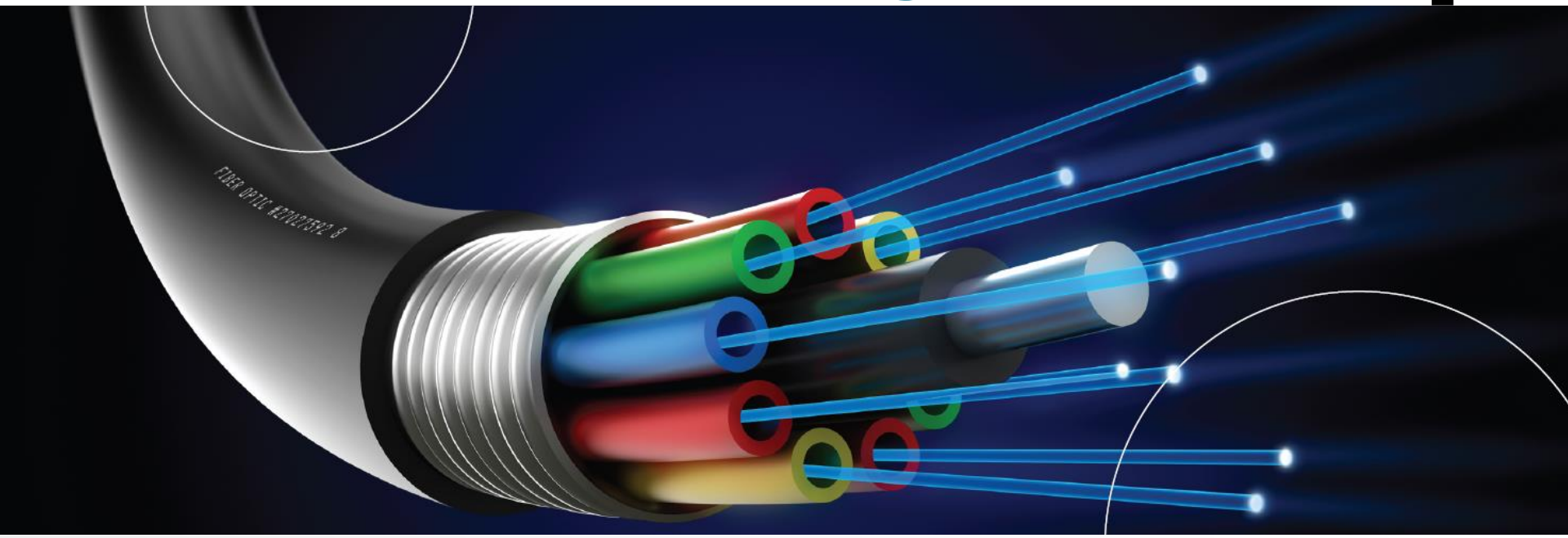
CHAPTER 4



Telecommunications and Networking

1. What Is a Computer Network?
2. Network Fundamentals
3. The Internet and the World Wide Web
4. Network Applications: Discovery
5. Network Applications: Communication
6. Network Applications: Collaboration
7. Network Applications: Education

1. Compare and contrast the major types of networks.
2. Describe the wireline communications media and transmission technologies.
3. Describe the most common methods for accessing the Internet.
4. Explain the impact that discovery network applications have had on business and everyday life.

5. Explain the impact that communication network applications have had on business and everyday life.
6. Explain the impact that collaboration network applications have had on business and everyday life.
7. Explain the impact that educational network applications have had on business and everyday life.

Opening Case

- **What to Do About Landline Telephones?**
  1. Should the large carriers be able to eliminate their POTS networks?
     a) Debate this argument from the viewpoint of the large telecommunications carriers.
     b) Debate this argument from the viewpoint of rural customers.
  2. Why are wireless networks unable to take over all of the functions of POTS networks at this time (September 2015)?

About Business 4.1

- The Least Connected Country on Earth
  1. Describe the impacts of a lack of telecommunications infrastructure on Eritrea.
  2. Besides improving the economy, what other areas of Eritrean life would be impacted by a greatly improved telecommunications infrastructure?
  3. Can the government of Eritrea allow an improved telecommunications infrastructure while maintaining strict control over communications and information? Why or why not? Support your answer.

4.1 What Is a Computer Network?

- Computer Network
- Bandwidth
- Broadband
- Local Area Networks
- Wide Area Networks
- Enterprise Networks

Figure 4.1: Ethernet Local Area Network (LAN)

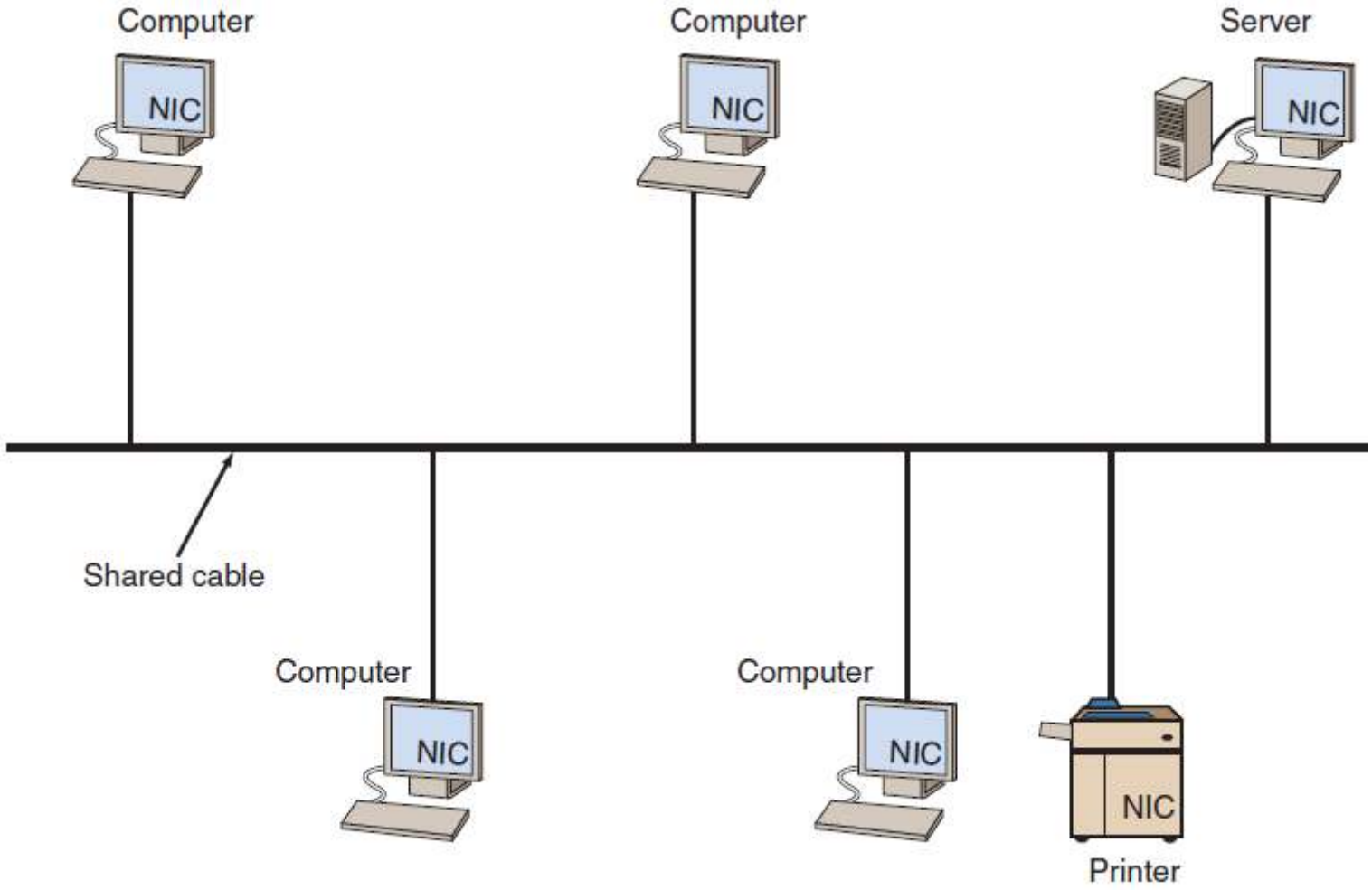
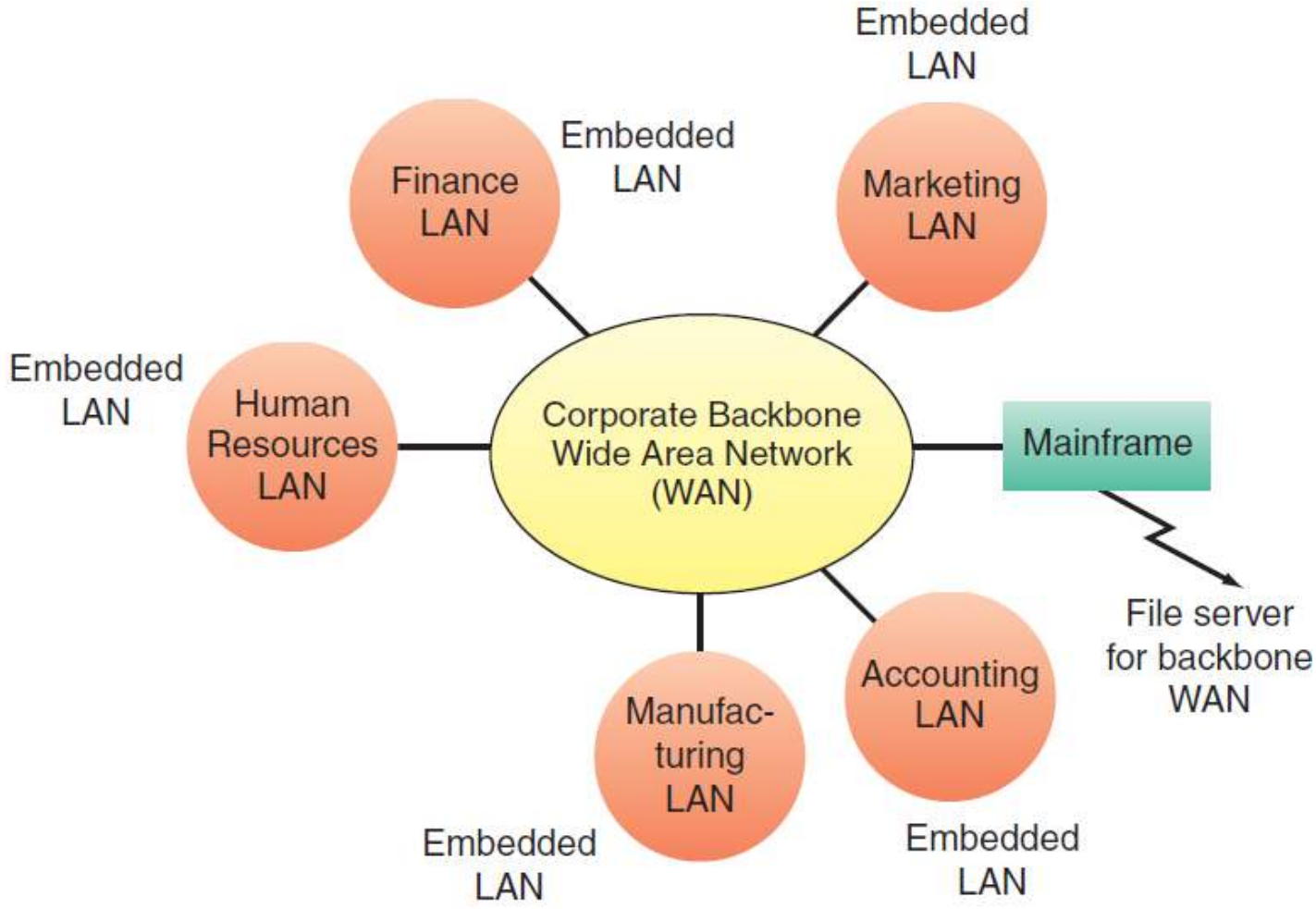


Figure 4.2: Enterprise Network



4.2 Network Fundamentals

- Communications Media and Channels
- Network Protocols
- Types of Network Processing

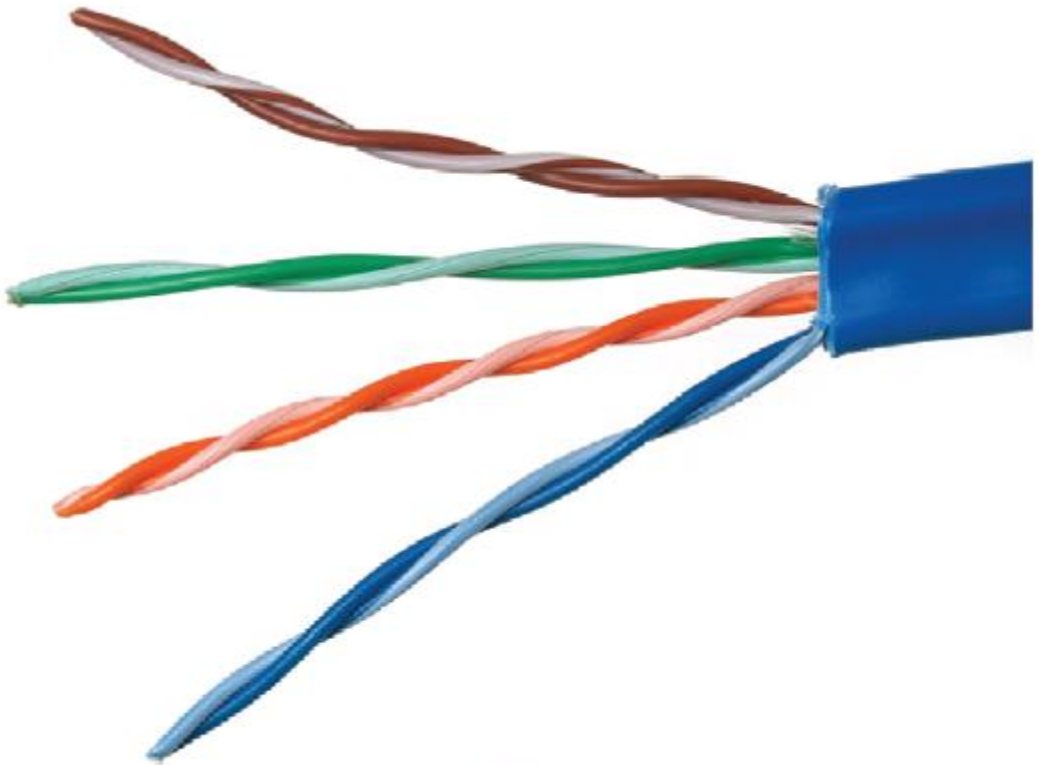
Communications Media and Channels

- Twisted-Pair Wire
- Coaxial Cable
- Fiber Optics

Table 4.1: Advantages and Disadvantages of Wireline Communications Channels

Channel	Advantages	Disadvantages
Twisted-pair wire	Inexpensive	Slow (low bandwidth)
	Widely available	Subject to interference
	Easy to work with	Easily tapped (low security)
Coaxial cable	Higher bandwidth than twisted-pair	Relatively expensive and inflexible
		Easily tapped (low to medium security)
	Less susceptible to electromagnetic interference	Somewhat difficult to work with
Fiber-optic cable	Very high bandwidth	Difficult to work with (difficult to splice)
	Relatively inexpensive	
	Difficult to tap (good security)	

Communications Media: Twisted-Pair Wire



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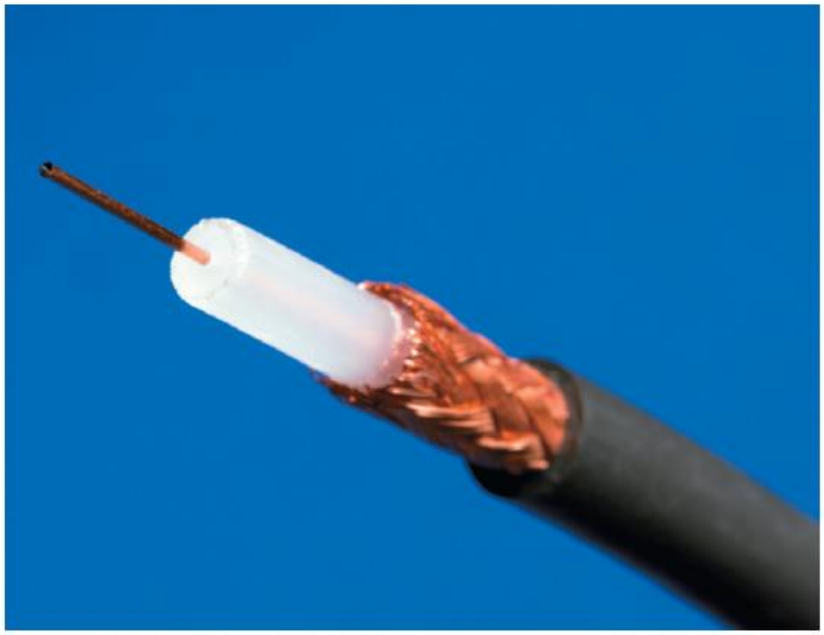
Communications Media: Coaxial Cable



GIPhotoStock/Science Source

Cross-section view

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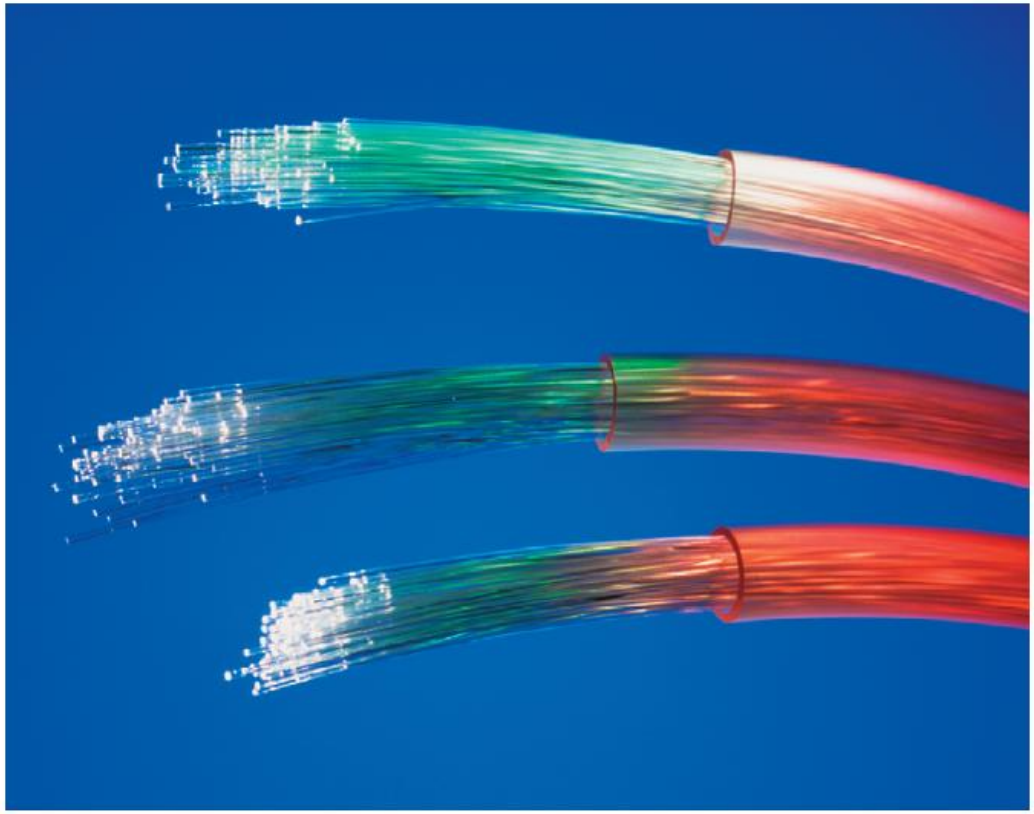
How coaxial cable looks to us

Communications Media: Fiber Optics



Philip Hatson/Science Source

Cross-section view

Chris Knapton/Science Source

How fiber-optic cable looks to us

Network Protocols

- Ethernet
- Transmission Control Protocol / Internet Protocol (TCP/IP)

Transmission Control Protocol / Internet Protocol

- Three Basic Functions of TCP
- Packets & Packet Switching
- Four Layers of the TCP/IP Reference Model

Three Basic Functions of the TCP

1. Manages the movement of data packets between computers by establishing a connection between the computers
2. Sequences the transfer of packets
3. Acknowledges the packets that have been transmitted

Four Layers of the TCP/IP Reference Model

1. Application Layer
2. Transport Layer
3. Internet Layer
4. Network Interface Layer

Figure 4.6: The Four Layers of the TCP/IP Reference Model

Email: Sending a Message via SMPT (Simple Mail Transfer Protocol)	Application	Email: Message received
Break Message into packets and determine order	Transport	Packets reordered and replaced (if lost)
Assign sending and receiving IP addresses and apply to each packet	Internet	Packets routed through internal network to desired IP address
Determine path across network/ Internet to intended destination	Network Interface	Receipt of packets

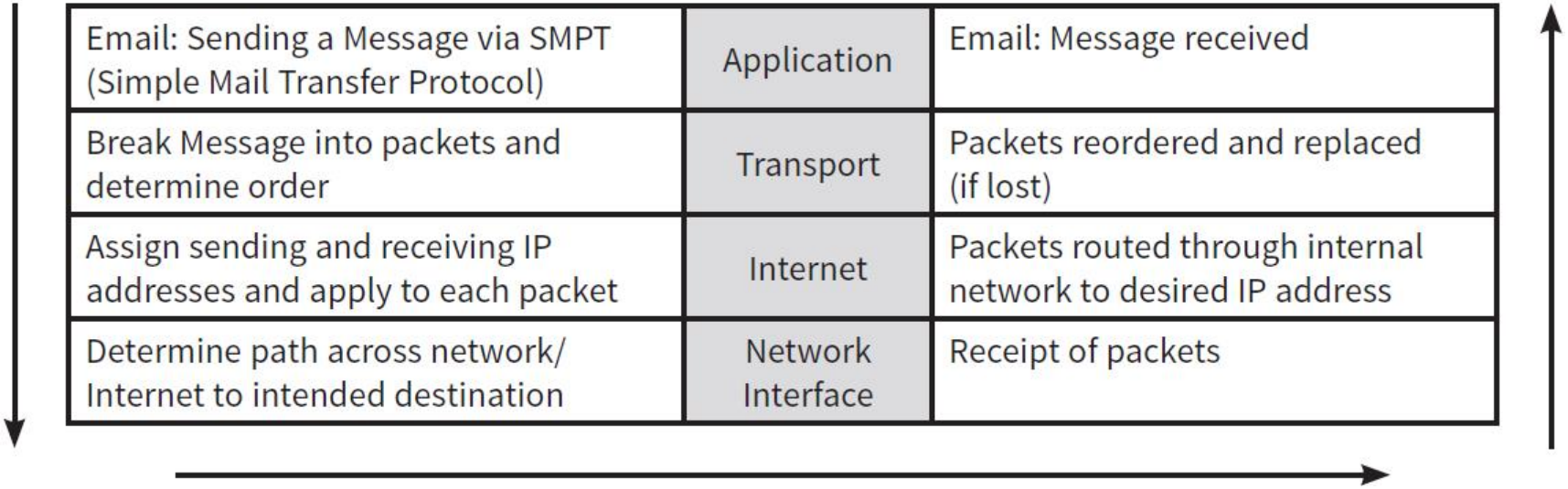
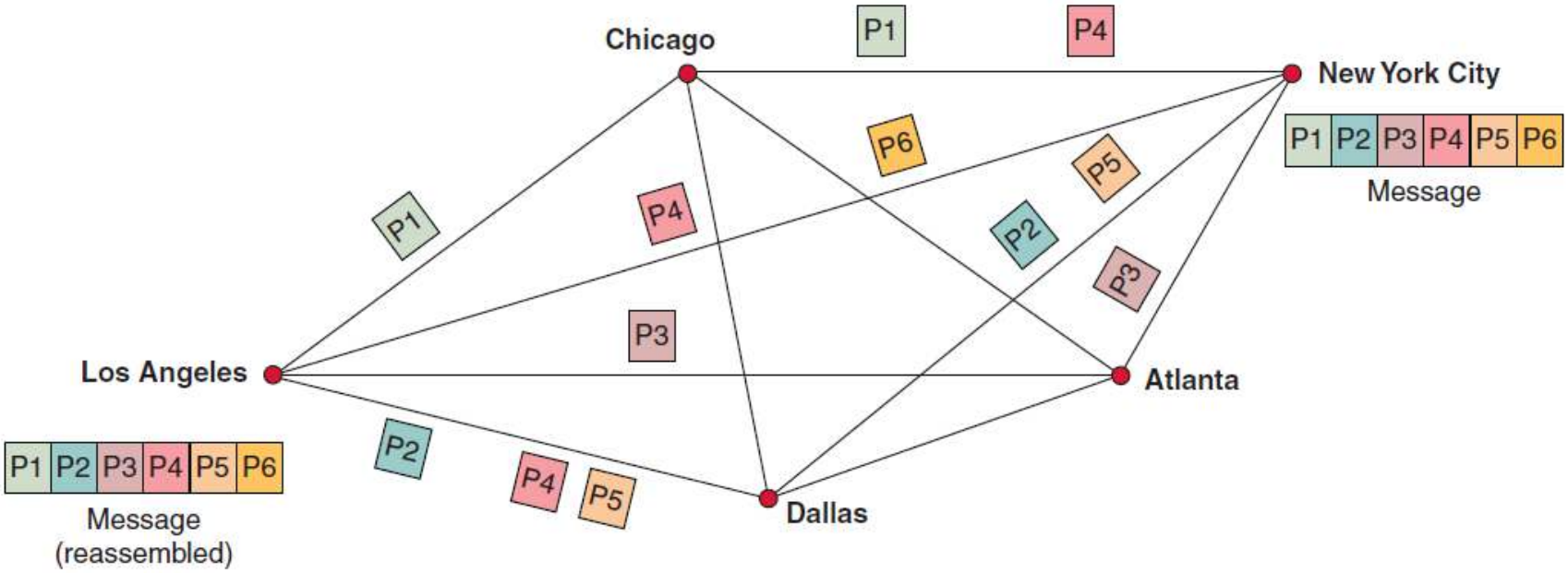


Figure 4.7: Packet Switching



Types of Network Processing

- Client/Server Computing
- Peer-to-Peer Processing

4.3 The Internet and the World Wide Web

- Internet ("the Net")
- Accessing the Internet
- The Future of the Internet
- The World Wide Web

Accessing the Internet

- Connecting via an Online Service
- Connecting via Other Means
  - Satellite
  - Google Fiber
- Addresses on the Internet

Figure 4.9: Internet (backbone in white)

Table 4.2: Internet Connection Methods

Service	Description
Dial-up	Still used in the United States where broadband is not available
DSL	Broadband access via telephone companies
Cable modem	Access over your cable TV coaxial cable. Can have degraded performance if many of your neighbors are accessing the Internet at once
Satellite	Access where cable and DSL are not available
Wireless	Very convenient, and WiMAX will increase the use of broadband wireless
Fiber-to-the-home (FTTH)	Expensive and usually placed only in new housing developments

Future of the Internet

- High User Demand = Reduced Performance in the Near Future
- The Internet is unreliable and not secure.
- Internet2

The World Wide Web (WWW)

- World Wide Web
- Hypertext
- URL

4.4 Network Applications: Discovery

- Search Engines and Metasearch Engines
- Publication of Material in Foreign Languages
- Portals

Publication of Materials in Foreign Languages

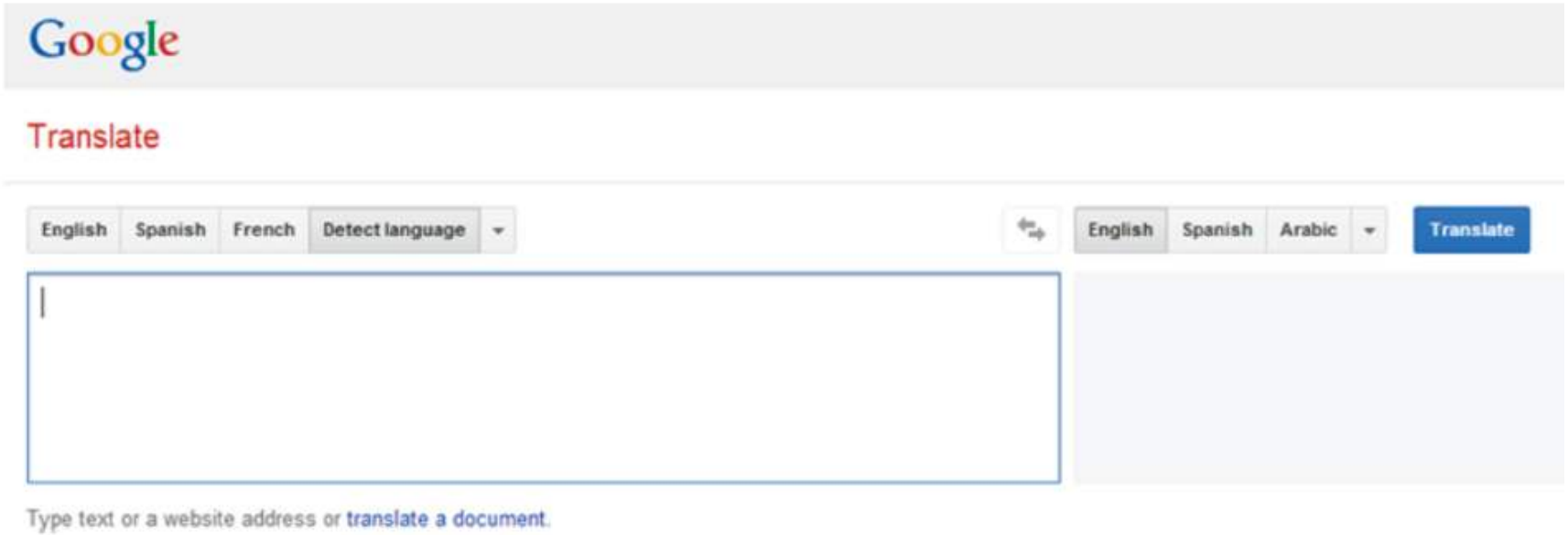


Figure 4.10 Google Translate. (Google and the Google logo are registered trademarks of Google Inc., used with permission)

Affinity Portals

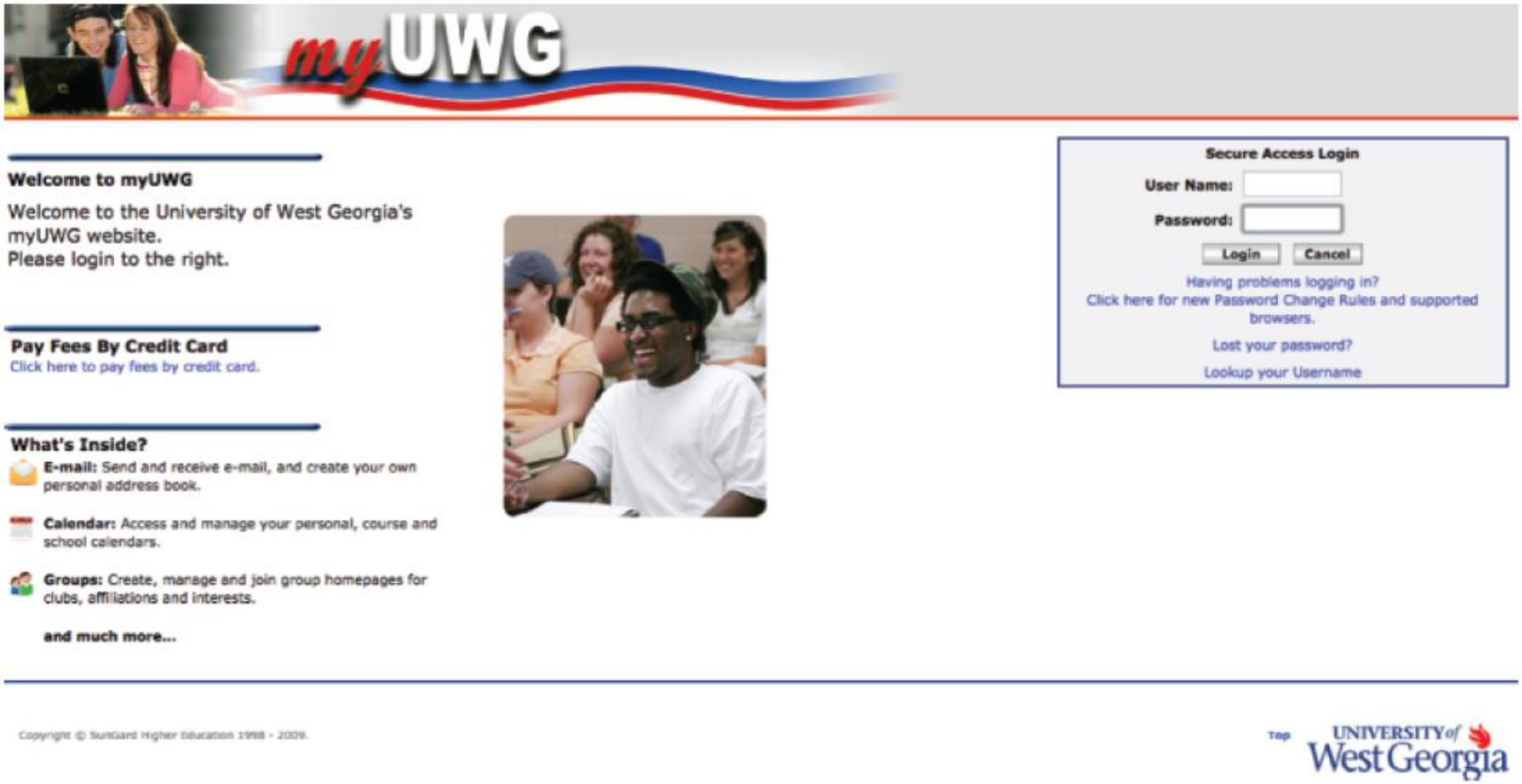


Figure 4.11 University of West Georgia affinity portal. (Courtesy of the University of West Georgia)

4.5 Network Applications: Communication

- Electronic Mail
- Web-Based Call Centers
- Electronic Chat Rooms
- Voice Communication
  - Voice Over Internet Protocol (VoIP)
- Unified Communications
- Telecommuting

4.6 Network Applications: Collaboration

- Workgroup
- Workflow
- Virtual Group (Team)
- Virtual Collaboration
- Crowdsourcing
- Electronic Teleconferencing and Video Conferencing

Figure 4.11: Telepresence System

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About Business 4.2

- The Collaboration Environment at Raytheon

1. Describe the use of information technologies in Raytheon's CAVEs.
2. What are potential disadvantages of using CAVEs in the product design process?

4.7 Network Applications: Educational

- E-Learning
- Distance Education
  - MOOC's
- Virtual Universities

About Business 4.3

- Massive Open Online Courses in India
  1. Discuss possible quality control issues with MOOCs in India. For each issue, explain how you would solve the problem.
  2. Discuss the possible impacts of MOOCs on traditional higher education in India.
  3. Would you be willing to enroll in a MOOC as a full-time student at your university? Why or why not?
  4. Would you be willing to enroll in a MOOC after you graduate? Why or why not?