growth of personal software
- Client/server era: 1983 to present
  - Desktop clients networked to servers, with processing work split between clients and servers
  - Network may be two-tiered or multitiered (N-tiered)
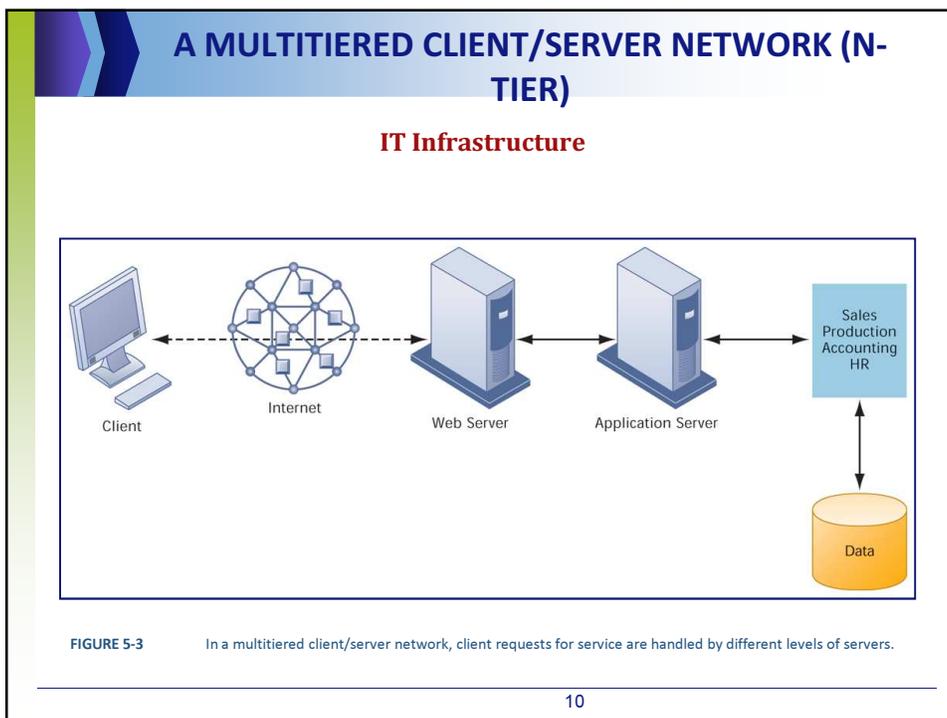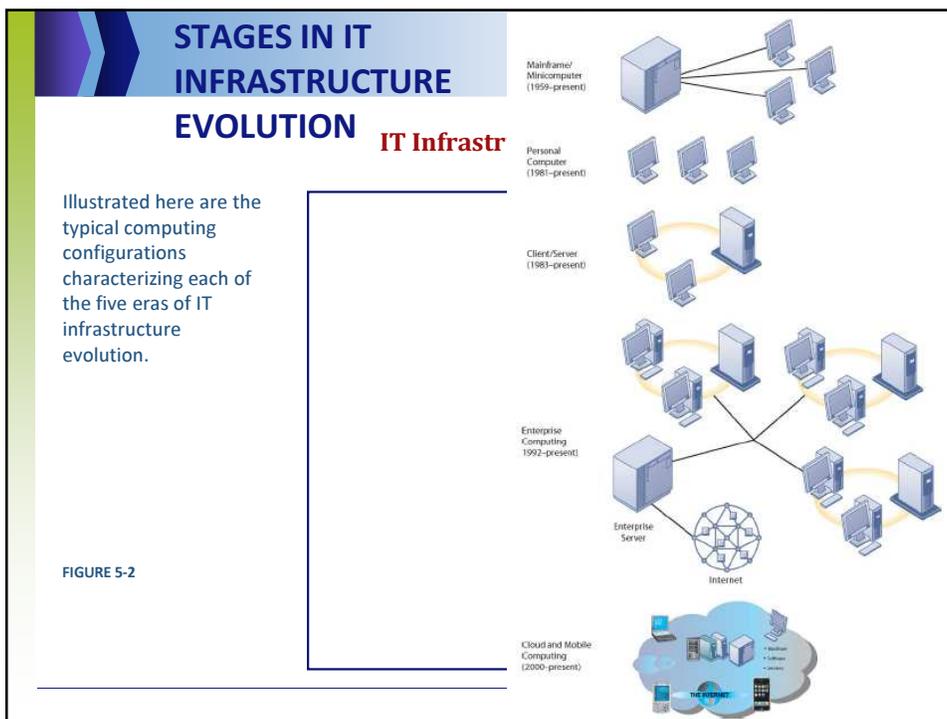 - Various types of servers (network, application, Web)

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IT Infrastructure

◆ Evolution of IT infrastructure (cont.)

- Enterprise computing era: 1992 to present
  - Move toward integrating disparate networks, applications using Internet standards and enterprise applications
- Cloud Computing: 2000 to present
  - Refers to a model of computing where firms and individuals obtain computing power and software applications over the Internet or other network
  - Fastest growing form of computing

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STAGES IN IT INFRASTRUCTURE EVOLUTION

IT Infrastr

Illustrated here are the typical computing configurations characterizing each of the five eras of IT infrastructure evolution.

FIGURE 5-2

Mainframe/Minicomputer (1959–present)

Personal Computer (1981–present)

Client/Server (1983–present)

Enterprise Computing 1992–present)

Enterprise Server

Internet

Cloud and Mobile Computing (2000–present)

A MULTITIERED CLIENT/SERVER NETWORK (N-TIER)

IT Infrastructure

Client

Internet

Web Server

Application Server

Sales Production Accounting HR

Data

FIGURE 5-3   In a multitiered client/server network, client requests for service are handled by different levels of servers.

IT Infrastructure

◆ Technology drivers of infrastructure evolution

- Moore's law and microprocessing power
  - Computing power doubles every 18 months
  - Nanotechnology:
    - Shrinks size of transistors to size comparable to size of a virus
- Law of Mass Digital Storage
  - The amount of data being stored each year doubles

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MOORE'S LAW AND MICROPROCESSOR PERFORMANCE

IT Infrastructure

Packing over 2 billion transistors into a tiny microprocessor has exponentially increased processing power. Processing power has increased to over 500,000 MIPS (millions of instructions per second).

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FALLING COST OF CHIPS

IT Infrastructure

Packing more
transistors into less
space has driven down
transistor cost
dramatically as well as
the cost of the
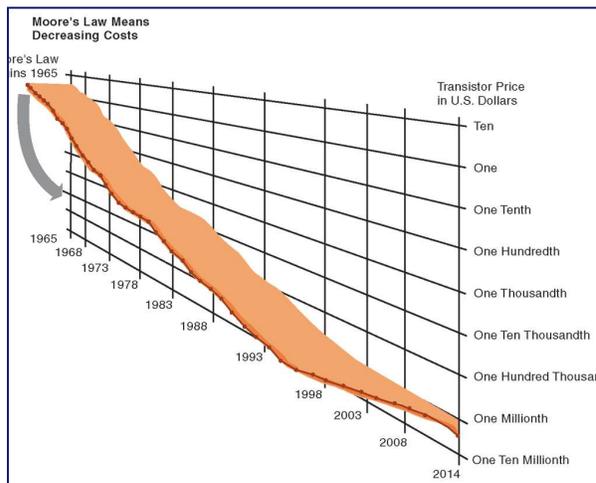products in which they
are used.

FIGURE 5-5

Moore's Law Means
Decreasing Costs

Moore's Law
begins 1965

Transistor Price
in U.S. Dollars

Ten
One
One Tenth
One Hundredth
One Thousandth
One Ten Thousandth
One Hundred Thousand
One Millionth
One Ten Millionth

1965
1968
1973
1978
1983
1988
1993
1998
2003
2008
2014

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IT Infrastructure

◆ Technology drivers of infrastructure evolution (cont.)

- Metcalfe's Law and network economics
  - Value or power of a network grows exponentially as a function of the number of network members
  - As network members increase, more people want to use it (demand for network access increases)

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IT Infrastructure

◆ Technology drivers of infrastructure evolution (cont.)

- Declining communication costs and the Internet
  - An estimated 1.5 billion people worldwide have Internet access
  - As communication costs fall toward a very small number and approach 0, utilization of communication and computing facilities explodes

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IT Infrastructure

◆ Technology drivers of infrastructure evolution (cont.)

- Standards and network effects
  - Technology standards:
    - Specifications that establish the compatibility of products and the ability to communicate in a network
    - Unleash powerful economies of scale and result in price declines as manufacturers focus on the products built to a single standard

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Contemporary Hardware Platform Trends

◆ The emerging mobile digital platform

- Cell phones, smartphones (BlackBerry, iPhone)
  - Have assumed data transmission, Web surfing, e-mail and IM duties
- Netbooks:
  - Small, low-cost lightweight notebooks optimized for wireless communication and core computing tasks
- Tablets (iPad)
- Networked e-readers (Kindle)

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Contemporary Hardware Platform Trends

◆ BYOD (Bring your own device)

- Allowing employees to use personal mobile devices in workplace

◆ Consumerization of IT

- New information technology emerges in consumer markets first and spreads to business organizations
- Forces businesses and IT departments to rethink how IT equipment and services are acquired and managed

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Contemporary Hardware Platform Trends

◆ Grid computing

- Connects geographically remote computers into a single network to combine processing power and create virtual supercomputer
- Provides cost savings, speed, agility

◆ Virtualization

- Allows single physical resource to act as multiple resources (i.e., run multiple instances of OS)
- Reduces hardware and power expenditures
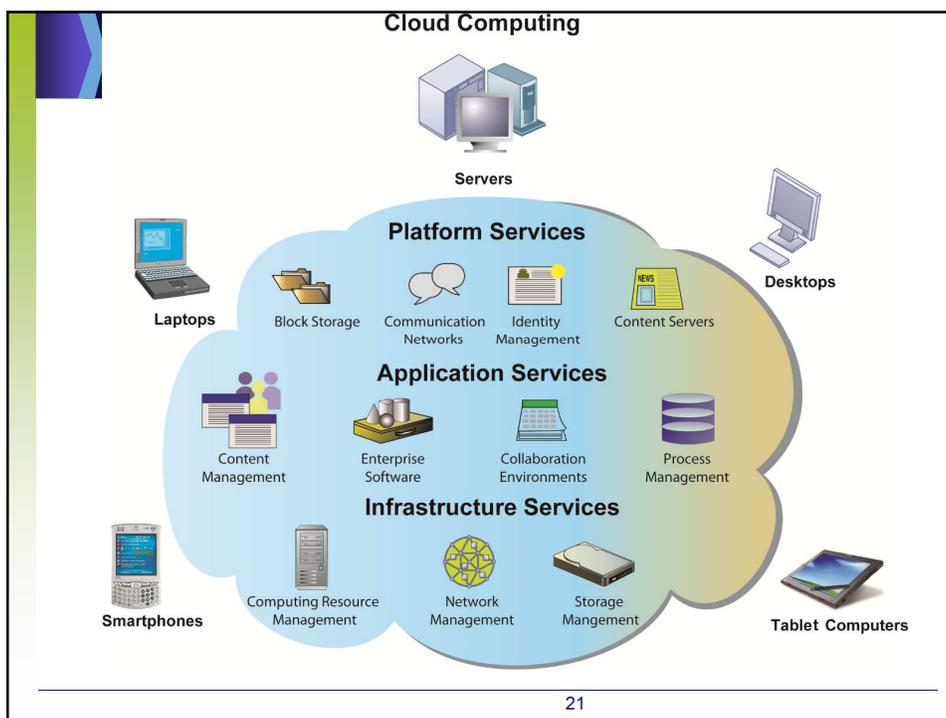- Facilitates hardware centralization

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Contemporary Hardware Platform Trends

◆ Cloud computing

- On-demand (utility) computing services obtained over network
  - Infrastructure as a service
  - Platform as a service
  - Software as a service
- Cloud can be public or private
- Allows companies to minimize IT investments
- Drawbacks: Concerns of security, reliability

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Cloud Computing

Servers

Platform Services

Laptops

Block Storage   Communication   Identity   Content Servers
                 Networks   Management

Desktops

Application Services

Content   Enterprise   Collaboration   Process
Management   Software   Environments   Management

Infrastructure Services

Smartphones   Computing Resource   Network   Storage
              Management   Management   Mangement

Tablet Computers

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Contemporary Hardware Platform Trends

◆ Green computing

- Practices and technologies for manufacturing, using, disposing of computing and networking hardware

◆ Autonomic computing

- Industry-wide effort to develop systems that can configure, heal themselves when broken, and protect themselves from outside intruders
- Similar to self-updating antivirus software; Apple and Microsoft both use automatic updates

◆ High performance, power-saving processors

- Multi-core processors

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Contemporary Software Platform Trends

◆ Web Services

- Software components that exchange information using Web standards and languages
- XML: Extensible Markup Language
  - More powerful and flexible than HTML
  - Tagging allows computers to process data automatically
- SOAP: Simple Object Access Protocol
  - Rules for structuring messages enabling applications to pass data and instructions
- WSDL: Web Services Description Language
  - Framework for describing Web service and capabilities
- UDDI: Universal Description, Discovery, and Integration
  - Directory for locating Web services

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Contemporary Software Platform Trends

◆ SOA: Service-oriented architecture

- Set of self-contained services that communicate with each other to create a working software application
- Software developers reuse these services in other combinations to assemble other applications as needed
  - Example: an "invoice service" to serve whole firm for calculating and sending printed invoices
- Dollar Rent A Car
  - Uses Web services to link online booking system with Southwest Airlines' Web site

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Contemporary Software Platform Trends

◆ Software outsourcing and cloud services

- Three external sources for software:
  - Software packages and enterprise software
  - Software outsourcing (domestic or offshore)
    - Domestic:
      - Primarily for middleware, integration services, software support
    - Offshore:
      - Primarily for lower level maintenance, data entry, call centers, although outsourcing for new-program development is increasing

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Contemporary Software Platform Trends

◆ Three external sources for software (cont.)

- Cloud-based software services
  - Software as a service (SaaS)
  - Accessed with Web browser over Internet
  - Ranges from free or low-cost services for individuals to business and enterprise software
  - Users pay on subscription or per-transaction
  - E.g. Salesforce.com
  - Service Level Agreements (SLAs): formal agreement with service providers

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Contemporary Software Platform Trends

◆ Software outsourcing and cloud services (cont.)

- Mashups
  - Combinations of two or more online applications, such as combining mapping software (Google Maps) with local content
- Apps
  - Small pieces of software that run on the Internet, on your computer, or on your cell phone
    - iPhone, BlackBerry, Android
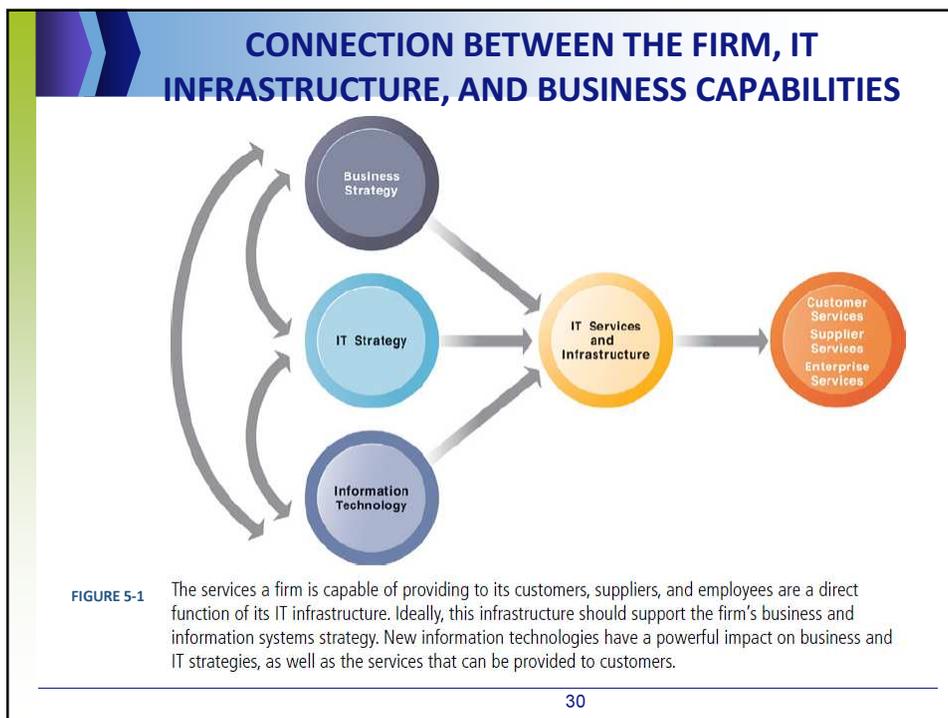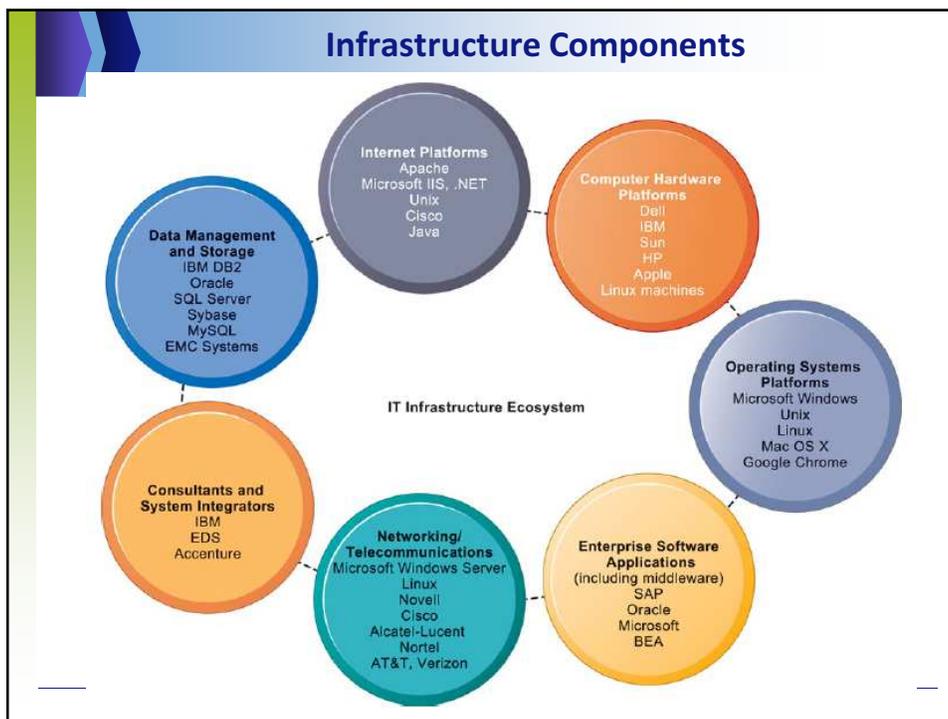 - Generally delivered over the Internet

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IT Infrastructure

◆ IT infrastructure:

- Set of physical devices and software required to operate enterprise
- Set of firmwide services including:
  - Computing platforms providing computing services
  - Telecommunications services
  - Data management services
  - Application software services
  - Physical facilities management services
  - IT management, standards, education, research and development services
- "Service platform" perspective more accurate view of value of investments

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Infrastructure Components

CONNECTION BETWEEN THE FIRM, IT INFRASTRUCTURE, AND BUSINESS CAPABILITIES

FIGURE 5-1   The services a firm is capable of providing to its customers, suppliers, and employees are a direct function of its IT infrastructure. Ideally, this infrastructure should support the firm's business and information systems strategy. New information technologies have a powerful impact on business and IT strategies, as well as the services that can be provided to customers.

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Management Issues

◆ Dealing with platform and infrastructure change

- As firms shrink or grow, IT needs to be flexible and scalable
- Scalability:
  - Ability to expand to serve larger numbers of users
- For mobile computing and cloud computing
  - New policies and procedures for managing these new platforms
  - Contractual agreements with firms running clouds and distributing software required

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Management Issues

◆ Management and governance

- Who controls IT infrastructure?
- How should IT department be organized?
  - Centralized
    - Central IT department makes decisions
  - Decentralized
    - Business unit IT departments make own decisions
- How are costs allocated between divisions, departments?

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Management Issues

◆ Making wise infrastructure investments

- Amount to spend on IT is complex question
    - Rent vs. buy, outsourcing
- Total cost of ownership (TCO) model
    - Analyzes direct and indirect costs
    - Hardware, software account for only about 20% of TCO
    - Other costs: Installation, training, support, maintenance, infrastructure, downtime, space and energy
    - TCO can be reduced through use of cloud services, greater centralization and standardization of hardware and software resources

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Management Issues

◆ Competitive forces model for IT infrastructure investment

- Market demand for firm's services
- Firm's business strategy
- Firm's IT strategy, infrastructure, and cost
- Information technology assessment
- Competitor firm services
- Competitor firm IT infrastructure investments

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COMPETITIVE FORCES MODEL FOR IT INFRASTRUCTURE

Management Issues
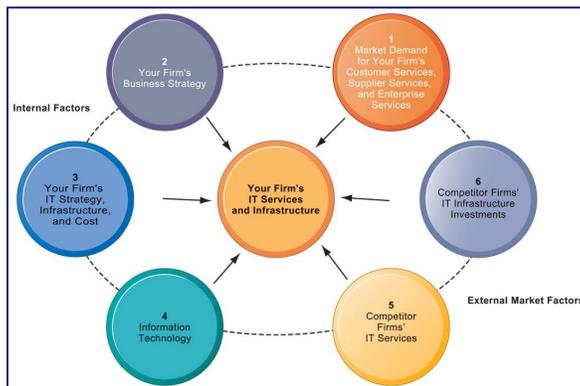
FIGURE 5-12   There are six factors you can use to answer the question, "How much should our firm spend on IT infrastructure?"

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Questions?

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