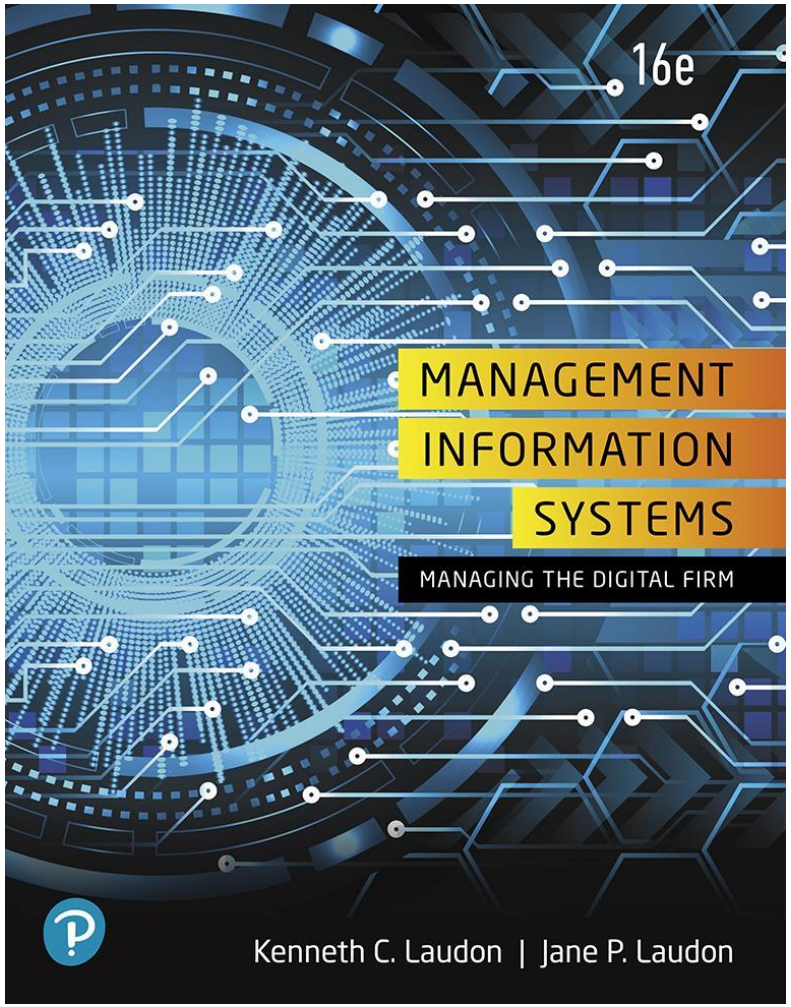
Management Information Systems: Managing the Digital Firm

Sixteenth Edition



Chapter 5

IT Infrastructure and Emerging Technologies

Learning Objectives

5.1 What is IT infrastructure, and what are the stages and drivers of IT infrastructure evolution?

5.2 What are the components of IT infrastructure?

5.3 What are the current trends in computer hardware platforms?

5.4 What are the current computer software platforms and trends?

5.5 What are the challenges of managing IT infrastructure and management solutions?

5.6 How will MIS help my career?

Video Cases

- Case 1: Rockwell Automation Fuels the Oil and Gas Industry with the Internet of Things (IoT)
- Case 2: ESPN.com : The Future of Sports Broadcasting in the Cloud
- Case 3: Netflix: Building a Business in the Cloud

PeroxyChem's Cloud Computing Formula for Success (1 of 2)

- Problem
  - Loss of IT infrastructure from divestiture
  - Limited time frame and resources
  - Inadequate in-house IT staff
- Solutions
  - Plan new IT Infrastructure
  - Make IT infrastructure investments
  - Shift from operational to strategic technology orientation
  - IBM-managed cloud computing services
  - SAP applications

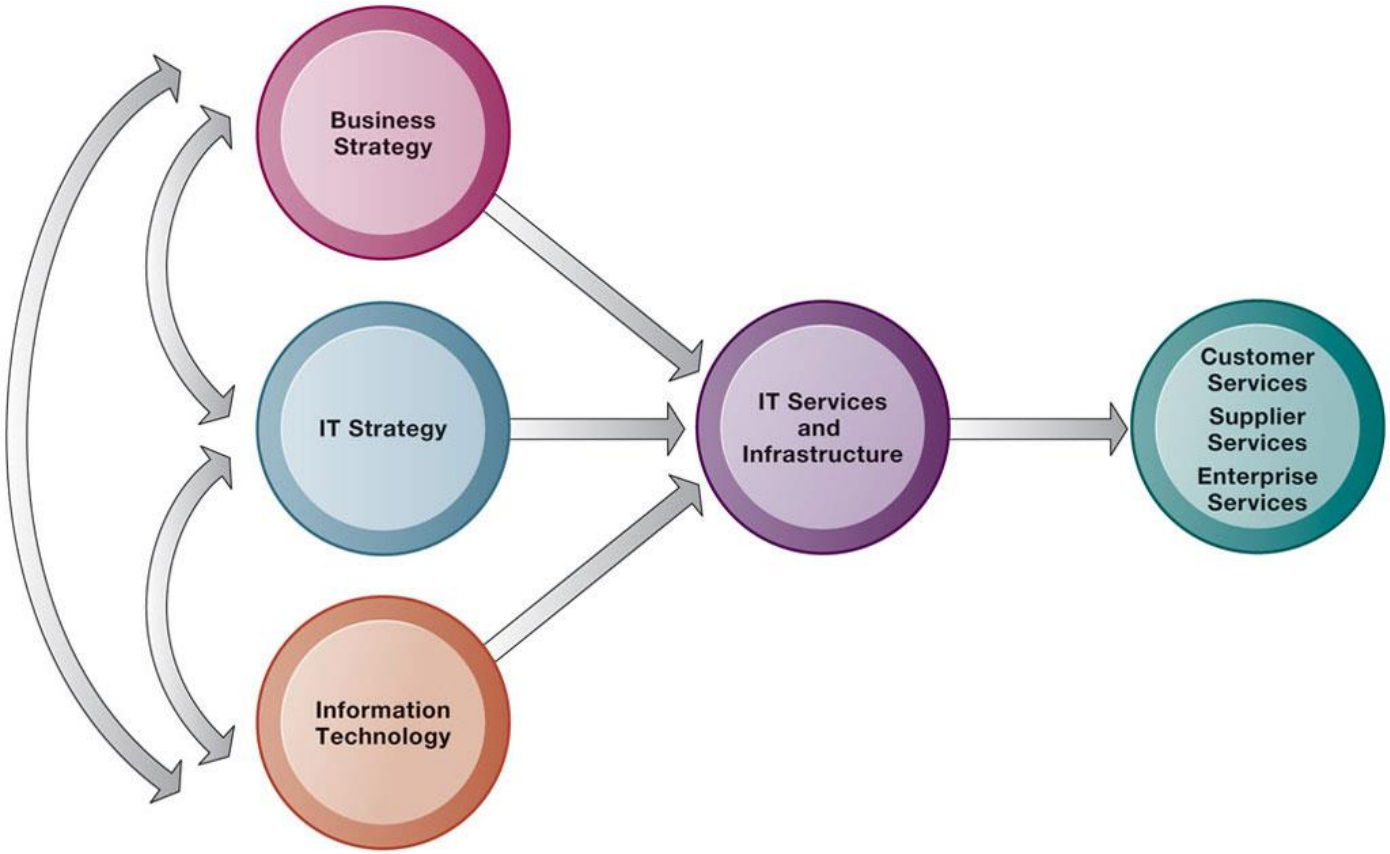
PeroxyChem's Cloud Computing Formula for Success (2 of 2)

- Outsource IT infrastructure management and operations
- Demonstrates the role of cloud computing in re-shaping a firms infrastructure
- Illustrates how firms can integrate their existing applications into a cloud platform

Defining IT Infrastructure

- Set of physical devices and software required to operate an enterprise
- Set of firm-wide services including:
  - Computing platforms providing computing services
  - Physical facilities management services
  - IT management, education, and other services
- "Service platform" perspective
  - More accurate view of value of investments

Figure 5.1 Connection Between the Firm, IT Infrastructure, and Business Capabilities



Evolution of IT Infrastructure

- General-purpose mainframe and minicomputer era: 1959 to present
- Personal computer era: 1981 to present
- Client/server era: 1983 to present 
- Enterprise computing era: 1992 to present
- Cloud and mobile computing: 2000 to present

Figure 5.2 Stages in IT Infrastructure Evolution

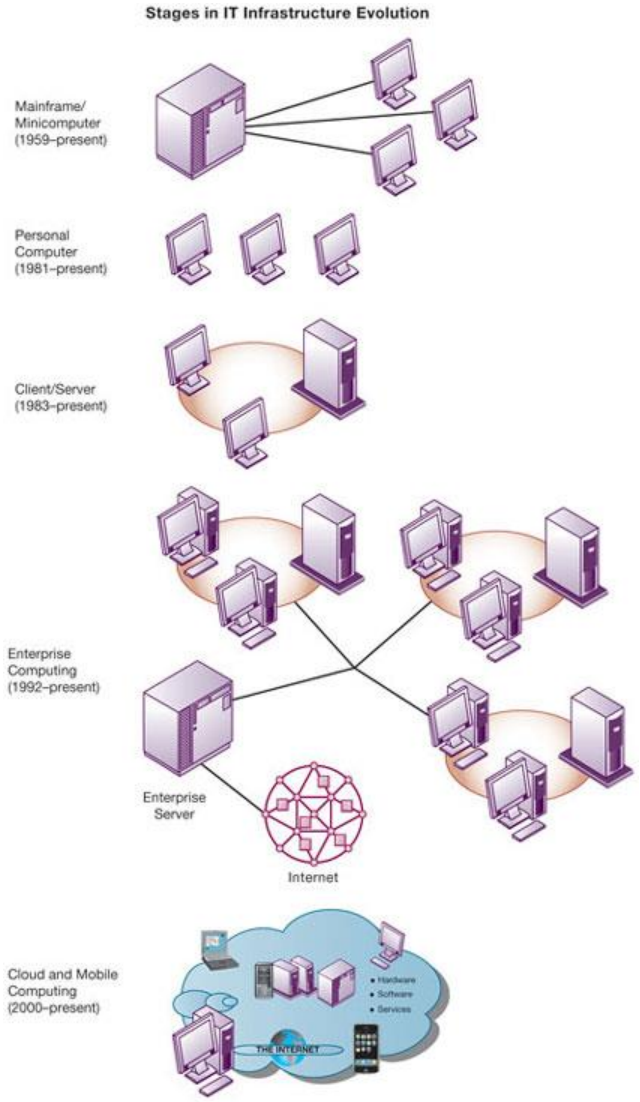
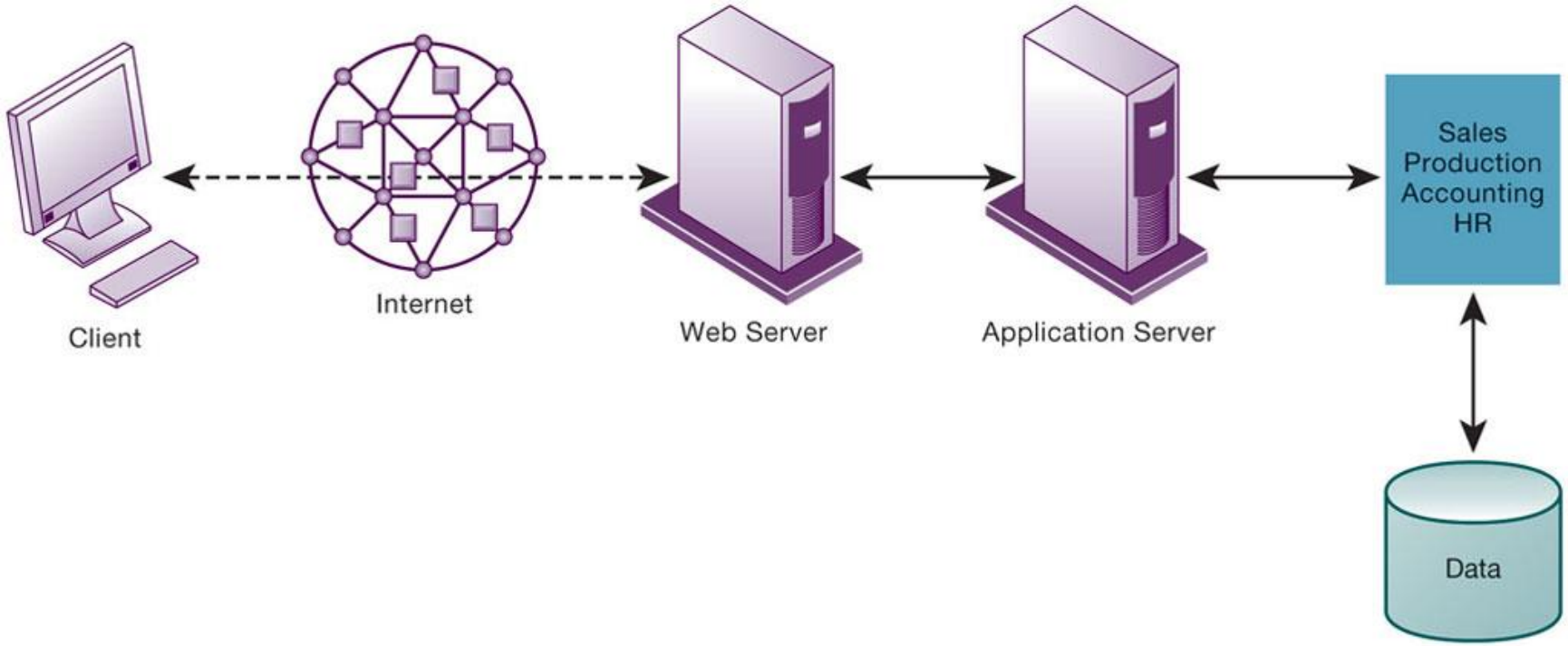


Figure 5.3 A Multitiered (N-Tier) Client/Server Network



Technology Drivers of Infrastructure Evolution (1 of 2)

- Moore's law and microprocessing power
  - Computing power doubles every 2 years
  - Nanotechnology
- Law of Mass Digital Storage
  - The amount of data being stored each year doubles
- Metcalfe's Law and network economics
  - Value or power of a network grows exponentially as a function of the number of network members.

Technology Drivers of Infrastructure Evolution (2 of 2)

- Declining communication costs and the Internet
  - Exponential growth in size of the Internet
- 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

Figure 5.4 Moore's Law and Microprocessor Performance

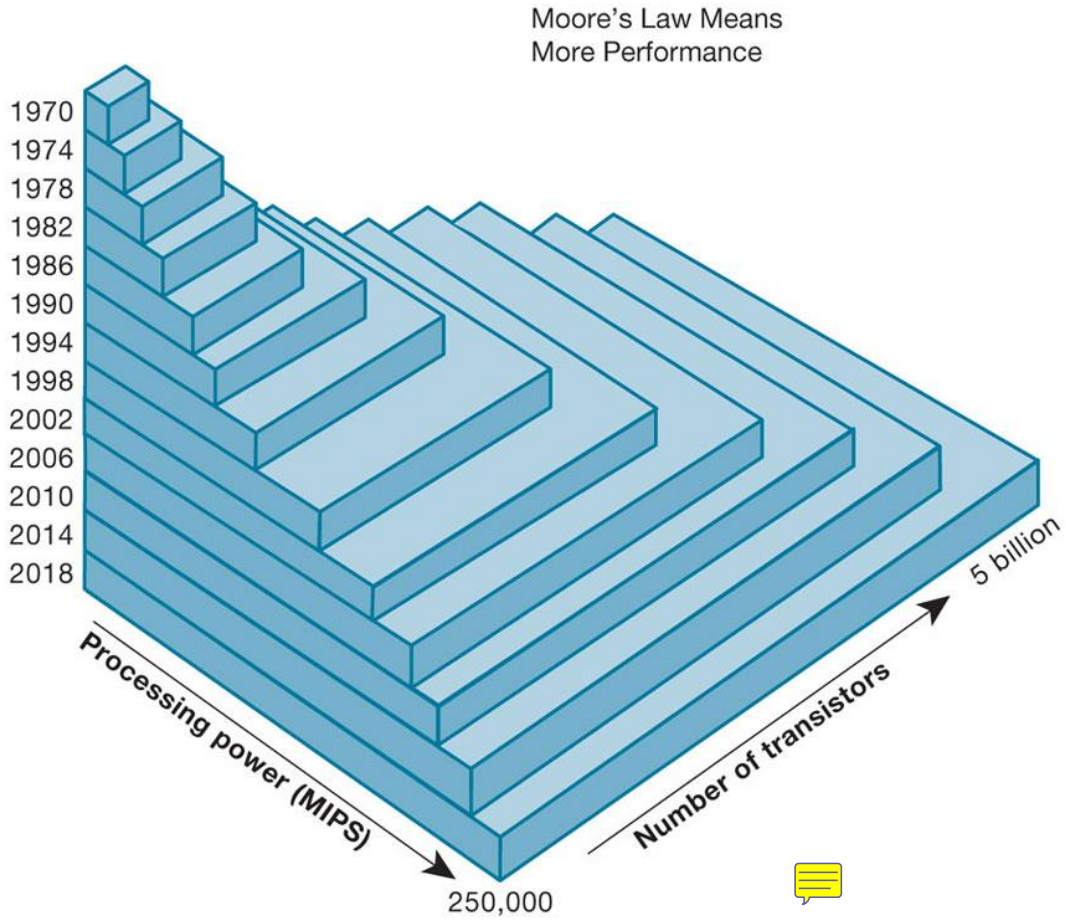
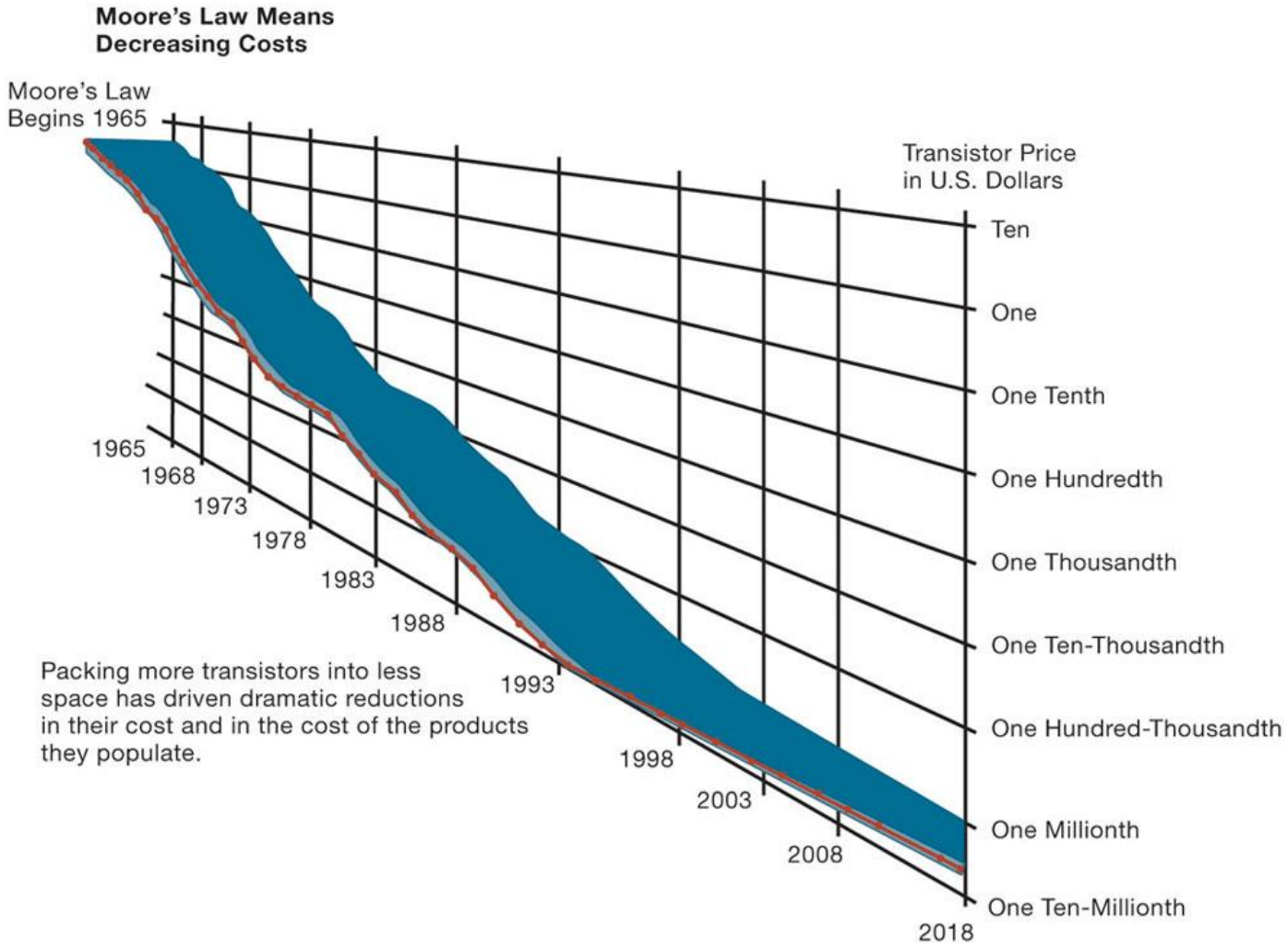


Figure 5.5 Falling Cost of Chips



Nanotubes

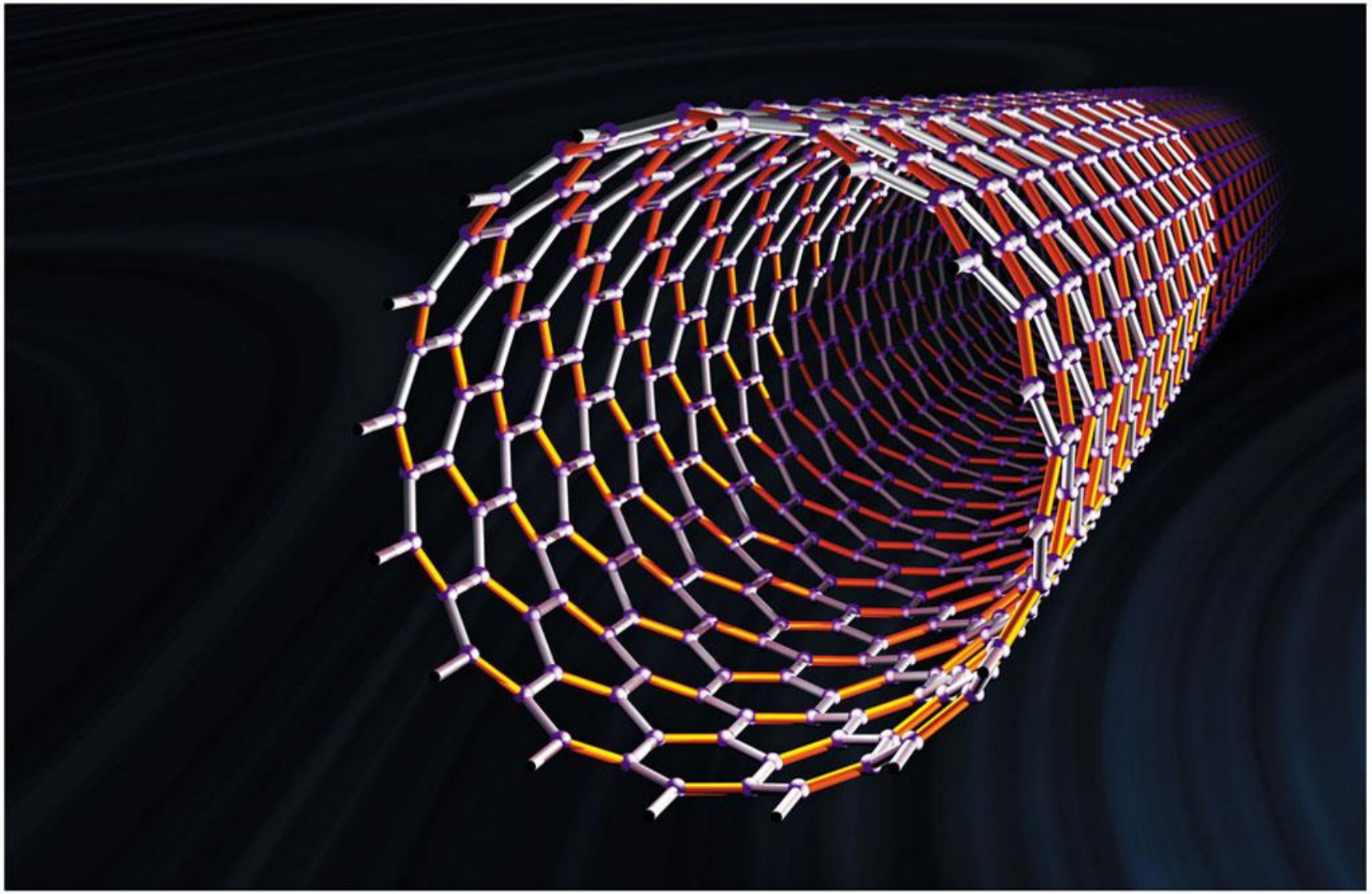


Figure 5.6 The Amount of Storage Per Dollar Rises Exponentially, 1950–2016

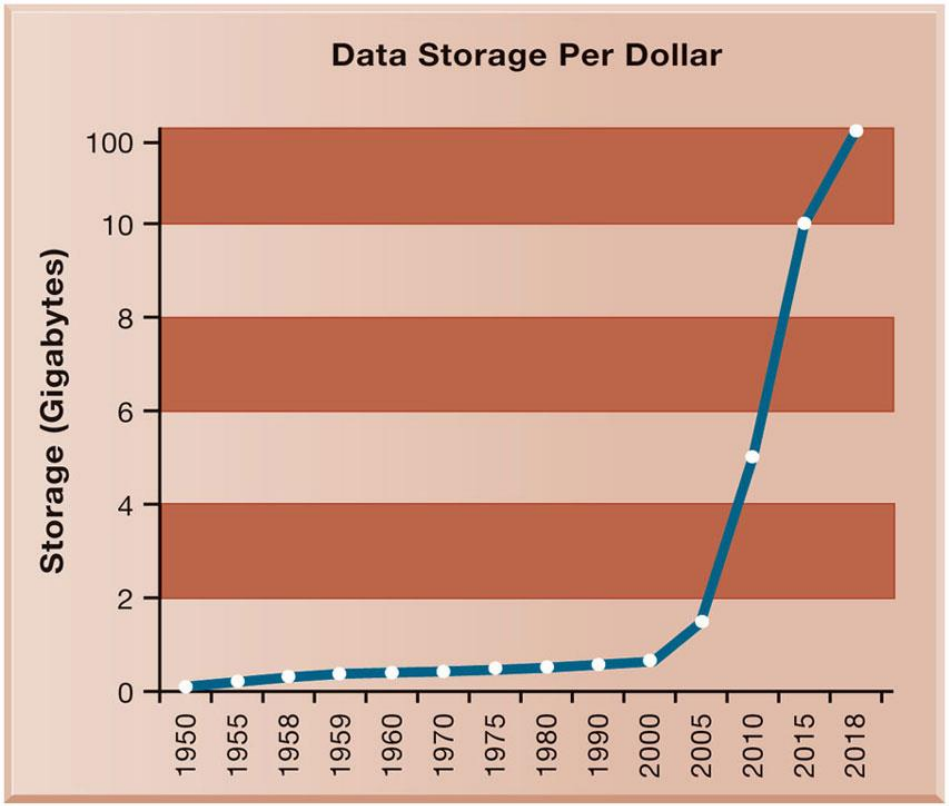
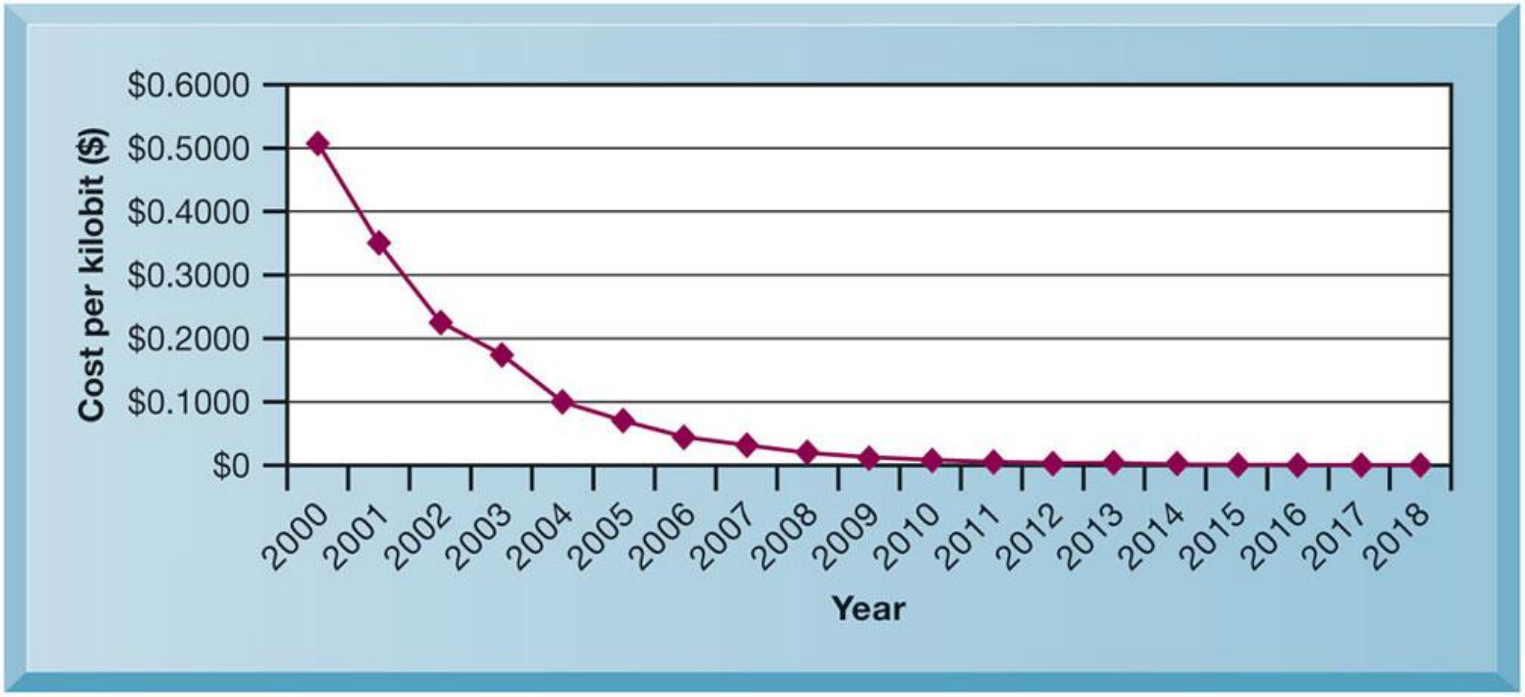


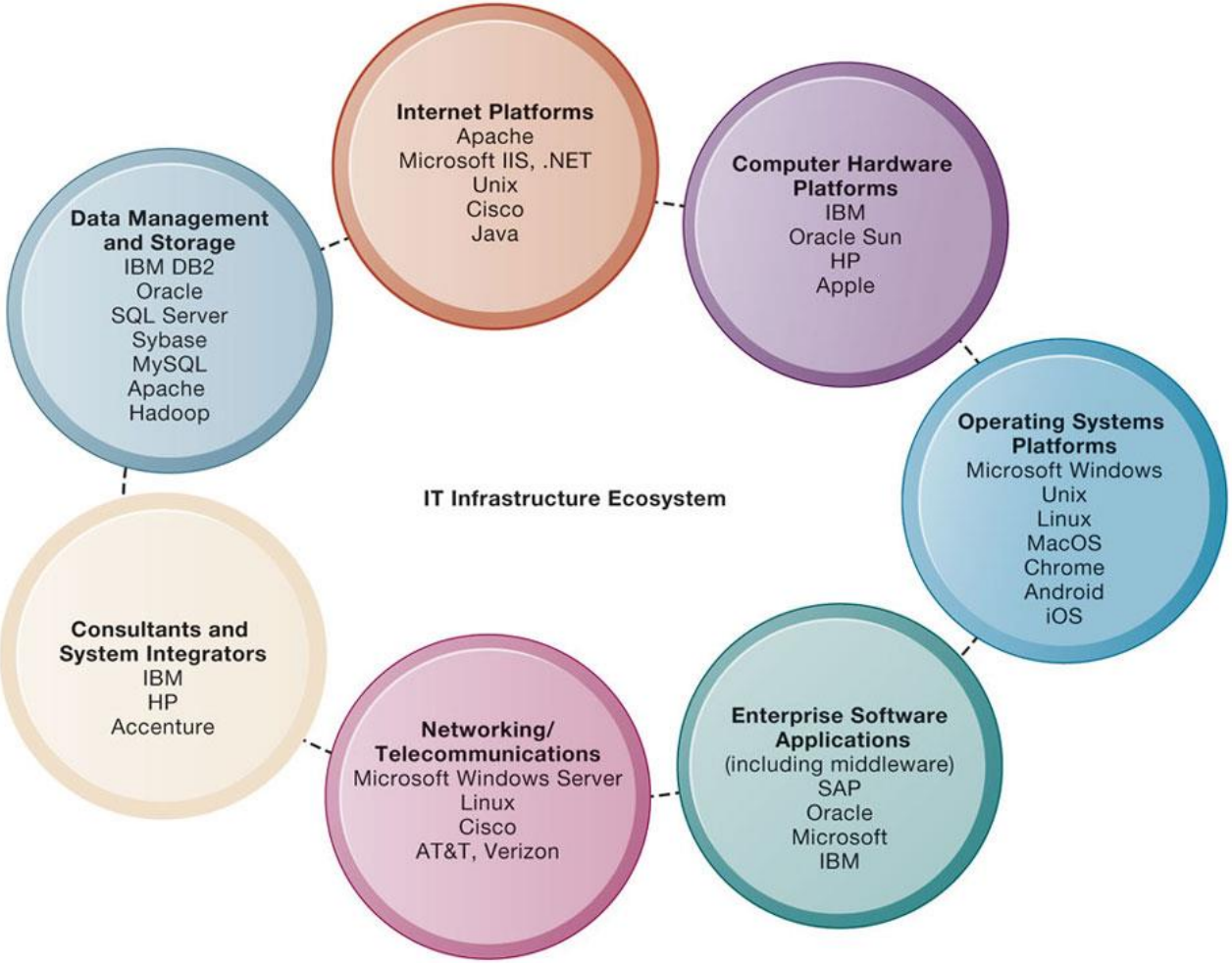
Figure 5.7 Exponential Declines in Internet Communications Costs ($/MBPS)



What Are the Components of IT Infrastructure?

1. Computer hardware platforms
2. Operating system platforms
3. Enterprise software applications
4. Data management and storage
5. Networking/telecommunications platforms
6. Internet platforms
7. Consulting system integration services

Figure 5.8 The IT Infrastructure Ecosystem



Computer Hardware Platforms

- Client machines
  - Desktop PCs, laptops
  - Mobile computing: smartphones, tablets
  - Desktop chips vs. mobile chips
- Servers
- Mainframes
  - IBM mainframe
  - Digital workhorse for banking and telecommunications networks

Operating System Platforms

- Corporate servers
  - Windows Server
  - Unix
  - Linux
- Client level
  - Microsoft Windows
  - Android, iOS, Windows 10 (mobile/multitouch)
  - Google's Chrome OS (cloud computing)

Enterprise Software Applications

- In 2018, firms spend $389 billion on software for enterprise applications
- Largest providers: SAP and Oracle
- Middleware providers: IBM, Oracle

Data Management and Storage

- Database software providers
  - IBM (DB2)
  - Oracle
  - Microsoft (SQL Server)
  - Sybase (Adaptive Server Enterprise),
  - My SQL
  - Apache Hadoop
- Physical data storage for large-scale systems
  - Dell EMC
  - Hewlett Packard Enterprise (H3C)

Networking/Telecommunications Platforms

- Network operating systems
  - Windows Server, Linux, Unix
- Network hardware providers
  - Cisco, Juniper Networks
- Telecommunication services
  - Telecommunications, cable, telephone company charges for voice lines and Internet access
  - AT&T, Verizon

Internet Platforms

- Hardware, software, management services to support company websites, intranets
  - Web-hosting services
  - Routers
  - Cabling or wireless equipment
- Internet hardware server market
  - IBM, Dell, Oracle, HP
- Web development tools/suites
  - Microsoft (Visual Studio and .NET), Oracle-Sun (Java), Adobe

Consulting and System Integration Services

- Even large firms do not have resources for full range of support for new, complex infrastructure
- Leading consulting firms: Accenture, IBM Global Services, HP, Infosys, Wipro Technologies
- Software integration: ensuring new infrastructure works with legacy systems
- Legacy systems: older TPS created for mainframes that would be too costly to replace or redesign

What Are the Current Trends in Computer Hardware Platforms? (1 of 5)

- The mobile digital platform
  - Smartphones
  - Netbooks
  - Tablet computers
  - Digital e-book readers and apps (Kindle)
  - Wearable devices
- Consumerization of IT and BYOD (bring your own device)
  - Forces businesses and IT departments to rethink how IT equipment and services are acquired and managed

Interactive Session: Technology: Is Business Ready for Wearable Computers?

- Class discussion
  - Wearables have the potential to change the way organizations and workers conduct business. Discuss the implications of this statement.
  - What management, organization, and technology issues would have to be addressed if a company was thinking of equipping its workers with a wearable computing device?
  - What kinds of businesses are most likely to benefit from wearable computers? Select a business and describe how a wearable computing device could help that business improve operations or decision making.

What Are the Current Trends in Computer Hardware Platforms? (2 of 5)

- Quantum computing
  - Uses quantum physics to represent and operate on data
  - Dramatic increases in computing speed
- 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
  - Software-defined storage (SDS)

What Are the Current Trends in Computer Hardware Platforms? (3 of 5)

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

What Are the Current Trends in Computer Hardware Platforms? (4 of 5)

- Edge computing
  - Servers at the edge of the Internet
  - Reducing latency, and network traffic

Figure 5.9 Cloud Computing Platform

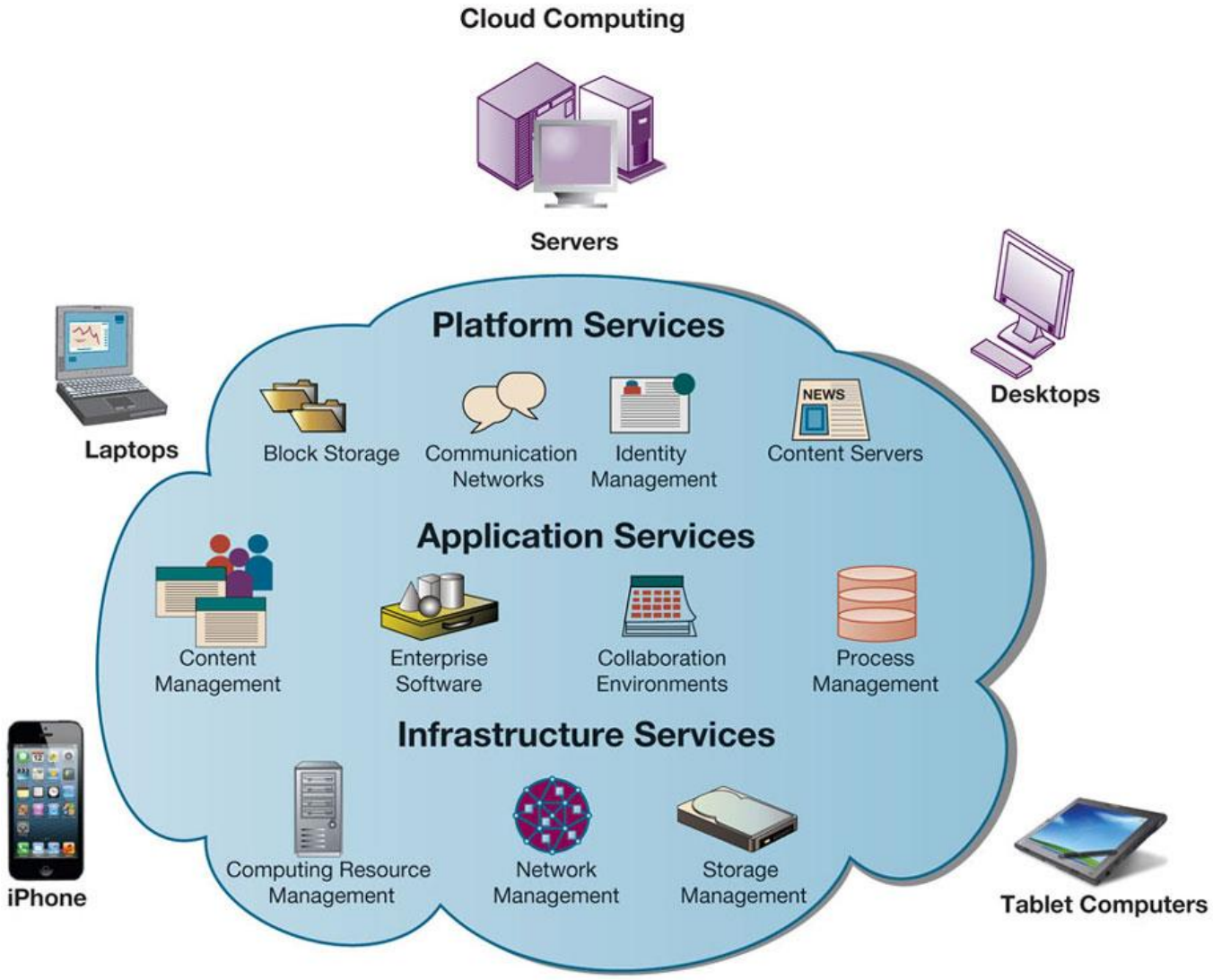
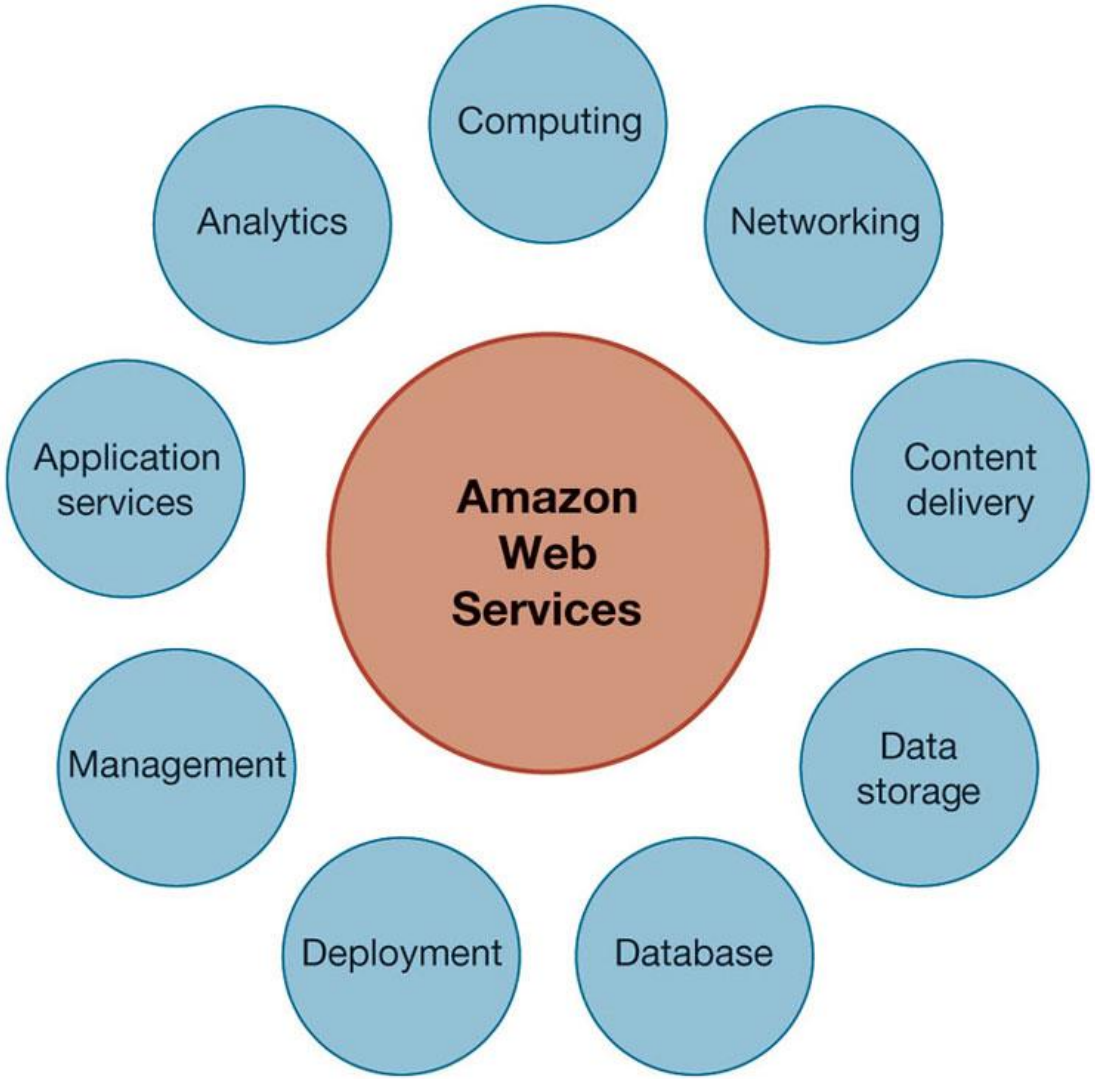


Figure 5.10 Amazon Web Services



Interactive Session: Organizations: Look to the Cloud

- Class discussion
  - What business benefits do cloud computing services provide? What problems do they solve?
  - What are the disadvantages of cloud computing?
  - What kinds of businesses are most likely to benefit from using cloud computing? Why?

What Are the Current Trends in Computer Hardware Platforms? (4 of 4)

- Green computing (Green IT)
  - Practices and technologies for manufacturing, using, disposing of computing and networking hardware
  - Reducing power consumption a high priority
  - Data centers
- High performance, power-saving processors
  - Multicore processors
  - Power-efficient microprocessors

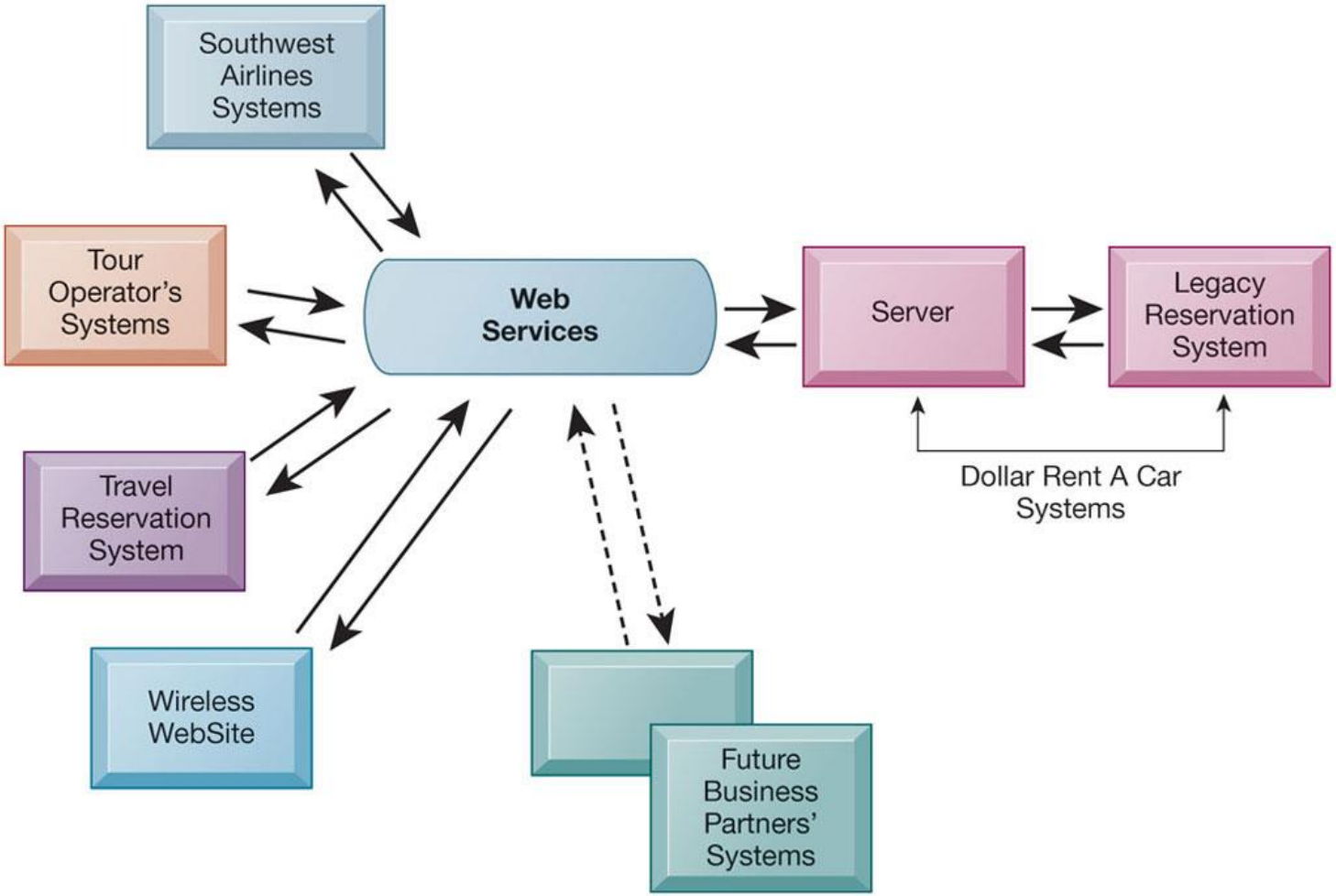
What Are the Current Computer Software Platforms and Trends? (1 of 3)

- Linux and open-source software
  - Produced by community of programmers
  - Examples: Apache web server, Mozilla Firefox browser, OpenOffice
  - Linux
- Software for the web: Java, HTML, and HTML5
  - Java Virtual Machine
  - Web browsers
  - HTML and HTML5
  - Ruby and Python

What Are the Current Computer Software Platforms and Trends? (2 of 3)

- Web services and service-oriented architecture
  - Web services
  - XML: Extensible Markup Language
  - SOA: service-oriented architecture
    - Set of self-contained services that communicate with one another to create a working software application
    - Software developers reuse these services in other combinations to assemble other applications as needed

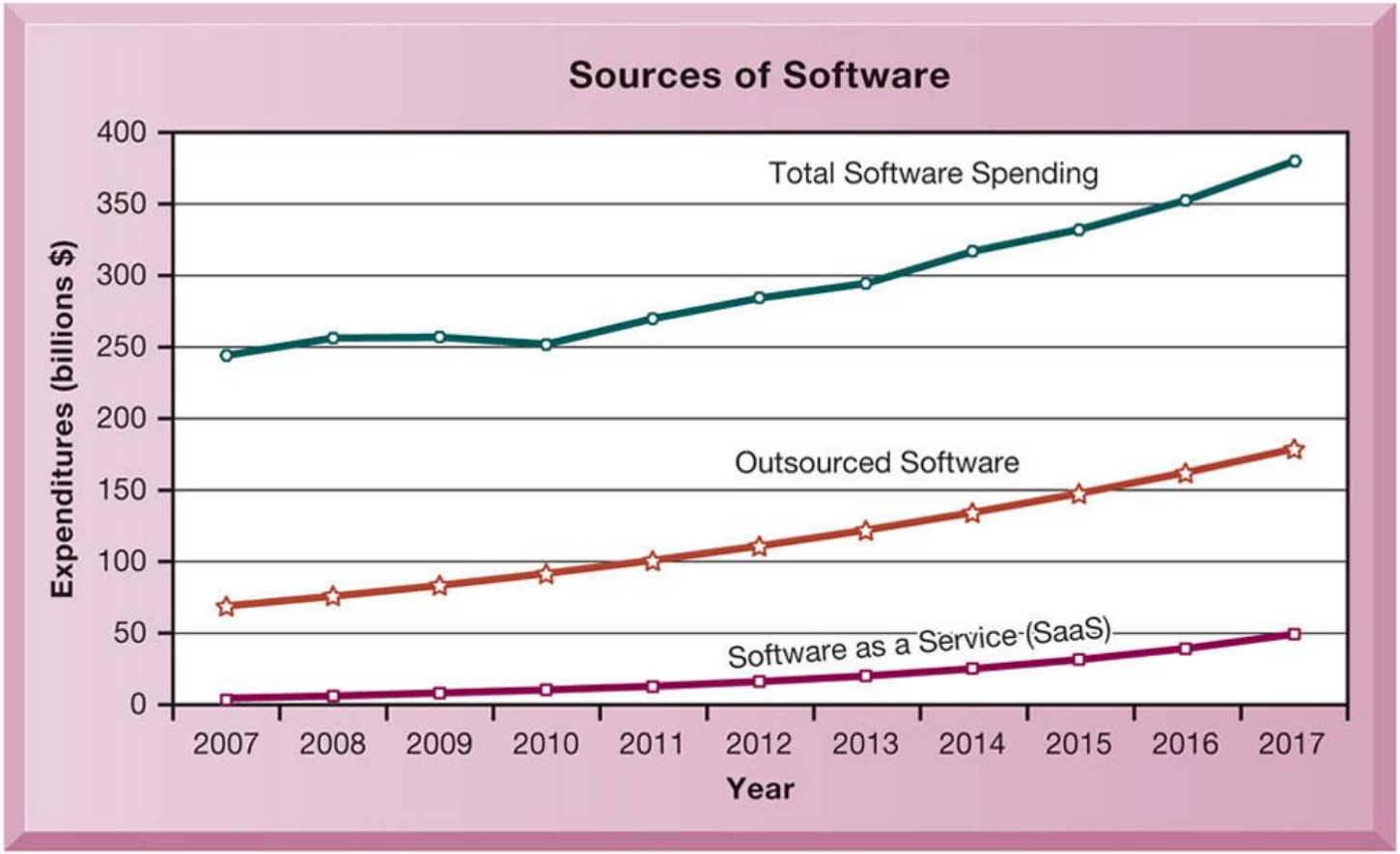
Figure 5.11 How Dollar Rent A Car Uses Web Services



What Are the Current Computer Software Platforms and Trends? (3 of 3)

- Software outsourcing and cloud services
  - Software packages and enterprise software
  - Software outsourcing
  - Cloud-based software services and tools
    - Service Level Agreements (SLAs): formal agreement with service providers
- Mashups and apps

Figure 5.12 Changing Sources of Firm Software



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 number 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

Management and Governance

- 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?

Making Wise Infrastructure Investments

- Under-investment and over-investment can hamper firm performance
- Rent-versus-buy
- Cloud computing
  - Security requirements
  - Impact on business processes and workflow
- Outsourcing

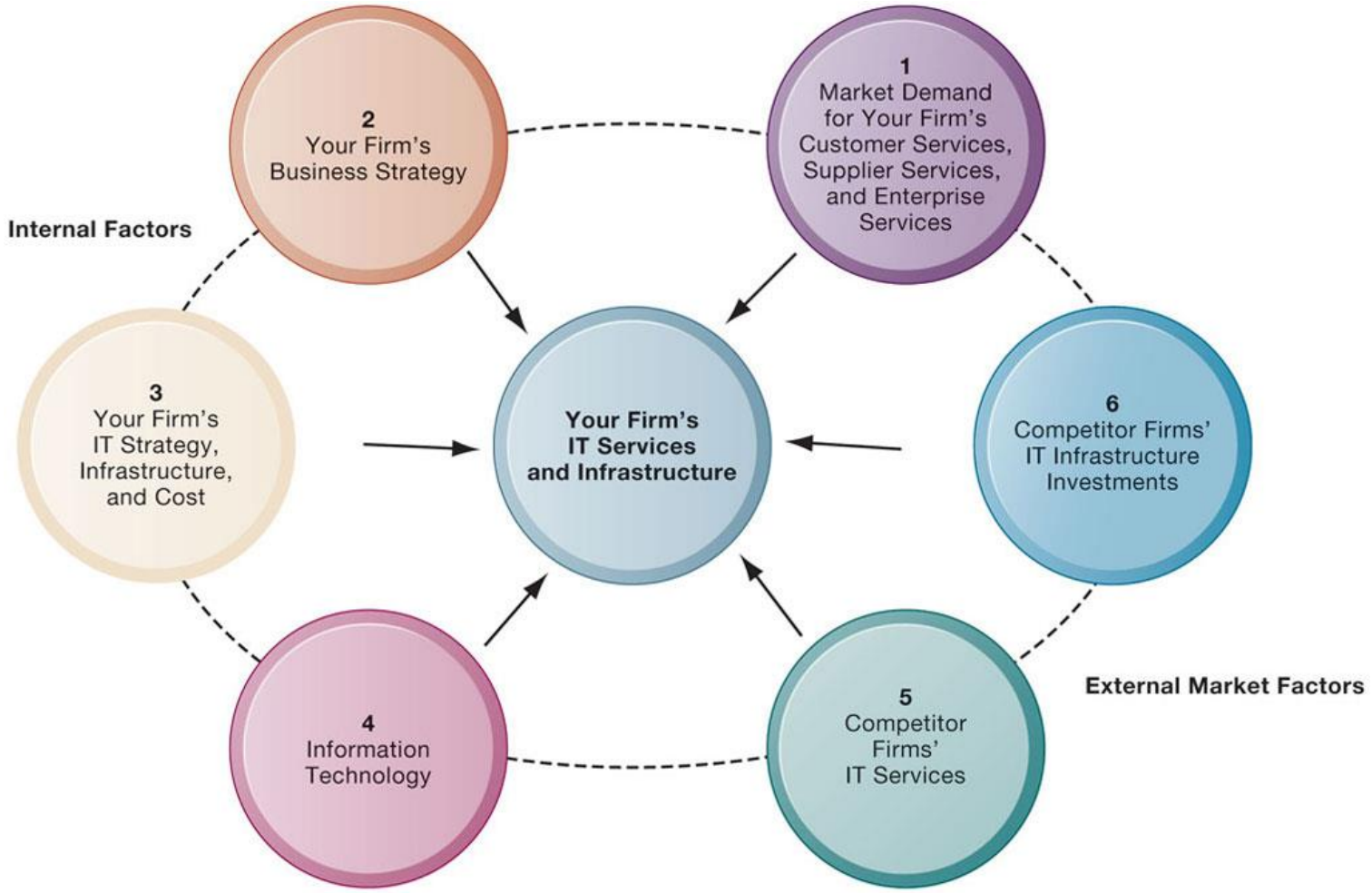
Total Cost of Ownership (TCO) Model

- 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
  - Use of cloud services, greater centralization and standardization of hardware and software resources

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

Figure 5.13 Competitive Forces Model for IT Infrastructure



How Will MIS Help My Career?

- The Company: A1 Tech IT Consulting
- Position Description: Entry-level IT consultant
- Job Requirements
- Interview Questions
- Author Tips

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