Contributors

DAVID AXNER, Industry Analyst/Consultant and President, DAX Associates, Ore-
land, PA

DOUGLAS R. BALLOU, President, Ballou Consultants Inc., Lancaster, OH

RICHARD A. BELLAVER, Associate Professor, Center for Information and Commu-
nication Sciences, Ball State University, Muncie, IN

DR. PHYLLIS BERNT, Associate Dean of the College of Communications, Ohio
University, Athens, OH

DR. THOMAS A. BROWDY, Program Director, Information Management Pro-
grams, Washington University, St. Louis, MO

PETER BROWN, Vice President, Information Technology, PRI Automation, Biller-
ica, MA

CHRISTOPHER S. CLEVELAND, Senior Consultant, KPMG Peat Marwick LLP, Rad-
nor, PA

DR. S. ANN EARON, President, Telemanagement Resources International Inc.,
Skillman, NJ

PHIL EVANS, Director of Telecommunications, Perot Systems Corp., Plano, TX

JOHN FISKE, Consultant, johnfiske.com, Prides Crossing, MA

DR. FRANK M. GROOM, Professor, Center for Information and Communication
Sciences, Ball State University, Muncie, IN

KEVIN M. GROOM, Senior Technical Associate, AT&T, Cincinnati, OH

JEFF C. HAFER, Telecommunications Manager, GPU Service Inc., Reading, PA

KENNETH HARNISCH, former Offer Manager, AT&T Managed Network Solutions,
New York, NY

DALE HIBNER, Manager, Whittman-Hart Inc., Chicago, IL

ANTOINETTE Z. HUBBARD, Principal, Leadership by Design, Cincinnati, OH

DR. RON KOVAC, Associate Professor, Center for Information and Communication
Sciences, Ball State University, Muncie, IN

DR. HANS KRUSE, Director, J. Warren School of Communications System Man-
agement, Ohio University, Athens, OH

LARRY L. LEARN, Director of Technical Planning, OCLC Online Computer Li-
brary Center Inc., Dublin, OH

JOHN M. LUSA, Principal, International Communications, Dayton, OH; and Ad-
junct Faculty, Center for Information and Communication Sciences, Ball
State University, Muncie, IN
Contributors

THOMAS OSHA, Director, Executive Communications, Cincinnati Bell Telephone, Cincinnati, OH
BRYAN PICKETT, Vice President, Enterprise Networks, Training and Documentation, Nortel, Richardson, TX
ARLYN S. POWELL, JR., Group Editorial Director, Cabling Installation and Maintenance magazine, PennWell Publishing Co., Nashua, NH
KIMBERLY RUSSO, Director of Marketing, Tele-Tech Services, Summerville, SC
ED SIMONSON, President, TeleDesign Management Inc., Burlingame, CA
DR. GEORGE THOMAS, Associate Professor, Electrical Engineering, University of Southwestern Louisiana, Lafayette, LA
COLIN WYND, WorldWide Channel Marketing Manager, NetMetrix Division, Hewlett-Packard Co., Palo Alto, CA
BILL YAMAN, Vice President, Solutions Management, Candle Corp., Santa Monica, CA
MICHAEL G. ZIVICH, Consultant, Ballou Consultants Inc., Lancaster, OH
Contents

INTRODUCTION ................................................................. ix

SECTION I THE MANAGEMENT TEAM................................. 1

1 The Corporate Information and Communications Hierarchy: Technological Management in Modern Enterprises ......................... 3
  Thomas A. Browdy

2 The Changing Role of the Network .................................. 21
  Phil Evans

SECTION II MAINTAINING THE NETWORK ............................ 37

3 Quality: The Key to a Successful Telecommunications Infrastructure ................................................................. 39
  Peter Brown

4 Managing Applications on the Network ............................. 55
  Bill Yaman and John Fiske

5 Tools to Manage Network Elements ................................. 67
  Hans Kruse

6 Enterprise Network Monitoring and Analysis ...................... 81
  Colin Wynd

7 The Cable Plant ............................................................. 97
  Arlyn S. Powell, Jr.

8 Designing Enterprise Networks ....................................... 113
  Kevin M. Groom and Frank M. Groom

9 Operating a Network Help Desk .................................... 137
  Jeff C. Hafer
## Contents

**SECTION III THE NETWORK PROVIDERS** ........................................... 149

10 The Impact of Regulatory Affairs on the Enterprise Network. .......................... 151

Phyllis Bernt

11 Dealing with Carriers ................................................................. 169

Kimberly Russo

12 The Changing Global Telecommunications Marketplace ............................. 179

Christopher S. Cleveland

**SECTION IV THE DATA NETWORK** .................................................. 209

13 Data Communications: The Physical Connections to the Wide Area Network ....... 211

Dale Hibner

14 Network Security: Firewalls Guard Intranets from Invasion ....................... 227

David Axner

**SECTION V THE VOICE NETWORK** .................................................. 241

15 Voice Network: Communications with the Sky-Is-the-Limit Versatility .............. 243

Bryan Pickett

16 Planning a Cutover to a New Voice System ....................................... 261

Thomas Osha

17 Dealing with Telephone Toll Fraud ............................................... 281

Ed Simonson and Jeff Dixon

**SECTION VI NEW TECHNOLOGIES** ................................................ 297

18 Emerging High-Bandwidth Networks ............................................. 299

Kevin M. Groom and Frank M. Groom

19 The Internet as an Alternative to the Corporate Network ......................... 317

Larry L. Learn

20 The Role of Wireless in Corporate Communications ................................ 335

George Thomas

21 Telecommuting: Distributed Work Programs ...................................... 361

Richard A. Bellaver
22 Operating Teleconferencing Systems  
(Audio, Audiographics/Multimedia, and Video) ............ 375  
S. Ann Earon

SECTION VII  SUPPORT FOR THE NETWORK MANAGER ............ 391

23 Evaluating the Information Technology Outsourcing Option ........................................ 393  
Kenneth Harnisch

24 Writing an Effective Request for Proposals ............ 415  
Douglas R. Ballou

25 Tapping the Experience Resources of Consultants ...... 425  
Michael G. Zivich

26 Budgeting in a Telecommunications Environment ...... 435  
Ron Kovac

27 Managing Data on the Network: Data Warehousing ..... 453  
Richard A. Bellaver

28 The Art and Science of Project Management ............ 469  
Antoinette Z. Hubbard

SECTION VIII  EDUCATION SUPPORT FOR  
THE NETWORK MANAGER ........................................ 481

29 Educating Aspiring Network Managers .................. 483  
John M. Lusa

30 Staying Updated with Media, Shows, and Seminars ..... 495  
John M. Lusa

SECTION IX  APPENDICES ........................................ 505

Appendix A  Selected Vendors and Manufacturers in the Networking and Communications Industries. .... 507

Appendix B  Selected Periodicals in the Networking and Communications Industries .................... 527

Appendix C  Glossary ........................................ 531

ABOUT THE EDITOR ........................................ 551

INDEX ........................................ 553

vii
Introduction

We are proud and happy to be able to present the second edition of *The Network Manager's Handbook*. The great response to our first edition was gratifying.

It is no secret that the world of information technology is one of rapid change and innovation, and we are well aware that the management of computer and voice network must constantly deal with this fact of life. Thus, we dedicate this new book to those changes.

There is hardly a business or organization today of any size that does not employ some form of advance telephony, networking, or computer technology. Keeping up can be a daunting task for those in charge of using this technology within their enterprises. For those who are just entering or aspire to a career in information technology it must seem even more bewildering.

At the core of much of this technology is a blossoming career field that has essentially been created during the past 5 or 6 years. For simplicity's sake and for purposes of this book, we generically use the title of network manager. The position may actually be a vice president, director, manager, supervisor, or some other title. The title infrastructure manager has been used as well.

The focus of this edition is on that corporate position with overall responsibility for the computer and telephone network within the enterprise or organization. Reporting to this position may be people with direct responsibility for network engineering, help desks, data networks, local area network (LAN) administration, Internet and intranet systems, voice systems, World Wide Web administration, etc., depending on the size of the organization and its network. In many organizations, such as the larger airline companies, the budget for network operations may reach into the hundreds of millions of dollars. Here you may find vice presidents reporting to vice presidents.

A network manager generally reports to the chief information officer or someone with the responsibility for technology deployment within the organization. This reporting structure occurs in about 80% of the situations.
Introduction

I know of some organizations in which the network manager is on the same level as the chief information officer (CIO). In other situations, where the organizations have not joined the modern world, the network manager, sometimes known as the telecommunications manager, is still reporting to the facilities manager. You may be able to ascertain the importance of the network to top management by where the network operation is positioned within the organizational chart.

This book is designed to help those hardworking networking professionals who constantly put their careers on the line as they investigate and employ new systems that come onstream with great rapidity; and, in many instances, they operate without the full and unequivocal support of top management. The trend, though, is in favor of new technology. Top management can no longer ignore the benefits of technology within their operations. Depending on background of the top executives, they may actually take a leading role in the employment and use of technology to ensure a strong competitive posture for their enterprise.

The inspiration for this book originally came from decades of experience in the computer and telecommunications industries as a writer, editor, and publisher for a number of business periodicals in these fields. Over the years I have seen tremendous changes. I have been there when momentous developments were announced or I have had the privilege to interview and meet firsthand many of those movers and shakers in the business and scientific world who made it happen, on both the user and provider sides.

As many of us have learned, keeping track and keeping up with the changes is no easy task. Much happens and it happens quickly. It is not only in the new technology but also in the marketing, distribution, and application of information and communications technology. To add to the perplexity, literally hundreds of vendors have come and gone during the past three decades.

I have heard others refer to this avalanche of information as information overload. It may be difficult at times to keep up with this constantly changing picture, but we, being humans, will always continue to try.

What really brought my thinking to a sharper focus was teaching a graduate-level class on telecommunications management, essentially networking management, at the Center for Information and Communication Sciences, Ball State University, Muncie, IN. This course was not meant to make a network manager out of a student in one 3-hour semester course, but to cover as many as possible of the more important management tools used by a network manager. When I took possession of the course, I also took possession of its textbook and reading assignments. Being well researched, this wealth of information did a good job of providing reference material for the course. However, I found it still necessary to provide supplementary reading material.
Introduction

By combining my decades of experience in the computer and communications field with my teaching undertaking, I felt the need to outline a book especially for network managers. Also, in realizing my own limitations, I knew that for assistance I could call on many experts in the various facets of networking, most of whom I have met over the years as an editor and a publisher of business publications directed toward the interests of network managers.

The next step was to contact my many associates in the field. The response was gratifying. The Network Manager's Handbook came together as an optimum mix of user, vendor, and academia input. You, as the reader, are offered a combination of both researched knowledge and real-world experience. What you read in this book is the result of a total of hundreds and hundreds of hours of work on the part of many—the chapter authors, their associates, and the talented editors and graphics artists at Auerbach division of CRC Press.

This book is designed as a compendium of technology, management techniques, and related information of interest to organizational network managers to assist them in their daily, as well as their longer term strategic business activities. It will also be a valuable and convenient desk-side reference that covers a wide range of topics for aspiring new network managers, and experienced executives who need to be refreshed on various topics.

The first section deals with the structure of the organization and how the network manager fits in it. In Chapter 1, Thomas Browdy of Washington University points out that the new breed of technological managers must effect a balance between technology, its application, and resources within an enterprise. He adds that the data processing (DP) manager of yesterday has been replaced with a multitalented executive who must step out and lead his or her enterprise technologically.

In Chapter 2, Phil Evans of Perot Systems Corp. points out that the network managers of the 1990s have more choices of services and equipment from more vendors than ever before. Because of the global nature of business, they have the opportunity to employ their choices in more locations than in the past.

The next section deals with maintaining the network. In Chapter 3, Peter Brown writes about the importance of quality management. He relates that the implementation of a quality program takes time, patience, training, and dollars; when it is done appropriately, the payback is a higher level of service, happier employees, and satisfied customers for fewer dollars. Chapters 4 through 6 provide a host of ideas and tools to manage and monitor the network and the applications running on it. Colin Wynd of Hewlett-Packard Co. in Chapter 6 writes that users are starting to expect error-free network connectivity with guaranteed uptime and response times.
Introduction

At the basic level a network is cabling, according to Arlyn Powell of Cabling and Installation Maintenance magazine, and he writes that this is where most of the network failures occur. This section goes on to give ideas on how to set up a help desk operation from Jeff Hafer of GPU Service Inc. An entirely new chapter on network design was written by Kevin Groom and Frank Groom, a professor at Ball State University, who has a wealth of experience in the telecommunications industry.

Without the public carriers of all types there would be no private network. The next section tells who they are, how to deal with them, and how they are regulated. Phyllis Bernt of Ohio University in Chapter 10 writes that network managers have had to understand the complexities of regulation to fully grasp the range of options available for getting effective services at optimum rates. In Chapter 11, Kimberly Russo gives advice on whom they are and how to deal with local and exchange carriers in the U.S. Also, in this section, Christopher Cleveland, consultant for KPMG Peat Marwick LLP, covers the global and international aspects of telecommunications. He deals with the telecommunications environment throughout the world and with the effects of deregulation.

The section on the data network provides the basics of data communications in Chapter 13 by Dale Hibner of Whittman-Hart Inc. He begins by describing LANs and takes the reader out to the wide area network (WAN). Chapter 14 by David Axner of DAX Associates deals with network security.

Historically, voice systems were separate from data networks. With the digitizing of the network, as well as the voice system, it has made good sense to merge the operation of voice and data at some level. The section on voice systems deals with the voice network and its integration with computer systems, planning a cutover of a major voice system, and how to protect against toll fraud. Ed Simonson, president of TeleDesign Management Inc., offers a five-step, proactive solution for fraud prevention.

The next section on new technologies covers a wide range of topics. They include the new high-speed asynchronous transfer mode (ATM) and digital subscriber line (DSL) networks, the Internet as a corporate alternative, wireless networks, telecommuting, and videoconferencing. The network manager now has alternatives in technology and versatility in solving user problems only dreamed about just a few years ago. In Chapter 19, Larry Learn of OCLC Online Computer Library Center Inc., writing about the Internet, exclaims that now is not the time to be faint of heart. This new technology, if used correctly, presents unprecedented opportunities for new and improved global marketing and sales, greatly enhanced customer and user support, and greatly facilitated communications within an organization.

The section on the support for network managers focuses on a number of management tools that are available to the network manager. Invaluable
tips are given on how to use outsourcing, requests for proposals (RFP), consultants, budgeting, and project management. In Kenneth Harnisch's Chapter 23 on outsourcing, he writes that the technological revolution now under way will undoubtedly accelerate the trend toward outsourcing because the need to manage sophisticated networks requires expertise and resources that many large organizations do not and will not possess. Douglas Ballou gives advice on writing RFPs, and Michael Zivich tells how to select a consultant. Ron Kovac and Antoinette Hubbard are welcomed as new writers in this edition. Ron explains the importance of budgeting as a management tool, while Antoinette details the importance of project management, a widely used tool. Richard Bellaver adds a new chapter on data warehousing and explains its impact on the network.

In the last section, readers are advised about educational opportunities in information and network management in higher education institutions throughout the U.S. and Canada. It is noted that these institutions are excellent recruiting sources for entry-level information system and networking professionals. Finally, Chapter 30 provides tips on sources of information that will help current professionals keep up with changes in information and networking technologies and their related industries.

The book closes with what should be three helpful appendices. The first two provide lists of industry vendors and publications, along with contact information, and the third is a comprehensive glossary of many industry terms and acronyms.

John M. Lusa
Consulting Editor
E-mail: jmlusa@compuserve.com
Section I
The Management Team
INTRODUCTION

The impact of technology has changed the way businesses have operated since the 1950s. Accounting machines (precomputers) revealed the ability for technology to efficiently replace processes that were tedious and time-consuming. As these devices grew in impact across the enterprise, their management became much more complex. The data processing (DP) manager of the 1960s and 1970s was concerned with identifying and conquering new processes with automation. The balance for his decision making was between serving a frenetic demand with a two-pronged talented team of analysts and programmers. The analysts were listeners and communicator who could translate what someone wanted into models programmers could understand. Programmers took this new understanding and created workable systems using a "standard" set of computers.

Today the traditional DP manager, with his "one size fits all approach," has almost become a relic. It is no longer a single technology that needs to
THE MANAGEMENT TEAM

be managed for process efficiency gains, but multiple technologies that
could be critical for business survival or growth. The chief information of-

cier (CIO), or perhaps a team of decentralized information systems (IS) di-

tectors, has replaced the traditional DP manager and, in some cases,

provides a new way for leadership to interact.

Telecommunications networks, data exchange, satellites, microwave,

local area networks (LANs), wide area networks (WANs), switches, fiber

optics, twisted pair, private branch exchanges (PBXs), cellular communi-

cations, transborder information automation, and a variety of telecommunications standards and proposed standards have all been thrown into a

multiplicity of computing environments, creating a mixture that requires

a whole new management orientation.

The new technological management orientation should include ways for

planning, assessing, and deploying technology within and across enter-

prises. CIOs or IS leadership teams need to balance technological capability with enterprise capability to become or to stay a modern organization that has a chance of survival. Survivability means not only staying competitive in existing markets but also learning how to adjust quickly to dynamic markets whose changes are founded in unclear global business opportuni-

ties and processes, as well as technological innovations.

A continuing challenge is to ensure that the technology infrastructure is

in place that services existing and new demands. This is coupled with a

push by leaders at the very top of an organization looking for stable growth, along with the disgust of middle managers at not getting all they

want from an information services organization (due to lack of budget or skill availability).

A power struggle ensues. Computing is pushed down the line until every
department has a computing resource to manage, but little experience in managing it. In such a situation, the CIO or IS leadership team steps in to bring particular rationality to situations that often become irrational (incompatibility of computing devices, networks that do not “talk” to one another, etc.) The power struggle between top leaders, the CIO, and middle business managers has become more than one of budget. It is a struggle about who can make decisions about particular information resources.

ENTERPRISE EFFECTIVENESS

Results of this three-party struggle will contribute to the enterprise’s effec-
tiveness. If any one role constantly wins, they all lose. If top leadership wins the case for controlled stable growth, the next technological paradigm shift will be missed and a competitor will quickly pull ahead (airline reservation systems were not a part of a stable growth strategy by many now defunct airlines). Most incumbents in existing markets miss innovation-based para-
digm shifts, and usually suffer the consequences of losing all or significant pieces of their businesses.

If middle-level business management always wins, there will be a constant changing of direction and technology learning will be stifled (Exhibit 1). Learning will never be able to reach a maturity level, which could spell the difference between enterprisewide effectiveness and point solutions that seldom contribute to the mission. If the CIO always wins, there will be a sophisticated technological infrastructure that no one uses. When one of these positions is weakened by organizational design, private power struggles, or ignorance, then the enterprise becomes less effective and its survival could even be threatened. A balanced power struggle is healthy.

Managing telecommunications within an enterprise is a formidable task. The swirl of technology coupled with the ever-changing business context creates a situation that demands high creativity and sharp intellectual acuity. Along with these characteristics the individual manager is also expected to actually get something done. Being creative and smart is just not enough.

This chapter presents frameworks that should sharpen one's intellectual capability about managing telecommunications; however, more than that, through usage of five case examples, it shows how these frameworks can be creatively applied to actually get something done. The frameworks are provided as a way to understand the parameters of effective technological management (Exhibit 2).
These parameters include technology context (high expectations of impact, and extreme flexibility), technology relevancy, competitive posture, technological learning, and organizational styles. The effective technological manager can quickly assess the "values" these parameters take on and see how they interact to create a unique but understandable technological environment.

CASE EXAMPLES

Not all enterprises are created equal. This is illustrated by briefly describing five institutions. These institutions will be used throughout the chapter to highlight technological and organizational issues.

MasterCard International Inc.

At MasterCard International a group of potential customers are escorted through the machine room and given a presentation on how networks are managed to ensure fast and efficient processing of information. Pride is clearly intoned by the head network administrator as he comments on how often they identify WAN problems of commercial carriers before the carriers themselves know. MasterCard's expertise about networking has grown since the very beginning of its business. The technology used to keep the network functioning in a reliable manner is aging quickly, and there have been various projects to replace the equipment.
Movement around the halls is fast and furious. People are coming and going to various meetings and conferences. The human resources department has just posted jobs for all varieties of IS positions, and a new management team tries to create a portfolio of projects that will keep the enterprise up to date. Some of these projects are large and aggressive. Even though similar projects have failed in the past, there is still a penchant to strive for success in large projects. Large projects have been international in scope due to purchasing-behavioral differences of cardholders between countries. Internet initiatives have become a serious endeavor, but exactly how to handle this new technology is still an open issue.

The customers for MasterCard are primarily banks, while cardholders are customers of the banks. MasterCard International adds value to its customers by supplying various information products, network services, and advertising. It is owned and operated by its customers—a group of banking and other financial card-issuing institutions.

**Smooth Ride Trucking (SMRT)**

SMRT, a small- to medium-sized trucking firm nestled in the heart of mid-America, is run by a former driver. As tours are given to existing and potential customers, oohs and aahs can be heard in the plush balcony that overlooks a gymnasium-sized "war room" located behind a one-way glass window. People, quietly seated behind the glass in the hush of semidarkness, overlook the dispatchers' war room. The war room is a beehive of activity and, with its sophisticated information displays, reminds one of the movie *War Games*. The room contains an impressive array of 15-sq ft video projected images showing summary load distributions, individual truck locations, and weather conditions across North America.

The war room is both a function for dispatchers and a marketing device for potential customers. By building on the tradition of transporting soda bottles without breakage, this enterprise continues to move all sorts of delicate cargo. Specially equipped trailers and attention to driver care for cargo have remained parts of their tradition. SMRT handles delicate loads with routes that primarily go north and south to Canada and Mexico. For the southern routes trailers are usually dropped off just over the border, and drivers from Mexico take the cargo to its final destination. After losing equipment through various pilfering schemes, contracts were negotiated with the Mexican trucking firms on penalties for lost goods (including cargo, trailers, and trailer equipment).

One of the competitive edges the enterprise has is accurate and efficient dispatching. Trucks across the U.S. and parts of Mexico and Canada are constantly monitored to make sure few of them are without loads between destinations. It is not good business to have empty trailers traveling too far.
THE MANAGEMENT TEAM

without a load. Ideally for every load that is dropped off the trailer is re-filled for a new destination. Each dispatcher has earned his stripes behind the wheel. The owner and president, being a former driver, maintains the rule that dispatchers have to know how drivers are thinking to make the drivers' jobs efficient.

Coupled with dispatcher expertise is a set of medium-sized computers that supports war room activities. Drivers are given cellular phones for official and private use. Each truck also has a telecommunications device that provides positioning information to dispatchers. The sophistication that has provided a competitive advantage is now becoming available to small independent trucking enterprises. This company feels compelled to take on the next network or computing challenge to maintain its market position. It hears the competition on its heels.

Big Auto Leasing (BIGAL)

From humble beginnings as a small dealership to one of the largest available fleets in the world, BIGAL competes aggressively on renting, selling, and leasing autos. It is a privately held company that has experienced exponential growth. BIGAL is within the top 10 companies that buy and "move" autos from manufacturing to ownership.

Local offices are opened with assistant managers learning their craft by washing autos—it is often heard on the lots that this is a company where "everyone starts from the bottom." An army of drivers, mostly part-time workers, are constantly moving autos from one location to another—sometimes to fulfill customer demands, sometimes in anticipation of demand (a large convention), and other times to level out the fleet across geographic locations (multiple states could be involved in any of these).

One of the biggest problems the company faces is knowing vehicle location. Each branch office has a significant number of vehicles. Operational decisions need to balance an ever-aging fleet (moving out older models) against individual and dealership customers who may want to buy, rent, or lease. An individual dealership purchase of a fleet of "program" cars from BIGAL is a critical part of this company's business.

BIGAL has one of the largest medium-sized computer environments in the world (housing a multitude of medium-sized computers in one location). Its communication technology is primarily satellite-based microwave. Using this communication capability each office reports its activities during the day to aid decision making about its multitude of vehicles.

Washington University (WU)

While strolling the Washington University campus, gothic architecture and the appearance of students and professors elicit a vision of great
minds at work. WU is a private research and education-based institution of higher learning located in St. Louis, MO. Freshman students make decisions about attending WU vs. other institutions such as Yale, Stanford, Princeton, Cornell, Northwestern, and Carnegie-Mellon. Along with high value comes a high cost. However, each of these institutions has endowments that support scholarships for those whose qualifications add quality to each admitted class. Students are housed in campus dorms and in various individually leased or rented apartments located nearby.

The university includes schools of arts and sciences, engineering and applied science, medicine, business, social work, law, fine arts, and architecture. There is also a first-class library and supporting libraries in most of the schools. Departments of computer science and information management are housed in the engineering school.

The university is operated in a decentralized fashion with each school responsible for its own budget, academic viability, and services. Some services are provided through central administration, including development, physical plant, accounting and finance, human resources, and computing. Each school also has its own small version of the central services, including computing. Schools have their own computing lab environments that may attach to central administration services. Even some departments run their own computer labs. The central administration is also responsible for an electronic network and communications, including one of the first major Internet sites. Dorms and offices are wired for network communications.

The dean of the library holds the CIO position for the university. Administrative systems are very old (most written in the 1970s), and there has been little interest in investing in such systems.

Both full- and part-time students make up the university community. Part-time students take courses in the evening usually taught by adjunct faculty. Distance learning has been discussed, but the strategy is to maintain a classroom environment with classes taught by highly qualified faculty.

Amazon.com

This Internet-based business is one of the most popular examples cited for electronic-commerce. The quick and almost immediate success of Amazon.com has been both exciting to e-commerce entrepreneurs and feared by many traditional businesses. Started just a few years ago, this business provides a specialized link between book purchaser and publisher.

Because Amazon.com is able to establish partnerships with publishers and book warehouses, it is able to offer a tremendous variety of books from a single source, which can be accessed at anytime, and almost from anywhere. While it has no actual storage of books, the ability to present a book
to a potential customer, along with ancillary services such as reviews and titles of similar books, has created a very powerful business. Special services are provided in terms of preference searches, as well as searches by author, topic, and title. Links to other services such as chat rooms are also provided.

Because of its success, and the potential of e-commerce, Amazon.com has become a well-known brand name for bookstores—even though it has no frontal footage in any mall or along any street. It has given "bookstore" a new meaning. One might say its telecommunications environment is its real business, along with adequate computing power to service Internet requests. Amazon.com must also pay attention to traditional front and back office information systems to carry out its business.

Defining Characteristics

Each enterprise possesses a set of defining characteristics, including people, business or market, location, size, structure, culture, and technology. The combination of these characteristics creates a unique enterprise not to be replicated anywhere. It is easy to forget this principle of uniqueness when common measures such as financial performance, market share, and service performance are used for comparison purposes. These comparisons can lead to actions that mimic those taken by another company in an attempt to achieve a similar outcome.

However, what MasterCard does to be successful will not be the same as SMRT, as BIGAL, or as WU. What is common between enterprises is not as great as what is different. Yet, we can speak in generalities about enterprises to understand how to manage them. Technology relevance is one of these generalities.

TECHNOLOGY RELEVANCY AND COMPETITIVE POSTURE

Network managers are expected to provide key insights on telecommunications technology investment for their enterprises. One way to gain insight into telecommunications investment is to consider the current vs. future enterprise relevancy of telecommunications technology. The importance of telecommunications technology varies according to type of industry, how an individual enterprise competes in that industry, and the impact of industry changes. A given level of telecommunications usage may or may not be appropriate for where an enterprise is now. The same can be said about the future. If future events are envisioned that require additional telecommunications capability, then these kinds of projects need to be considered today. Exhibit 3 shows a relevancy grid for telecommunications technology. Determining where one is positioned on this grid may spell the difference between future success or failure.
Industries, in general, may be placed on the relevancy grid. This gives one a place to start when considering an individual company (Exhibit 4).

Because each enterprise has a unique way it competes, blindly assigning an enterprise to a position on the relevancy grid strictly on the grounds of industry type may be unwise. Traditional market competitive analysis says that an enterprise can compete on cost, differentiation, or niche. The combination of industry technology relevancy, competitive posture, and available expertise provides guidance for where a particular enterprise falls on the grid. See Exhibit 5 for where our five case examples fall.

The example cases are completely predictable by industry type according to Exhibit 5. However, with a little more detail on one of the cases we can see how it could change positions. Suppose at WU we decided to initiate distance learning, begin recruiting freshmen through the Internet or...
multimedia, and initiate research consortia through electronic sharing of research results that may include nontext-based medical diagnostic documents. The ability for multiple researchers at multiple locations to share information quickly is assumed to create the synergy to drive the research toward early conclusions and perhaps more funding.

At WU, future telecommunications technology capability will play a key role. Hence, the relevancy moves from support to transitioning. Relevancy should be coupled with a competitive posture to make clearer what, in particular, needs to be planned. Coupling relevance with competitive posture permits us to see what technology may be applicable. For example, if WU is a low-cost provider, then telecommunications technology can be used to increase volume. If WU is competing by differentiation, then one way to apply technology would be to use the Internet to increase the quality of the freshman class (Exhibit 6).

Support relevance suggests there is little need for planning significant changes to the telecommunications infrastructure. Sustaining indicates the current level of investment must continue, and the network manager needs to ensure contributions to the business remain visible so that they may continue. A transitioning enterprise means the network manager will be required to identify projects and gather resources to raise the telecommunications environment to a new plane. For strategic, the current investment needs to remain visible and future investment opportunities need to be identified and planned (Exhibit 7).

The big challenge looming before us in the business world is to be able to choose between learning our businesses as they continually evolve, which implies looking for competitive advantage through technology; or responding to transmutations of business segments, which implies using technology to create and compete in dynamic markets.
Due to globalization of businesses—including production and market implications, and innovative connectivity technologies such as the Internet—markets have become much more dynamic in this decade and will continue to do so well into the next. One of the general goals of many companies has been to strive for competitive advantage using technology. Since markets have become so dynamic, this goal may need to be replaced with one that utilizes technology to create and participate in dynamic markets. To illustrate this point, consider Amazon.com books and Britannica Encyclopedia.

With Amazon.com, what was a very traditional market became much more dynamic with the use of the Internet to sell books. One needs only to access Amazon.com on the Internet at anytime from anywhere, use a provided search mechanism, order a book or books, wait a few days, and it or they arrive at your doorstep. Responses by Barnes and Noble and others are bringing their own new added dimensions to selling books. This has become a changing market.

The ease of customers choosing between companies and products, customers who may visit at any time from almost anywhere, and integrative
services contribute to this new era of dynamic markets. The next three characteristics present demands on those who expect to compete. First, the new ease that customers have to choose among companies means brand identity of the company will become more important and in new ways open cross-selling approaches (e.g., buying music compact discs [CDs] as well as books at Amazon.com). Second, customers visiting at any time from almost anywhere means there has to be a sustainable connectivity and responsiveness capability. Third, integrative services means bringing together in one place responses to direct as well as tangential customer needs and interests (e.g., getting a loan from the same place you purchase an auto).

Britannica did not consider the three demands of customer ease of choice, potential ubiquitous access, and integrated services, which resulted in it getting driven from the market by a lower quality product partnered with a personal computer operating system (i.e., Encarta and Windows). Britannica had brand identity, but it failed to understand the interests of customers to look up information with ease and the ability to integrate that information with other tasks (e.g., using it while writing a term paper). These new demands require a leadership that can think about future possibilities, as well as an appropriate technology infrastructure. Although there are other considerations in analyzing the negative outcome of Britannica, failure to realize the dynamic nature of its market contributed significantly to a disaster from which the company may never recover.

OVERALL TECHNOLOGY IMPACT

Modern planning practices have shifted from reducing everything to the lowest level of control, toward understanding what “containing whole,” or context, the enterprise is a part of. To this end we should consider in which technology sea our enterprise finds itself afloat. Two important context issues are stability and flexibility of the environment, and technological synergistic effects.

Regardless of an enterprise's position on the relevancy grid almost every enterprise will have to deal with telecommunications technology in some form. What we have experienced, and will experience for some time, is the impact of technological component synergy. Technological component synergy occurs when mutually dependent, yet independently developed, technologies come together in a way that creates something new.

The DC 3 aircraft is a prime example for commercial aviation. Independent development of retractable landing gear, flaps, wing structure, and powerful engines, coupled with a desire from the public to travel at faster rates from coast to coast, came together in the DC 3. The importance of component interdependencies was not realized until the idea of commercial air travel became a problem someone thought solvable.
The personal computer was also a result of technological component synergy. The combination of computer on a chip, display devices, electrical printers, word processing, and eventually spreadsheet software, along with an increasing demand in office environments, led to a computing sea change.

Technological component synergy is also driving telecommunications technology. Components that are a part of this synergistic effect are fast switches, installed communication links, standards, communications interfaces (e.g., the Navigator browser from Netscape Communications Corp.), and Internet feeding frenzy by the general public. Few enterprises will be immune from the effects of this new technological component synergy. This means not just understanding where you are now technologically speaking, but where you want to be in the future.

The new imperative of modern enterprises is flexibility within constraints of intense competition. To become a low-cost producer means acquiring that capability usually through repeated trial and error refinements (continuous process improvement, as an example). However, to continue to improve the processes that are in place means to entrench the enterprise farther into what is currently important. Enterprise flexibility requires a focus on the future and could result in changing the way of doing business—the business product or products, the target customers, the suppliers, the workers, the geographic location, etc. To compete by differentiation, flexibility means finding new ways to make product or products different. Flexibility for a niche strategy could mean making or finding a new niche within which to compete.

Constant exploration of what can be done and creative solutions to problems of work force integration, coupled with the wisdom of controlled expansion, characterize modern organizations. The new era of flexibility requires telecommunications technology be managed to achieve the connectivity necessary to compete and remain agile. In fact, the agility of many enterprises is their ability to establish a multiplicity of communications modes, while in others it is a more narrowly focused telecommunications approach.

**TECHNOLOGY LEARNING**

Every significant technology goes through a learning process. If one can decide where he fits on a technology learning curve, then actions can be taken to move to a more mature usage of the technology. The learning curve has four distinct phases (flex points on the curve). Phase I is an initial exposure of the technology to a select group; phase II is expanded usage with contagious effects within and across enterprises. In phase III there is a recognition that the uncontrolled nature of experiences needs to be controlled so standards for usage are put into place, and phase IV is widespread assimilation. How much one pays attention to enterprise learning issues depends on how relevant the technology is to the enterprise.
**Exhibit 8. Learning Curve Attention**

<table>
<thead>
<tr>
<th>Relevancy Position</th>
<th>Learning Phases</th>
<th>Phase I Initiation</th>
<th>Phase II Expansion</th>
<th>Phase III Control</th>
<th>Phase IV Assimilation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategic</td>
<td>Phase I</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Transitioning</td>
<td>Phase II</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Sustaining</td>
<td>Phase III</td>
<td>High</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Supporting</td>
<td>Phase IV</td>
<td>High</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
</tbody>
</table>

Exhibit 8 relates technology relevancy to effort expended within each phase. Phase I needs to be traversed no matter the relevancy position, while high effort for phase IV is suggested for only the strategic relevancy condition.

Exhibit 9 shows how managerial actions differ by what phase of learning an organization is in with respect to telecommunications technology. Management's job will shift as the enterprise becomes more and more aware of how telecommunications technology will affect the organization. There is little doubt that everyone will eventually go through phases I and II. Phases III and IV should be traversed by those who see telecommunications technology as becoming critical for their enterprise.

**Exhibit 9. Managerial Action Examples**

<table>
<thead>
<tr>
<th>Action</th>
<th>Phase I Initiation</th>
<th>Phase II Expansion</th>
<th>Phase III Control</th>
<th>Phase IV Assimilation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Projects</td>
<td>Experimental projects (some fail)</td>
<td>Establish connections with various users</td>
<td>Connected LANs, client/server projects</td>
<td>Interorganizational systems</td>
</tr>
<tr>
<td></td>
<td>For example, provide connections to the Internet Information exploration projects</td>
<td>For example, home pages on the Internet Online catalogs with phone numbers and e-mail responses</td>
<td>For example, implementation of intranets</td>
<td>Integrated supplier and buyer chain</td>
</tr>
<tr>
<td>Key decisions</td>
<td>Initiate a special project team Educate small group Outsource LAN install (learn) Secure WAN connectivity</td>
<td>Hire telecommunications expertise Negotiate WAN capability Install additional LANs</td>
<td>Develop network management function Become a telecommunications-enabled buyer (electronic data interchange [EDI])</td>
<td>Provide a secure telecommunications environment—both physically and logically</td>
</tr>
</tbody>
</table>
ORGANIZATIONAL STYLE

Where telecommunications technology fits in the enterprise depends on the current organizational style and what enterprise contribution telecommunications will have in the future. Organizational style may be characterized as organic or mechanistic. Mechanistic organizations are command- and control-centric, hierarchically run, concerned with production efficiency (both service or product), structured planning and control techniques, and monolithic in how projects are approached (not given to an experimental and research orientation). Organic organizations are loosely controlled, group- or team-oriented, flat chain of command, and concerned with intra- and inter-enterprise boundary spanning.

Mechanistic enterprises are very good at continuous process improvement (usually leading to low cost) because they can enact the standards that come with operational efficiencies. Telecommunications technology can enable mechanistic organizations to behave in flexible ways, contributing to long-term survival. Cross-functional networked teams can reach into the heart of an enterprise and provide a new view of what could be done and is being done. Such teams have been used to initiate new businesses, to attack immediate problems, as well as to seek out new ways in which a business can reintegrate itself internally among divisions, departments, and staff; as well as externally with markets, customers, and other institutions. This is using telecommunications to enable an organic overlay on a mechanistic organization to keep it competitive.

Changes are incremental by nature within mechanistic enterprises; hence, planning is a critical issue. Plans should be of two varieties: one dealing with infrastructure and the other, with penetration of the effect of telecommunications on the enterprise’s products and services. (This is a telecommunications relevancy issue as discussed earlier.) Managing telecommunications in such an environment means providing “official” mechanisms by which telecommunications capabilities are installed, maintained, and supported. For the network manager, it means trying to stay ahead of the demand curve both in volume and sophistication.

This may be done with official surveys (not terribly popular with participants), help facilities (resource laden), sponsorship of events depicting the next wave of telecommunications capability during which individuals discover a viable usage for the technology, or initiating projects that may seem risky due to complexity of the technology involved.

Projects that use sophisticated technology do not lend themselves to planning, but they may be a necessary organic overlay to sustain a competitive posture. Organic overlays for the mechanistic structure of MasterCard are critical moves to keep its telecommunications technology
relevant. The company overlays include running large projects with fairly loose controls.

Organic organizations, due to their nature, often need to provide a "control overlay" so technology can mature beyond phase II of learning. Organic organizations, while flat, usually have a residual hierarchy that serves to integrate teams or groups; and provide a communication mechanism for top leadership, owners, or board of directors. Teams or groups are enabled by a participant from the team or group representing them, to the residual hierarchy. A committee made up of these representatives, when required to meet regularly, can function as a mechanistic overlay to the organic organization. One of the functions of this committee is to provide a control point for technological decisions.

For network managers, this committee is critical. Otherwise, each team or group may enact its own standards and technology infrastructure sometimes serving to disintegrate activities that, through telecommunications technology, could be integrated for the good of the enterprise. The issue is not to remake an organic organization into a mechanistic one, but to engage the enterprise in control activities that mature telecommunications to phase IV. Phases III and IV are critical for organizations whose telecommunications technology is transitioning the technology or is of strategic relevance.

WU requires a committee, appointed by deans of its respective schools, to make sure there is telecommunications compatibility that reaches within the schools. While students have majors in each school and departments within schools all support particular programs, the push for across school eclectic experiences by students is very real. Also, departments are sharing intellectual resources to conduct research and secure research funding. For the organic WU enterprise this committee provides a mechanistic overlay that reinforces the mission of education and research.

For an enterprise such as BIGAL that is experiencing phenomenal growth, the organizational style is moving from organic to mechanistic. To survive, a more mechanistic structure is needed to control the vast numbers of people and resources. Telecommunications projects are critical because information needs to be consolidated and used for effective decision making. Telecommunications decision making, as well as other decision making, becomes more centralized in keeping with the move toward a more mechanistic structure. Hence, planning for telecommunications has been a part of the core planning process for the business.

SUMMARY

The parameters of technology context (expected impact and flexibility), technology relevance, competitive posture, technological learning, and or-
The Corporate Information and Communications Hierarchy

Organizational styles each have "values" they take on. For instance, one could be managing telecommunications technology with a transitioning relevancy, in a differentiation posture, in a flexible and high technological impact context, at an expansion phase (phase II) of learning, and within a mechanistic organization. Given these values, one manages differently in terms of planning and control, kinds of projects initiated, and how much relative attention to spend in a particular phase of learning.

There are over 300 possible "solutions spaces" given these parameters and their respective values. One cannot learn them all (and some parameters are undoubtedly missing), but one can develop the agility to manage according to what the possibilities are. It will take high creativity and sharp intellectual acuity, along with the energy to actually get something done (Exhibit 10).

The new reality for technological managers involves flexibility while remaining competitive. This calls for a flexible style of organization, led either directly, or indirectly through overlays, by a powerful technological management. The new breed of technology managers should be able to think abstractly through such frameworks as presented in this chapter and others. The new breed of technology managers can participate to effect a balance between technology, its application, and resources within an enterprise. Also, they ought to understand implications for various technologies, take up the slack for novice management of other computing resources, be advocates for particular technological solutions, and gener-
THE MANAGEMENT TEAM

ally be held accountable for how technology affects the enterprise. The DP manager of yesterday has been and is being replaced with multitalented executives who step out and lead their enterprises technologically.
Managing Applications on the Network

Grygo, Eugene M. End the Application (Then Manage It), Client/Server Computing, December 1996.

Tools to Manage Network Elements


Enterprise Network Monitoring and Analysis


Dealing with Carriers

Ibid.

The Art and Science of Project Management

Kerzner, Harold. Project Management, Van Nostrand Reinhold, 1998. (This is the expensive ($60) encyclopedia of project management.)
Reddy, Brendan, Intervention Skills, Pfeiffer & Company, San Diego, CA, 1994. (This book is an excellent introduction to ideas about group process.)
Weinberg, Gerald, Becoming a Technical Leader, Dorset House Publishing, New York, 1986. (This is a wonderfully written, enjoyable, and applicable book.)