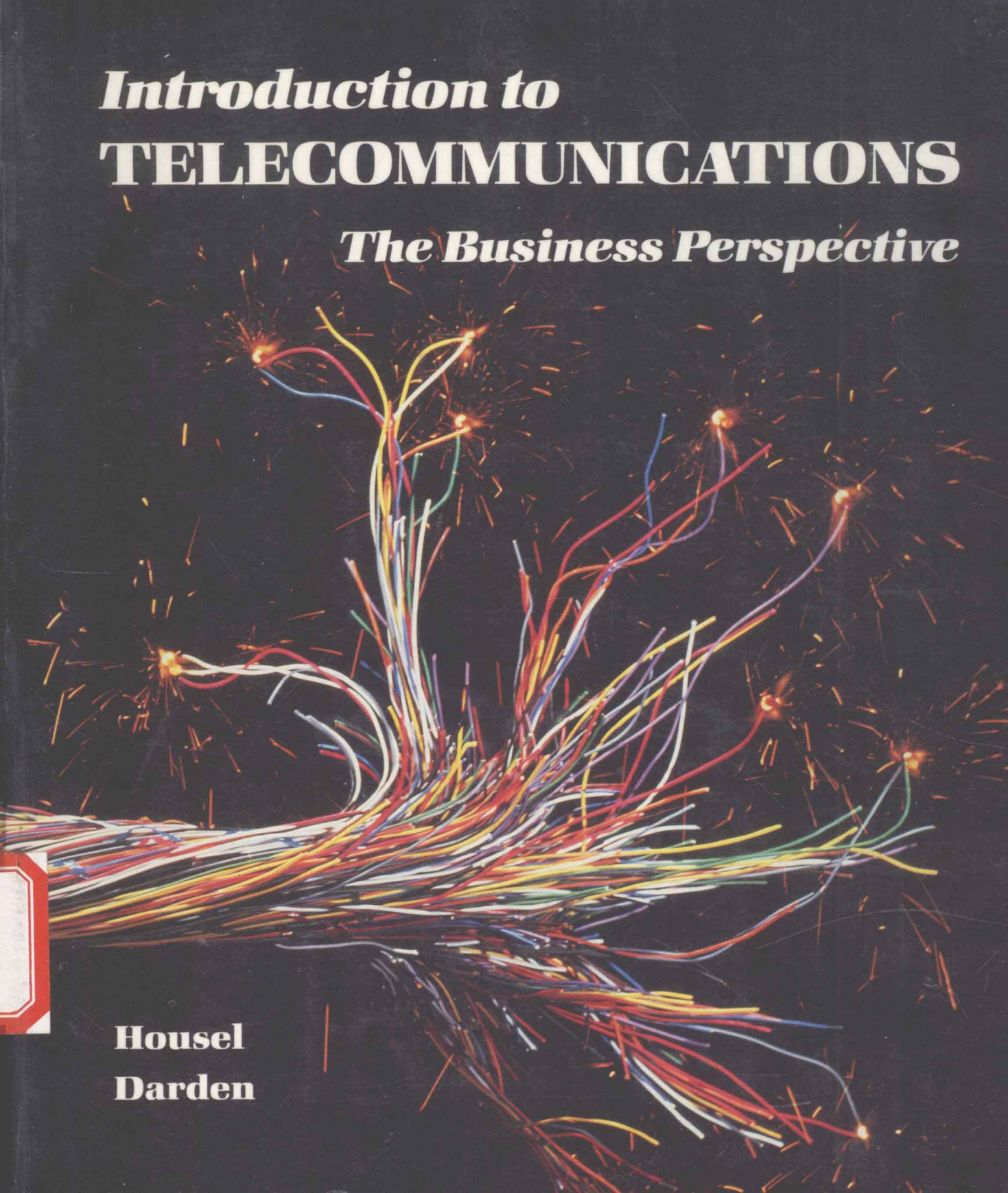
Introduction to
TELECOMMUNICATIONS
The Business Perspective



Housel
Darden

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TELECOMMUNICATIONS

The Business Perspective

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Preface

Taking the mystery out of telecommunications is the primary goal of the first edition of *Introduction to Telecommunications: The Business Perspective*. By taking the mystery out of this subject, we hope to encourage managers and future managers to become more actively involved in planning for their organizations' telecommunications needs.

Information is the lifeblood of any modern organization and success depends in large part on the effectiveness of an organization's telecommunications network to deliver information to decision makers. With the divestiture of AT&T and the continuing deregulation of the telecommunications industry, organizations can no longer afford to abdicate responsibility for this necessary function.

The practical orientation of this text is largely a result of the combined experiences of the authors in working and consulting in the telecommunications field. The business orientation of the text will help anyone studying telecommunications understand the business issues that must be addressed in creating and maintaining an effective telecommunications network.

This text was primarily designed for those with limited or no technological background. Through analogies, we attempted to simplify some of the more complex technological topics such as transmission, switching, and networking. It will also prove useful to people with narrow technical expertise in telecommunications who desire a broader overview of the business issues in telecommunications.

Introduction to Telecommunications: The Business Perspective can be used as the primary text for an introductory course in telecommunications. It would also be useful as a supplement for any course that intends to provide students with an overview of the field from a business perspective. This makes it especially useful as a supplement in data communications courses or introduction to information systems courses that tend to focus exclusively on the data

application to the exclusion of the voice, image, and text applications. Since the voice application represents costs that are up to five times as much as the data application, it is critical to take this application into account in planning for an effective telecommunications network.

Chapter 1 provides a conceptual framework for the text by explaining the evaluative criteria that must be met in making business decisions about telecommunications systems. It also provides a brief history of the field, which includes landmark policies and regulations. Chapter 2 examines the major technological components of modern telecommunications systems and uses analogies to simplify these descriptions. Chapter 3 is devoted to describing the basic concepts necessary for an understanding of the various kinds of telecommunications terminal equipment and their place in telecommunications systems. Chapter 4 describes the issues involved in the networking of transmission, switching, and end-user terminal equipment. Chapter 5 gives the reader a basic overview of the business concerns of management, cost, procurement, security, and market segments. Chapter 6 deals with the complexities of federal, state, and local regulation of the telecommmunications industry. Chapter 7 focuses on the new and innovative voice, data, image, and text applications. Chapter 8 assesses the social and organizational impacts of telecommunications. Chapter 9 is a vision of the future of telecommunications and its impact on society.

Some of the other features found in each chapter of this text include chapter objectives, a chapter overview, a glossary, review questions, and a bibliography. There is also a composite glossary at the end of the text. Margin definitions are provided in the outer margins to highlight key terms, regulations, and abbreviations found throughout the text.

Another feature of this text includes discussions throughout the text of technological advances in telecommunications. Also, a number of illustrations and photographs are featured to hold students' interest and to reinforce learning.

The Instructor's Manual that accompanies *Introduction to Telecommunications: The Business Perspective* provides teaching suggestions, teaching outlines, answers to end-of-chapter review questions, student activities, tests, and transparency masters. This is intended to assist instructors in teaching telecommunications.

We would like to thank the following reviewers for their assistance in creating *Introduction to Telecommunications: The Business Perspective*:

Dr. Ruth Hudson Lankford, Purdue University — Indianapolis
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Mr. Jack Fraser, Telecom Canada

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About the Authors

Dr. Tom Housel. Dr. Housel is a professor in the Business Communications Department at the University of Southern California Business School. He is the winner of the 1986 Society for Information Management paper competition for his research on information systems for crisis management.

Dr. Housel is also the author of numerous articles on modern business communications in the areas of teleconferencing, Integrated Services Digital Network (ISDN), crisis information systems, and human communication. His teleconferencing research is based on feasibility studies conducted for Southern California Edison, Hughes (EDSG), and other large user companies.

William E. Darden III. In April of 1985, William E. Darden III accepted the position of Director of Corporate Telecommunications at the Northrop Corporation, an aerospace manufacturer based in southern California. Prior to his present position, Mr. Darden was the manager of corporate telecommunications for $7\frac{1}{2}$ years at Storage Technology Corporation, a computer peripheral manufacturer located outside of Boulder, Colorado. While at Storage Technology Corporation, he intervened in numerous rate cases before the Colorado Public Utilities Commission and in FCC Docket 81-893 and was elected president of the Colorado Telecommunications Association. Mr. Darden is an active writer, speaker, and member of numerous trade associations and user groups.

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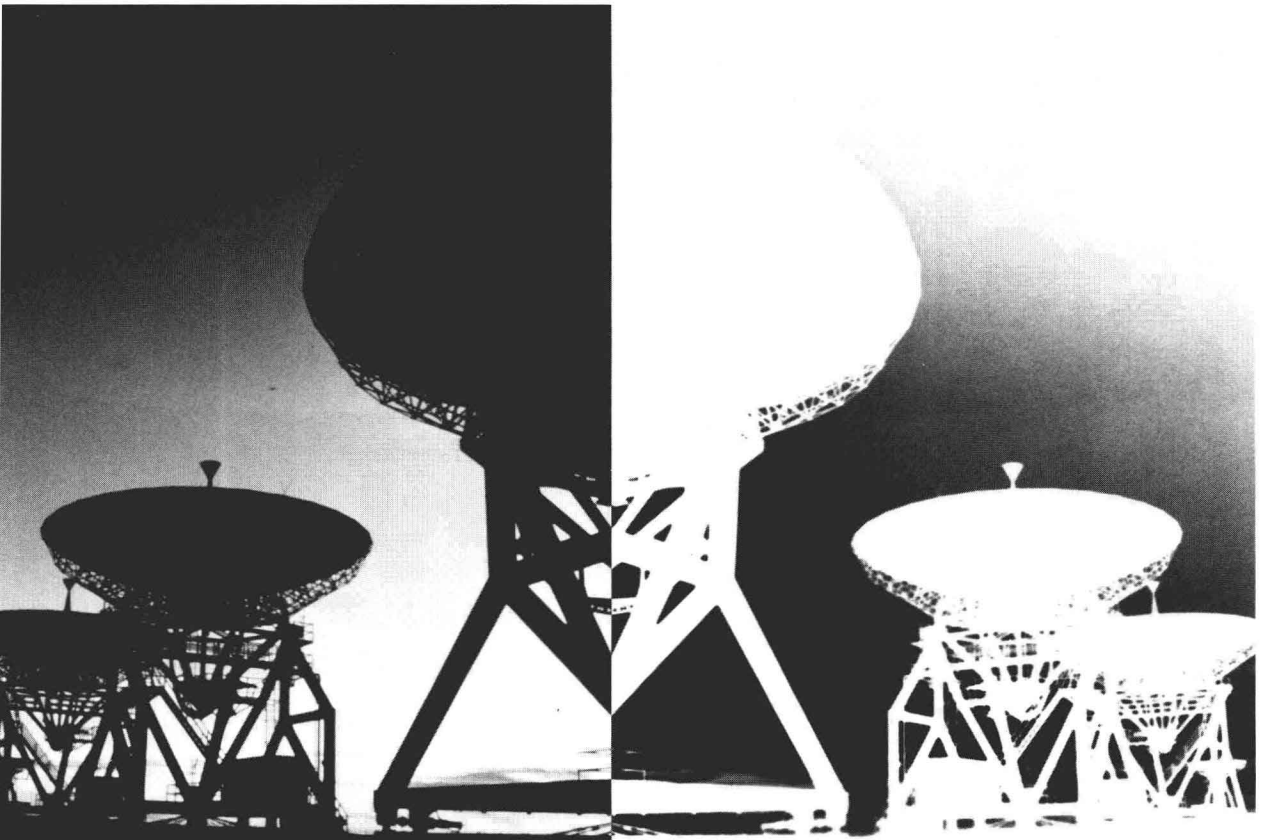
1 Historical Issues: Past to Present



CHAPTER OBJECTIVES

1. To understand the history and the needs that have shaped the telecommunications industry.
2. To understand the development and the growth of the telecommunications system.
3. To understand the role AT&T has played in the development of the telecommunications system.
4. To recognize the importance of the major technological breakthroughs in the development of the telecommunications system.
5. To understand the role regulations play in the structure and development of the telecommunications system.
6. To recognize the potential directions for the industry in the future.

OVERVIEW

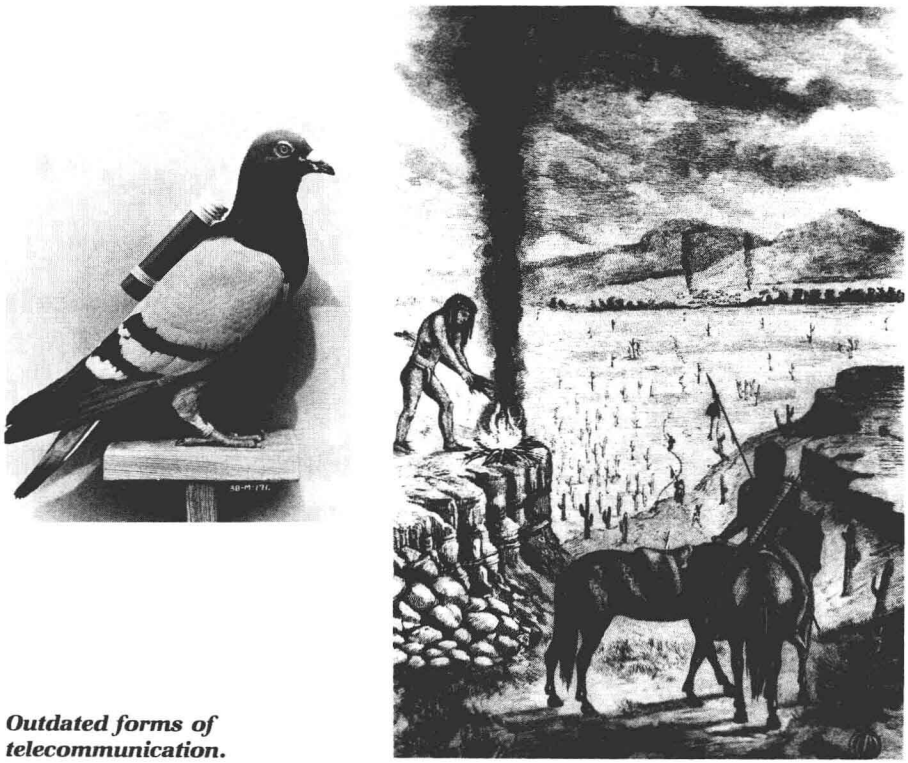
This chapter will provide a basic understanding of the telecommunications industry, including its history, technological breakthroughs, regulations, and future. There are six basic evaluative criteria (timeliness, reliability, quality, cost, security, and ease of use) and three primary motivators (military, government, and business) that shape the industry and cause it to change in predictable ways. An understanding of these evaluative criteria and motivators within the context of the industry's history and progress will provide a framework for examining all the telecommunications applications.

Before Telephone — B.T.

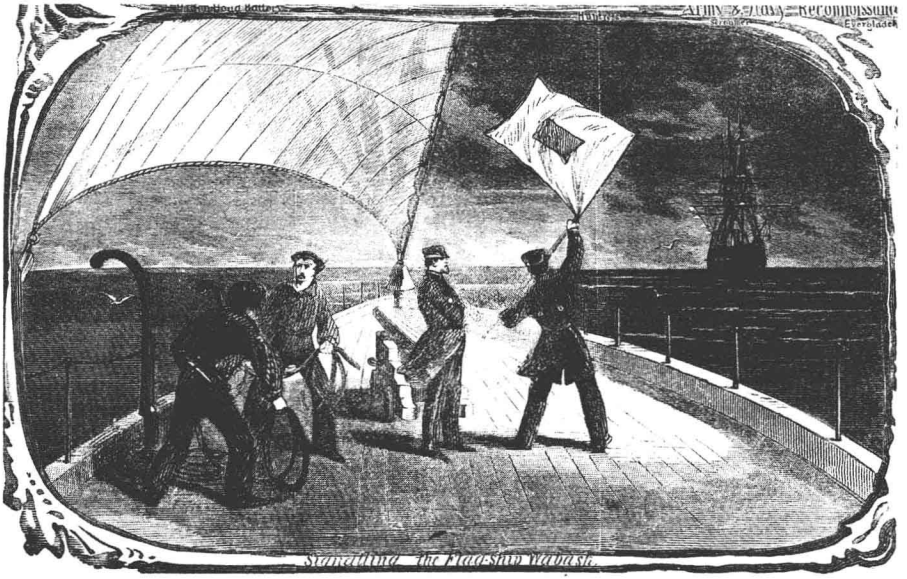
telecommunications any system for communicating over a considerable distance

Telecommunications is any system for communicating over a considerable distance. Telephone communication is a relatively new form, within the last 100 years, of telecommunicating over distance. Modern telecommunications is the electronic transportation of information over distances. The telecommunicating of a primitive society was limited by how far a sound would carry. Realizing the advantages of sending a message farther than the force of a sound, a variety of telecommunication forms were developed.

The Indians used smoke signals, the Greeks used runners, Paul Revere used light signals, and the armed forces used flags and carrier pigeons, but all of these forms of distance communication had limitations. Smoke signals could be affected by wind conditions; runners could tire and fall prey to the enemy; light signals could only carry as far as the eye could see during the night; flag signals required the receiver to have special training to interpret the message; and carrier pigeons could only carry short messages.



Outdated forms of telecommunication.



Outdated forms of telecommunication.

Evaluative Criteria

We judge these primitive forms of telecommunications as inadequate because of our successful experience with the telephone. All forms of telecommunication can be judged by six interrelated evaluative criteria.

1. Timeliness. The speed with which a given amount of information is transmitted and received.
2. Reliability. The degree to which the system will operate dependably and maintain the integrity of the information it transmits and receives.
3. Quality. The strength, intelligibility, and clarity of the transmission signal. This criterion also applies to the capacity of the telecommunications equipment to produce and receive a strong, clear signal.
4. Ease of use (or user acceptance). The relative level of knowledge a user must have to operate the system.
5. Cost. The system's expense compared to its performance characteristics.
6. Security. The system's capacity to transmit and receive information without compromise, interception, or interference from outside sources.

These criteria will be used throughout this textbook to examine the capacity of telecommunications systems to meet user needs.

Motivators

It is important to understand the historical motivations for advances in telecommunications because many of the same forces are creating the need for improved telecommunications today. Historically, as political, military, religious, and commercial organizations have grown in complexity, more elaborate telecommunications systems have been needed to coordinate their efforts. The primary motivators of modern telecommunications are the military, government, and business because their research and development expenditures are propelling changes in new telecommunications products and services.

Most of the modern advances in telecommunications were motivated by the needs of these organizations to coordinate their activities more quickly over increasingly long distances. Timely, reliable, high-quality, and secure information is critical to military

operations that span the globe. Modern international conglomerates require sophisticated telecommunications systems to maintain a competitive edge because these systems allow them to respond more quickly and efficiently to marketplace changes. Governments use telecommunications systems to coordinate the activities of their different functions. Many of the telecommunications systems used today are commercial implementations of systems developed for government and military applications.

Postal and Telegraphic Services

Postal services help create a distribution network for written messages covering a broad geographic area. The postal system is an important and viable communications system because it is relatively cost-effective, easy to use, usually secure, and usually reliable. However, its usefulness is limited to messages that do not require immediate action. The need for a more timely information exchange by modern business, government, and military organizations required the development of electronic telecommunication.

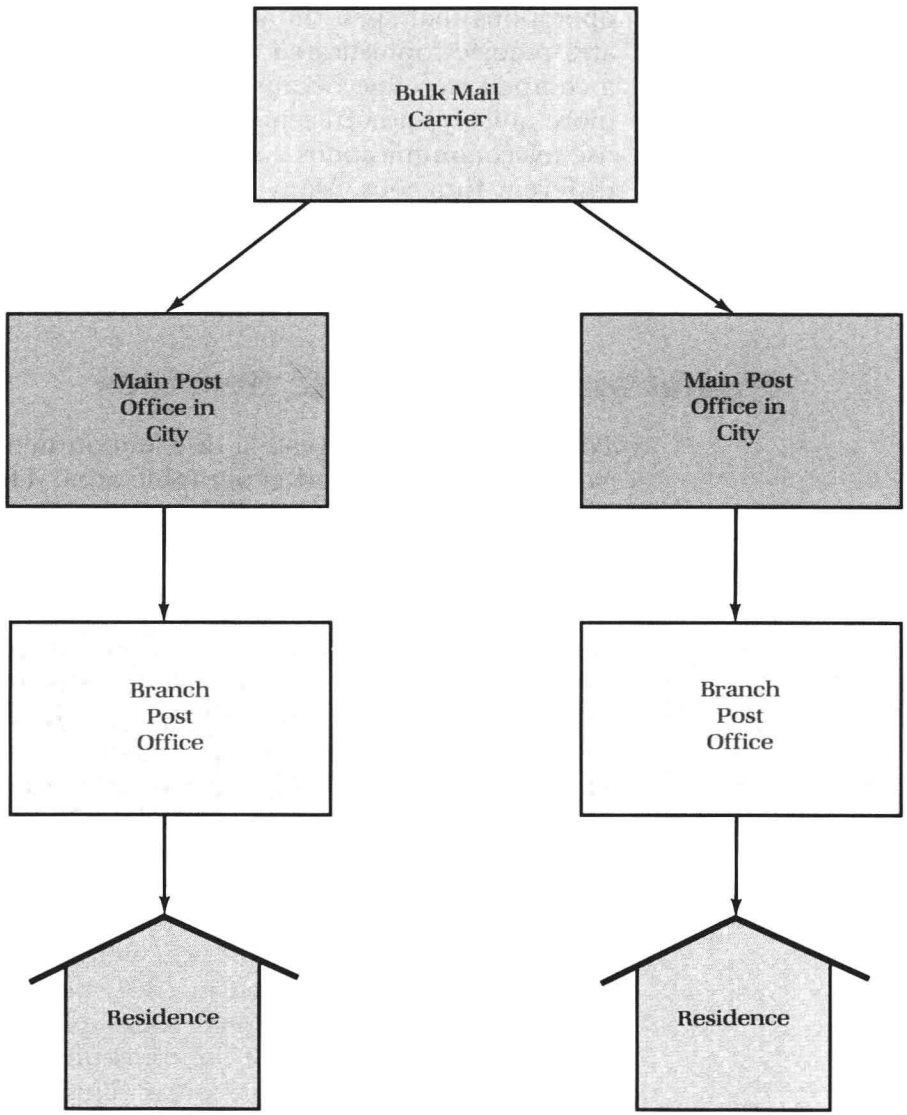
The discovery that electricity could be carried through a wire eventually helped lead to the invention of telegraphy by Samuel Morse in 1835. The telegraph was a dramatic advance in telecommunicating because it carried information over long distances between two points at the speed of light. The development and spread of this medium provided a timely, relatively reliable, and cost-effective way to move information.

For approximately one year before a transcontinental telegraphic link was established in 1861, pony express riders carried telegraphed messages between telegraph stations in Missouri and Nevada. The completion of the transcontinental telegraph link signaled the end of the pony express. This is a good illustration of a telecommunication technology (i.e., the pony express) that became rapidly outdated because it was not as timely, cost-effective, reliable, or secure as the alternative (telegraph wire link). There are many examples of modern applications of technology that become rapidly outdated for the same reasons.

As telegraphy became a proven technology, its use spread throughout the United States within a few years. The military operations of the Civil War helped create the need for the proliferation of this timely and reliable medium.

FIGURE 1-1

Postal Connections Geographically



Even though the telegraph was a significant improvement over the other forms of telecommunicating, the major limitation that prevented its widespread use was that it required special skills for operation. The operator had to know Morse code and how to transmit it using the telegraphic device. There were also technological limitations (e.g., switched service) that might have been overcome with time had it not been for the invention of the telephone.