

# SOLUTIONS MANUAL

Copyrighted Material

## BUSINESS DATA COMMUNICATIONS & NETWORKING

TENTH EDITION

FitzGerald | Dennis

Copyrighted Material

# Chapter 1: Introduction to Data Communications

## *Chapter Outline*

### INTRODUCTION

- A Brief History of Communications in North America
- A Brief History of Information Systems
- A Brief History of the Internet

### DATA COMMUNICATIONS NETWORKS

- Components of a Network
- Types of Networks

### NETWORK MODELS

- Open Systems Interconnection Reference Model
- Internet Model
- Message Transmission Using Layers

### NETWORK STANDARDS

- The Importance of Standards
- The Standards Making Process
- Common Standards

### FUTURE TRENDS

- Pervasive Networking
- The Integration of Voice, Video, and Data
- New Information Services

### IMPLICATIONS FOR MANAGEMENT

### SUMMARY

### ***Teaching Notes***

I usually spend 1 hour of class time on this chapter.

My goals in teaching this chapter are to introduce the basic concepts of data communications and to motivate the importance of learning this material for the students. I usually focus on the network layer model approach because this sets the stage for everything that follows in the book. I take time to trace how a message starts in the application layer and moves through the other layers, each of which adds a packet to the message. This helps to give the students a conceptual underpinning as to how the rest of the course will be laid out. I then refer to this introduction across the course as each new layer is explored in depth later on. I then trace how the message flows upward in the receiver. Together with this chapter, I cover binary representation and the number system topics outlined in the preface. Binary is sometimes a review for students, but not always, so it is useful to have all students have the same level of understanding.

I usually caution the students that this material is complex and difficult to learn, and that it is best approached in three ways: 1) first, treat it as if one is learning a foreign language, and try to absorb the material by not letting oneself become overwhelmed or to get too far behind- a little bit each day is a much better approach to learning about networks. 2) If one does not grasp it all immediately, they are not to worry, but to come at it again and again from several sessions, using several different learning styles- reading, lectures, labs, slides and conversations in class. 3) The students are well served by being sure to attend as many classes as possible, and to skim the material before the lectures, as well as read the chapters in depth after the lectures. The student who tries to learn it all on their own will struggle, but the student who keeps up will really enjoy learning all about this new and interesting topic.

I pull up a jobs website, and explore several current job offers to show the students how interesting networking jobs can be- and it doesn't hurt for them to learn about the potential salaries in this area, either!

I downplay the future trends section, but some instructors use this effectively to engage the students in a discussion.

## **War Stories**

### **Microsoft Internet Explorer and HTML Standards** (could also fit in Chapter 2)

(Objective: illustrate the importance of standards)

In early 1996, when we were developing our Web-groupware software (now a commercial product called Consensus @nyWARE ([www.softbicycle.com](http://www.softbicycle.com))) we discovered that Microsoft's IE would not work with our software. IE did not support the full HTML 3.0 standard in forms processing. All the form information was returned in reverse order from the standard. Since IE was a marginal product at the time and since our project was a research project, we decided not to bother rewriting our software to support IE.

I received an email message from an IE user mentioning that they had discovered that IE would not work with our software and asking if we knew why. I didn't really read the note very carefully. I explained the problem and told them they should use Netscape and forget about IE ... It turned out that the user was Microsoft's chief software architect for IE.

Microsoft quickly confirmed that the problem was indeed their non-support for the standard. However, they ultimately decided not to support the standard, thus requiring developers to change the way they write code (must use the form value tags, not position in the file returned from the forms).

Other topics to cover here in terms of war stories for illustrating the importance of networks is to talk about current standards with which the students are familiar- MP3 vs. ripped iPod files, or Blue Ray CD's vs. the new High Def standards. I ask them what technology standards they use each and every day, and write these on the board. Some prompting will uncover the standards that are in the chapter- TCP/IP and HTML, and then this can be a good place to re-introduce Figure 1.4.

**Answers to End-of-Chapter Questions**

1. How can data communication networks affect businesses?

Data communication networks can affect businesses by being the foundations for distributed systems in which information system applications are divided among a network of computers. Data communication networks facilitate more efficient use of computers and improve the day-to-day control of a business by providing faster information flow, aiding strategic competitive advantage. They also provide message transfer services to allow computer users to talk to one another via electronic mail.

2. Discuss three important applications of data communication networks in business and personal use.

Three important applications of data communication networks in business and personal use include email, videoconferencing, and the Internet.

3. Define *information lag* and discuss its importance.

Information lag is the time it takes for information to be disseminated worldwide. Collapsing the information lag speeds the incorporation of new information into our daily lives. In fact, today's problem is that we cannot handle the quantities of unfiltered information we receive.

4. Describe the progression of communications systems from the 1800s to the present.

Communications systems progression from the 1800s to the present:

1837	Invention of the telegraph
1876	Invention of the telephone
1892	Telephone system regulation begins in Canada
1910	Telephone system regulation begins in the United States
1951	Direct dialed long distance service begins
1962	Satellites begin to transmit international telephone calls
1968	Carterfone court decision permits non-Bell telephone equipment to be used
1970	Court permits MCI to provide long distance services
1984	Breakup of AT&T Cellular phones enter service
1996	Telecommunications Act of 1996 deregulates American telephone system

5. Describe the progression of information systems from the 1950s to the present.

Information systems progression from the 1950s to the present:

1950s	Batch processing done with punch cards
1960s	Use of online terminals for batch processing
1970s	Online real-time systems (single transaction-oriented processing) Change from discrete files to database files Integrated systems
1980s	Completely integrated systems
1990s	Distributed database systems Data mining and warehousing Increased information modeling in database design; object concepts On-line Analytical Processing (OLAP)
2000s	10G switch supporting OC192 fiber produced by Nortel Increased use of Web-based databases Increased use of wireless systems

6. Describe the progression of the Internet from the 1960s to the present.

Internet progression from the 1960s to the present:

1969	Started by US Department of Defense as four-computer network called ARPANET
1974	ARPANET networks 62 computers
1983	ARPANET split into Milnet and Internet
1985	Canadian government completes BITNET
1986	US National Science Foundation creates NSFNET to connect leading US universities
1987	10,000 host computers on Internet and 1,000 on BITNET New high speed backbone network for NSFNET
1988	13 regional Internet networks connected
1989	Canadian National Research Council replaces BITNET with CA*NET Web conceived at the European Laboratory for Particle Physics (CERN) in Geneva
1990	Over 200,000 computers on combined US and Canadian Internet
1991	CERN's first Web browser available on Internet
Early 1990s	Most individual country networks linked together into one worldwide network of networks. Commercial networks began connecting into NSFNET, CA*net, and government-run networks of other countries
1993	Mosaic, the first graphical Web browser, developed at the University of Illinois as part of a project for the university's National Center for Supercomputing Applications (NCSA)
1994	More than 4 million host computers on the internet (most commercial.) US and Canadian governments stopped funding their few remaining circuits and turned them over to commercial firms Netscape and other startup companies introduce commercial Web browsers
1990s	Commercial and social impacts of the Internet and Web; E-commerce

2000s	Wireless Internet in use; Web databases; improved Internet access (e.g. DSL)
-------	--

7. How do LANs differ from MANs, WANs, and BNs?

A Local Area Network (LAN) is a group of microcomputers or terminals located in the same general area. A Backbone Network (BN) is a large central network that connects most everything on a single company site. A Metropolitan Area Network (MAN) encompasses a city or county area. A Wide Area Network (WAN) spans cities, states, or national boundaries. Typically, MANs and WANs used leased facilities, while LANs and BNs are often located internally in an organization and used owned facilities.

8. What is a circuit?

The circuit is the pathway through which the messages travel. It can be made up of a copper wire, although fiber optic cable and wireless transmission are becoming more common. A circuit can also pass across many types of physical facilities such as copper wire or fiber optic cable, but the single end-to-end connection, no matter what the equipment, is referred to as the circuit. There are many devices along the circuit's path that perform special functions such as hubs, switches, routers, and gateways.

9. What is a client?

The client is the input or output hardware device at the other end of a communication circuit. It typically provides remote users with access to the network and the data and software on the server.

10. What is a host or server?

The server (or host computer, or more simply host) stores data or software that can be accessed by the clients, or remote users of a hardware input or output device. In client-server computing, several servers may work together over the network to support the business application.

11. Why are network layers important?

Communication networks are often broken into a series of layers, each of which can be defined separately, to enable vendors to develop software and hardware that can work together in the overall network. These layers enable simplicity in development and also in the comprehension of complex networks. In the end, the strategy of using more simplistic network layers allows vastly different kinds of equipment to be able to have connectivity over a common platform or network, using protocols and standards that are applicable to each narrow slice of the network.

12. Describe the seven layers in the OSI network model and what they do.

The *application* layer is the application software used by the network user. The *presentation* layer formats the data for presentation to the user by accommodating different interfaces on different terminals or computers so the application program need not worry about them. The *session* layer is responsible for initiating, maintaining, and terminating each logical session between end users. The *transport* layer deals with end-to-end issues, such as procedures for entering and departing from the network, by establishing, maintaining, and terminating logical connections for the transfer of data between the original sender and the final destination of the message. The *network* layer takes the message generated by the application layer and if necessary, breaks it into several smaller messages. It then addresses the message(s) and determines their route through the network, and records message accounting information before passing it to the data link layer. The *data link* layer formats the message to indicate where it starts and ends, decides when to transmit it over the physical media, and detects and corrects any errors that occur in transmission. The *physical* layer is the physical connection between the sender and receiver, including the hardware devices (e.g., computers, terminals, and modems) and physical media (e.g., cables, and satellites).

13. Describe the five layers in the Internet network model and what they do.

The *application* layer is the application software used by the network user. The *transport* layer deals with end-to-end issues, such as procedures for entering and departing from the network, by establishing, maintaining, and terminating logical connections for the transfer of data between the original sender and the final destination of the message. The *network* layer takes the message generated by the application layer and if necessary, breaks it into several smaller messages. It then addresses the message(s) and determines their route through the network, and records message accounting information before passing it to the data link layer. The *data link* layer formats the message to indicate where it starts and ends, decides when to transmit it over the physical media, and detects and corrects any errors that occur in transmission. The *physical* layer is the physical connection between the sender and receiver, including the hardware devices (e.g., computers, terminals, and modems) and physical media (e.g., cables, and satellites).

14. Explain how a message is transmitted from one computer to another using layers.

The *application* layer is the application software used by the network user. The *transport* layer is responsible for obtaining the address of the end user (if needed), breaking a large data transmission into smaller packets (if needed), ensuring that all the packets have been received, eliminating duplicate packets, and performing flow control to ensure that no computer is overwhelmed by the number of messages it receives. The *network* layer takes the message generated by the application layer and if necessary, breaks it into several smaller messages. It then addresses the message(s) and determines their route through the network, and records message accounting information before passing it to the data link layer. The *data link* layer formats the message to indicate where it starts and ends, decides when to transmit it over the physical media, and detects and corrects any errors that occur in transmission. The *physical* layer is the physical connection between the sender and receiver, including the



## Introduction to Data Communications

hardware devices (e.g., computers, terminals, and modems) and physical media (e.g., cables, and satellites).

### 15. Describe the three stages of standardization.

The formal standardization process has three stages: specification, identification of choices, and acceptance. The specification stage consists of developing a nomenclature and identifying the problems to be addressed. In the identification of choices stage, those working on the standard identify the various solutions and choose the optimum solution from among the alternatives. Acceptance, which is the most difficult stage, consists of defining the solution and getting recognized industry leaders to agree on a single, uniform solution.

ISO standards development is pursued at the national and international levels. Authorized national technical committees can be designated as Technical Advisory Groups (TAGs) to international subcommittees or workgroups.

Examples of national-level standards bodies (with the legal authority for national standards development and articulation with ISO) are:

<b>Standards Designation</b>	<b>Name of National Standards Body (ISO Member)</b>	<b>Web Site</b>	<b>Nation</b>
ANSI	American National Standards Institute	<a href="http://www.ansi.org">www.ansi.org</a>	USA
SCC	Standards Council of Canada	<a href="http://www.scc.ca">www.scc.ca</a>	Canada
DGN	Dirección General de Normas	<a href="http://www.economia.gob.mx/normas">www.economia.gob.mx/normas</a>	Mexico
BSI	British Standards Institution	<a href="http://www.bsi-global.com">www.bsi-global.com</a>	UK
JISC	Japanese Industrial Standards Committee	<a href="http://www.jisc.org">www.jisc.org</a>	Japan
AFNOR	Association française de normalisation	<a href="http://www.afnor.fr">www.afnor.fr</a>	France
BIS	Bureau of Indian Standards	<a href="http://www.bis.org.in">www.bis.org.in</a>	India
CSBTS	China State Bureau of Quality and Technical Supervision	<a href="http://www.csbts.cn.net">www.csbts.cn.net</a>	China
GOST R	State Committee of the Russian Federation for Standardization and Metrology	<a href="http://www.gost.ru">www.gost.ru</a>	Russian Federation
SNV	Swiss Association for Standardization (Schweizerische Normen-Vereinigung)	<a href="http://www.snv.ch">www.snv.ch</a>	Switzerland
DIN	Deutsches Institut für Normung	<a href="http://www.din.de">www.din.de</a>	Germany

### 16. How are Internet standards developed?

The Internet Engineering Task Force (IETF; [www.ietf.org](http://www.ietf.org)) sets the standards that govern how much of the Internet will operate. Developing a standard usually takes 1-2 years. Usually, a standard begins as a protocol developed by a vendor. When a protocol is proposed for standardization, IETF forms a working group of technical experts to study it. The working group examines the protocol to identify potential problems and possible extensions and

improvements, and then issues a report to IETF. If the report is favorable, the IETF issues a Request for Comment (RFC) that describes the proposed standard and solicits comments from the entire world. Once no additional changes have been identified, it becomes a Proposed Standard. Once at least two vendors have developed software based on it, and it has proven successful in operation, the Proposed Standard is changed to a Draft Standard. This is usually the final specification, although some protocols have been elevated to Internet Standards, which usually signifies a mature standard not likely to change. There is a correlation of IETF RFCs to ISO standards.

17. Describe two important data communications standards-making bodies. How do they differ?

The International Organization for Standardization (ISO) makes technical recommendations about data communication interfaces. The Telecommunications group (ITU-T) is the technical standards-setting organization of the United Nations International Telecommunications Union (ITU). Postal Telephone and Telegraphs (PTTs) are telephone companies outside of the United States. ITU-T establishes recommendations for use by PTTs, other common carriers, and hardware and software vendors. Although a complicated series of acronyms, it is useful to point out that the ISO created the OSI model!

Information technology standards contribute to data communications. In the USA, the National Committee for Information Technology Standards (NCITS) has responsibility (under ANSI) for multimedia (MPEG/JPEG), intercommunication among computing devices and information systems (including the Information Infrastructure, SCSI-2 interfaces, Geographic Information Systems), storage media (hard drives, removable cartridges), database (including SQL3), security, and programming languages (such as C++). The NCITS T3 committee on Open Distributed Processing (ODP) is the US Technical Advisory Group (TAG) to JTC 1/SC 6/WG 7 (Subcommittee 6, Workgroup 7). JTC 1 is the ISO/IEC Joint Technical Committee 1 on Information Technology. Among NCITS/T3's current projects are: Abstract Syntax Notation One (ASN.1), the OSI Directory Services (and protocols), routing information exchange protocols, multicasting (all of considerable interest to the telecommunications industry.) T3 has US TAG responsibility for codes and character sets.

IEEE plays an important standards role for data communications, particularly in LAN technology protocols.

Note that the HTML specifications state that HTML uses the ISO 8859-1 (Latin 1) character set.

18. What is the purpose of a data communication standard?

The use of standards makes it much easier to develop software and hardware that link different networks because software and hardware can be developed one layer at a time. The

## Introduction to Data Communications

software or hardware defined by the standard at one network layer can be easily updated, as long as the interface between that layer and the ones around it remains unchanged.

19. What are two of the largest inter-exchange carriers (IXCs) in North America?

Two of the largest inter-exchange carriers (IXCs) in North America are AT&T and Sprint, and the formerly large MCI was acquired in a post bankruptcy merger with Verizon.

20. Name two RBOCs. Which ones provide services in your area?

Some regional bell operating companies (RBOCs) are Bell South, PacBell, Ameritech, and Verizon. AT&T recently made a bid to buy Bell South, and it seems to be repositioning itself to provide both long distance and local service, not unlike the pre-divestiture AT&T.

21. Discuss three trends in communications and networking.

First, pervasive networking will change how and where we work and with whom we do business. Pervasive networking means that we will have high speed communications networks everywhere, and that virtually any device will be able to communicate with any other device in the world. Prices for these networks will drop and the globalization of world economies will continue to accelerate. Second, the integration of voice, video, and data onto the same networks will greatly simplify networks and enable anyone to access any media at any point. Third, the rise in these pervasive, integrated networks will mean a significant increase the availability of information and new information services. It is likely that application service providers will evolve that act as information utilities.

22. Why has the Internet model replaced the OSI model?

The Internet model is simpler (effectively collapsing the top three layers of the OSI model into a single model) and easier to remember and understand. Further, the ISO OSI Reference Model is the result of a formal standardization process and is technical in its presentation. By contrast, the Internet model is appropriate for those within the networking community with practical needs related to implementing the Internet and networking.

However, only a few years ago the Internet model was commonly understood to have only four layers. Today, the transport layer is now separately identified in the Internet model, yielding an important, fifth layer for comprehension. This evolution in presentation may show that at least one technical distinction from the OSI model is now considered practical as the scope, volume of traffic, and complexity of networking (and of the Internet) grows.

23. In the 1980s when we wrote the first edition of this book, there were many, many more protocols in common use at the data link, network, and transport layers than there are today. Why do you think the number of commonly used protocols at these layers has declined? Do

you think this trend will continue? What are the implications for those who design and operate networks?

Today there is convergence around the non-proprietary use of TCP/IP as the protocol of choice for all networks. For the most part, network software is designed to interface with networks using this protocol. By non-proprietary, this means that TCP/IP is an interoperable protocol portable to any manufacturer's hardware. All manufacturers are developing their products to use TCP/IP as their protocol of choice. This is of great benefit for those operating networks because they do not have to deal with the incompatibilities of various proprietary networks. In the past, network equipment such as IBM's SNA and Novell's Netware products had retained proprietary protocols that did not interface with as much ease as today's more compatible and TCP/IP based products. The decline of the number of competing protocols is related to the emergence of TCP/IP as the universal connector, along with the rise in competition and subsequently better price availability from those vendors who market to this protocol, thus ensuring the viability of this standard for a long time to come for network managers.

24. The number of standardized protocols in use at the application layer has significantly increased from the 1980s to today. Why? Do you think this trend will continue? What are the implications for those who design and operate networks?

The biggest reason that there are more standardized protocols at the application layer is related to the predominant use of the Web and its standardized graphic interface (HTTP, DHCP, for example). In a way, many new protocols ride on top of TCP/IP networks, and some of these new protocols have been developed to enable the retrofitting of new technologies on top of an older networking architecture. On the other hand some proprietary protocols connected with such models as IBM's SNA and DECNet have declined in significance while the importance of Internet-related protocols has grown,

**Mini-Cases**

**I. Big E. Bank**

Nancy Smith's task as a Senior Network Project Manager is to connect Ohio Bank's network with Big East Bank's network. She has several alternatives. Your job is to develop a short list of pros and cons for each alternative and make a recommendation.

	<b>Big East Bank</b>	<b>Ohio Bank</b>
<b>Size</b>	Presumed large	Small
<b>Location</b>	Not stated	Columbus
<b>Infrastructure</b>	Not stated	WAN connecting 5 cities with branches MANs in cities LANs in branches

Alternative A is to leave the two networks separate but install a few devices in OB's headquarters to translate between the set of protocols used in the BEB network and those in the OB network so that messages can flow between the two networks.

*Pros: Easiest (and likely the least expensive and fastest) to implement; little impact on infrastructure*

*Cons: Performance penalties from lack of network architecture integration*

Alternative B is to replace all the WAN, MAN, and LAN network components in OB's entire network so that OB uses the same protocols as BEB and the two can freely communicate.

*Pros: Performance gains from network architecture integration*

*Cons: Major impacts on infrastructure; major costs; time required*

Alternative C is to replace the devices in the OB WAN (and possibly the MANs) so that each city (or each branch, if the MANs are replaced as well) can communicate with the BEB network, but the LANs in individual branch remain unchanged. In this case, the device connecting the MAN (or the branch) will translate between the OB protocols and the BEB protocols.

*Pros: Intermediate to good performance gains (over Alternative A) but some penalties, depending on whether just OB WAN or both MAN and WAN technologies are affected and the extent to which the resulting interface between OB's and BEB's technologies turns out to cause performance problems. Intermediate expense and infrastructure impact.*

*Cons: Does not achieve full network integration. Necessity to support OB's LAN or LAN/MAN technology over time will add additional problems to network management for BEB.*

*Recommendation: Alternative C is the most practical in terms of time frame to implement and costs to achieve at least a substantial level of network architecture integration. However, from a longer-term point of view, Alternative B is the best, provided that BEB offers a transition stage like Alternative A to meet immediate needs and takes sufficient time to implement the full infrastructure changes. This plan will enable the banks to achieve their full potential from their communications infrastructure, and facilitate integration of more than just the networks, but also carry over into integration among the staff and customers.*

## **II. Global Consultants**

What advice would you give Mr. Adams? (...given two de facto standards for financial software, neither of which is completely satisfactory as neither one supports both required financial analysis tasks adequately.)

*One solution would be to choose a software source adhering to the de facto standards of either Group A or Group B and attempt to negotiate the development of a new and satisfactory version of the financial analysis task deemed inadequate. This likely would not work because no firm could be found that would agree to develop a new version of its software or because Global Consultants would be expected to bear high development costs to meet its specific need. Most software companies would be unwilling to interrupt or significantly modify a software development schedule for the sake of a single client. .*

*Thus, if no software source can be found that will undertake the needed development for reasonable cost, the practical solution may be for Global Consultants to undertake a ground up development project of new software that will meet all needs. This could be done internally or by hiring a consultant firm (outsourcing). This approach could be evaluated in light of the firm's strategic plan, and, if the new software is highly successful for GC, it might become a marketable product for the firm.*

## **III. Atlas Advertising**

What types of standard protocols and technologies do you think they are using at each layer?

*Students should refer to Figure 1.5 to address the issues raised with this mini-case.*

## **IV. Consolidated Supplies**

Should Consolidated Supplies replace all the networking equipment in all the warehouses now, should it wait until newer networking technologies are available, or should it upgrade some of the warehouses this year, some next year, and some the year after, so that some warehouses will benefit from the expected future improvements in networking technologies?

*Students should consider the history of information systems when thinking about this issue. Rapid changes in technology will continue to make the decision about when to implement new technologies a difficult one for businesses. The solution must be one that fits well with the*

## **Introduction to Data Communications**

*nature of the organization itself and its corporate, long term goals. If Consolidated Supplies is in an aggressive acquisition mode and involved in a rapidly changing, high tech industry, perhaps a more aggressive upgrade of the network would be appropriate. If Consolidated Supplies is in a market niche that does not face deep market changes and offshore competition for its continued success, and is less concerned about the role of technology in their immediate strategy, then the firm may have the luxury of waiting out a round of technological change in the interest of allowing the future improvements to reach the marketplace.*

### **V. Asia Importers**

What are the potential benefits and challenges that Asia Importers should consider in making the decision about whether or not to move to one integrated service?

*An integrated service will enable Ms. Wong to consolidate her bills and technical support with a single company. This single source of contact would be of benefit to Asia Importers by streamlining services and technological sourcing. However, a potential disadvantage of the single source approach is that the sole vendor would then manage more of Asia Importers' technical infrastructure, leaving the firm with some vulnerability due to single sourcing. If the vendor proves unreliable or inefficient, this will affect a greater portion of Asia Importers' business than if the vendor was only servicing one or another technology.*

### **VI. Mega Investments**

Outline the pros and cons of upgrading the networks.

*The pros of upgrading the networks include increased system speed and reliability for Mega Investments, as well as getting out from under the concerns over potential major problems or total outages due to equipment availability problems such as might occur for some Token Ring products. On the other hand, possible cons include the cost of the upgrade, the potential for confusion on the part of end users during the transition, and the challenges of upgrading remote offices in the Caribbean.*

### **Next Day Air Service Case Study**

1. Briefly describe the current state of Next Day Air Service's office automation, system integration, and networking. Begin by explaining how each department uses information technology, what hardware it uses, and what functions currently are automated. Also assess which department is most in need of a network.

The level of automation varies significantly among the NDAS departments and offices. In addition, NDAS is in the process of downsizing to achieve a more cost-effective computer support system.

For example, the Sales and Marketing Division has a desktop computer for each of the account representatives. All of these computers are connected to a small local area network (LAN) that serves only the Sales and Marketing Division. The Accounts Receivable Division recently downsized its minicomputer to a powerful desktop computer with a faster processor, motor memory and increased disk storage space. This new desktop supports databases for both customer billing and “bad dept” expenses. The Accounts Payable Division has an older minicomputer and is in the process of downsizing to a modern powerful desktop computer. It has its own vendor database that includes invoices received by NDAS from other carries stored on the older minicomputer.

Fleet Maintenance prefers to process all its information manually; however, this area is being considered for automation. None of the departmental computers is integrated.

The Dispatch department needs a high speed data communication network the most, because it is the very essence of Next Day Air Services business. Without an efficient parcel tracking network, there will be no NDAS!

2. With the “types of networks” and future technologies discussed in this chapter, what kind of network would appear to be the most beneficial to Next Day Air Service? Justify your answer.

Initially, an integrated, organization-wide, multiapplication network appears to suit the needs of NDAS the best. This type of network would run many kinds of applications that share common databases and communication facilities. Assuming that Next Day Air Service will continue to expand its operations, any network that is developed or acquired should be capable of being upgraded to a multi-organizational network.

Note to instructor: Some students may be confused between network technology (LANs, WANs, MANs, BNs) and network type. This is a good place to clear up any misconceptions on this point.

3. What are the current characteristics or practices that identify NDAS as a possible candidate for its proposed integrated data communication network?



## Introduction to Data Communications

NDAS has a number of geographically remote facilities that currently are not connected either to one another or to the corporate headquarters. Note that figure A1-1 in the text shows the routes Next Day Air Service covers; it is not a communication network. The public telephone network currently provides the only way for direct communication among these scattered locations.

In addition, a high volume of interbranch mail currently is being sent from the remote offices to the corporate headquarters. Billing information and other correspondence are sent daily from the remote offices to the corporate office. Timecards need to be sent twice monthly, and this frequency would probably double if NDAS decides to adopt a weekly pay period. Also, a massive amount of paperwork appears to be required for the day-to-day operation of the company. Each facility must make photocopies of billing and timecard information before sending it to corporate headquarters. This is done to safeguard the information in case it is lost in transit.

Moreover, if questions or problems arise pertaining to the delivery of a parcel (package tracking), but the billing ticket information has yet been entered into the corporate database, then that ticket must be located manually. Locating these tickets manually is very time consuming, which is a factor that could keep NDAS from serving its customers quickly and maintaining a competitive advantage in the overnight delivery market.

4. Which two of the four networks (e.g., LAN) might be appropriate for NDAS?

NDAS definitely needs a WAN because of its widespread operations as shown in the text. It also needs LANs in the various offices and departments. These LANs would eventually be interconnected to each other and with the WAN.

Note to instructor: An alternate answer could be a single large LAN for the entire headquarters, interconnected via a WAN to the field offices.

5. When looking over the organization chart, you notice that the acting manager of the Information Services/Data Processing department is also named Coone (Les Coone). Inquiring, you learn that Les is President Coone's nephew. Les has just joined NDAS. This is his first job, and he has no background in information systems, data processing, or data communications. Will this be a problem for you? If so, why? How will you handle it?

This can be a problem because of Les Coone's inexperience and his relationship with President Coone. The best way to handle the situation is to try to make a friend of Les by being helpful, honest, and cordial.

Note to instructor: This part of the case scenario will give you the opportunity to stress the importance of working with the user community and management when developing systems and installing data communication networks.