

Linking LANs

A Micro Manager's Guide

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Stan Schatt

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Introduction

I wrote this book for anyone who needs to understand how different networks can be linked together. In a very short time, an entirely new industry has developed with its own language—terms like *brouters*, *source routing*, *enterprise networking*, and *management network protocols*. Companies are beginning to look at their enormous investments in mainframe and LAN hardware and software and demanding that someone (perhaps you) come up with some answers on how these incompatible resources can be made to communicate effectively with each other. As if that were not a large enough assignment, corporate computing resources often include remote sites as well as LANs that use different network operating systems.

The first section of this book shows the hardware and software required for a local area network. I examine the different types of file servers and network interface cards now available as well as specific features to look for when selecting a network workstation. You also look at a number of operating systems including DOS, OS/2, and Unix as well as network operating systems including NetWare and LAN Manager. Finally, I show you the client-server model that is bound to play an increasingly important role in network design and system integration.

This book's second section focuses on network protocols, the software that must be understood in order to link together different networks. I discuss the OSI model, TCP/IP, and the problems associated with migrating from TCP/IP to OSI model protocols. In order to understand the problems associated with bridging and routing LANs, I show specific protocols associated with Ethernet and Token Bus as well as Token Ring and FDDI. I also examine the suite of protocols associated with AppleTalk and Arcnet.

This book's third section concentrates on internetwork operability by examining bridges, routers, and routers. You will see how the incompatible routing schemes used by Ethernet and Token Ring can be reconciled as well as how a new class of routers can solve problems that plague many large companies.

The book's fourth section provides a global perspective on linking together networks. It looks at the specific requirements for a metropolitan area network (MAN), how T-1 lines can be used as part of a wide area network (WAN), and how networks can be linked to packet switched networks (X.25).

It is becoming increasingly necessary for a network manager or systems integrator to understand telecommunications as well as data communications. I show the Integrated Services Digital Network (ISDN), which promises to integrate voice and data transmission over the public telephone network. You will see how gateways and LANs can be linked to host computers. This chapter will examine AppleTalk links to both IBM and DEC computers in addition to different methods of linking Token Ring networks to these computers.

Chapter 12 examines some key systems integration issues that are critical when networks are to be linked together. This section also covers the movement toward an international standard for electronic mail (X.400) and a global directory (X.500).

One area of growing importance is network management. I give you the different approaches taken by IBM, AT&T, and DEC, as well as the current battle of network management protocols between Simple Network Management Protocol (SNMP) and Common Information Network Management (CIMP). One of these protocols will probably play an important part in your network sometime in the future.

I have included an annotated list of books that belong on the shelf of the network manager as well as a discussion of seminars available on "cutting edge" topics such as network management and bridges, routers, and gateways. I have also included an extensive glossary that defines all the key terms that appear in the text.

I sincerely hope this book helps you understand the bewildering world of enterprise networking and the problems associated with integrating different network components. This book assumes no prior knowledge of networking or specific LANs. No book can answer all the questions you probably have about the very fast changing field, but I hope this book will help you formulate the questions you need to ask and the answers you need to find in order to solve your company's enterprise networking problems.

Contents

Introduction xvii

Chapter 1. LAN hardware basics 1

Introduction 1

Centralized and distributed processing 2

The microcomputer revolution 2

The network workstation 3

The workstation architecture 3

Micro Channel architecture 3

EISA architecture 4

Random access memory 4

Some RAM management techniques 5

The microprocessor 6

Video adapter cards 7

Why purchase a specialized LAN workstation 7

The network interface card 9

The disk server 9

The file server 10

Disk drive technology jargon 13

The optical disk as a file server 14

Network media 15

Twisted pair 15

A proprietary twisted pair approach 16

Disadvantages of twisted pair 18

Coaxial cable 19

Optic-fiber cable 21

Structured vs. unstructured cabling 22

LAN topologies	22
The star	22
The bus topology	24
Ring topology	24
Summary	26

Chapter 2. LAN software basics 27

Introduction	27
The role of an operating system	28
The MS-DOS operating system	29
MS-DOS and IBM's NetBIOS	30
MS-DOS and the Redirector program	32
The limitations of MS-DOS on a local area network	33
The release of Microsoft's OS/2	33
Major OS/2 features	35
Real and protected mode	35
Virtual memory	35
OS/2 version 2.0	36
Presentation Manager	36
The Session Manager	37
The major components of OS/2	38
Processes	38
Threads	38
The kernel	38
Device drivers	38
Interprocess communications under OS/2	39
Shared memory	40
Semaphores	40
Pipes	40
Named Pipes	40
Queues	41
Named mailslots	41
OS/2 2.0	42
Network operating systems	42
Microsoft's MS-Net and Novell NetWare	42
LAN Manager	42
Client-server applications under OS/2	44
Advantages of client-servers	46
Client servers using OS/2	47
Client-servers and the future	47
Novell NetWare	48
NetWare and OS/2	50
Novell's vision of the future	50
UNIX and local area networks	52
LAN Manager/X	52
AT&T's StarGroup illustrates UNIX power	53
Summary	53

Chapter 3. Unlocking network protocol mysteries 55

Introduction 55

The importance of protocols 56

A basic data communications model 57

Protocols in a data communications model 58

Moving toward standards 58

How standards are created 58

The Open Systems Interconnect model 58

Layered protocols 59

The rationale for the OSI model 59

A layer in the OSI model 60

Primitives 63

The Application layer of the OSI model 61

Presentation layer 63

Session layer 63

Transport layer 64

Network layer 65

Data Link layer 67

The IEEE and network standards 68

The IEEE 802 committee 68

802.1 and 802.2 standards 68

The 802 high-level interface for LANs 69

The 802.2 Logical Link Control
and Medium Access Control sublayers 69

The Physical layer 71

The Physical layer in LANs 71

The Government OSI Profile (GOSIP) 72

NetBIOS networks and OSI 74

OS/2 and the model OSI 74

IBM's OS/2 Extended Edition and OSI 75

TCP/IP as today's internet protocol standard 75

Network services under TCP/IP 76

Transmission Control Protocol (TCP) 77

User Datagram Protocol (UDP) 79

The Internet Protocol (IP) 79

The aging champion TCP/IP vs. the challenger OSI 80

Strategies for moving toward OSI 81

The gateway approach 81

The dual protocol stacks approach 81

Xerox Network System (XNS) suite of protocols 82

A look at XNS in action 84

3Com's Demand Protocol Architecture (DPA) 85

Summary 99

Chapter 4. Ethernet and the token bus 89

Ethernet 89

Carrier Sense Multiple Access with Collision Detection (CSMA/CD) 90

The 802.3 and Ethernet frame format differences	91
802.3 as an evolving standard	92
A closer look at an Ethernet network	92
A bus by any other name...	94
10BaseT	95
Ethernet on optic-fiber cable	96
Using optic-fiber backbones to link Ethernet networks	96
Ethernet on broadband coaxial cable	98
An example of broadband Ethernet	98
Why use Ethernet or 802.3	99
The IEEE 802.4 token bus	100
Description	100
The 802.4 frame	101
Some advantages of a Token Bus network	102
Protocols to manage the factory and office	103
MAP and TOP in action	105
The 1988 Enterprise Event	
and the freezing of MAP/TOP standards	105
MAP and TOP in the future	106
Summary	107

Chapter 5. Token Ring network and FDDI 109

Introduction	109
The IEEE 802.5 Token Ring description	110
The Open Token Foundation and 802.5 interoperability	110
The use of a token on 802.5 networks	111
Basic components of a Token Ring network	112
Network Interface Cards (NICs)	112
Cabling and multistation access units	114
MAUs and repeaters	115
The 802.5 frame	116
The token on an 802.5 network	117
The role of the Active Monitor	118
Error checking or "Someone To Watch Over Me"	119
Common problems on Token Ring networks	120
IBM's 16 Mbs Token Ring Network	121
The importance of fiber optics with 16 Mbs Token Ring	121
A Token Ring network in action	122
Fiber Distributed Data Interface (FDDI)	122
The basic components of an FDDI network	126
The FDDI frame	127
Using multiple tokens on an FDDI network	128
Integrating FDDI networks with existing LANs	128
XTP and FDDI	130
FDDI-II might be better than Rambo II	130
An example of FDDI in action	130
Summary	131

Chapter 6. The nonstandard Apple networks and Arcnet standards 133

- Introduction 134
- The Macintosh environment 134
- The building blocks of AppleTalk networks 135
 - The Macintosh workstation 135
 - LocalTalk 135
 - Cabling 135
 - PhoneNet 136
 - CSMA/CA 137
- LocalTalk's Link Access Protocol (LLAP) 137
 - How workstations transmit using LLAP 138
- AppleTalk 138
 - Phase 1 139
 - Phase 2 140
- AppleTalk protocols and the OSI model 141
 - Presentation layer 141
 - Session layer 141
 - Transport layer 142
 - Network layer 142
 - Data Link layer 143
 - Physical layer 143
- AppleShare 144
- Other major Macintosh network options 144
 - Transcendental Operating System (TOPS) 145
 - 3Com's 3+ Macintosh network software 145
 - NetWare for the Macintosh 148
 - A corporate AppleTalk network in action 148
- Arcnet LANs 150
 - Why Arcnet is popular 150
 - Topology 151
 - Arcnet's access method 152
 - The Arcnet packet 152
 - Arcnet Plus at 20 Mbs 153
- Summary 154

Chapter 7. Local bridges 155

- Introduction 155
- The internet or enterprise network 156
- What a local LAN bridge is 156
- Why use bridges 157
- Intelligent bridges 159
- The Spanning Tree bridge 160
- Source Routing bridges 161
 - How a workstation gathers Source Routing information 163
 - The Source Routing bridge in operation 164

NetWare and Source Routing	164
Current ways of linking Ethernet and Token Ring networks	164
Source Routing Transparent bridges	166
A guide to selecting bridges	166
Packet filtering and forwarding rates	166
Filtering on the basis of packet length	167
"Learning" bridges	167
Link ports	168
The ability to filter broadcast and multicast packets	168
Load balancing	168
Bridge management and statistical software	168
Summary	169

Chapter 8. Local routers and routers 171

Introduction	171
What a router is	172
Local and remote routers	173
Static routers	173
Dynamic routers	173
Routers create "fire walls"	174
Easier management of a large internet	174
Point-to-Point Protocol (PPP)	
for multivendor router communications	175
Open Shortest Path First (OSPF)	175
Routing features to consider	176
Number/type of local and wide area network interfaces	176
Network management protocols supported	177
Router performance	177
Protocols supported	177
Security	178
Bridges vs. routers	178
Brouters	179
How a brouter uses its routing tables	180
Summary	181

Chapter 9. Wide area networks 183

Introduction	183
What a metropolitan area network (MAN) is	184
What wide area networks (WANs) are	185
The effect of divestiture on WANs	186
Digital signal transmission	186
Why T-1 circuits are popular	188
T-1 frames	189
The standard D-4 Super Frame	189
The Extended Super Frame	190
Time division multiplexing	191
Remote bridges and the WAN	191

Digital access and cross-connect systems (DACS)	193
Selecting a T-1 multiplexer	193
Fractional T-1	195
A WAN using fractional T-1	196
T-3 multiplexers	197
The 802.1G committee's remote bridge standards for WANs	198
Packet switched (X.25) networks	198
The X.25 standard	199
Packet switched network vendors and services	200
Choosing a public packet switched network vendor	200
Throughput	200
Protocols supported	201
Maximum speeds supported	201
Error correcting	201
Network management	201
Private packet switched networks	201
Hybrid networks	202
X.25 packet switching vs. T-1 multiplexing	202
Creating a WAN by bridging LANs via X.25	204
Using X.25 gateways and satellite transmission to link LANs	204
Fast packet technology	206
Frame relay technology	207
Cell relay technology	207
The Synchronous Optical Network (SONET)	208
Summary	209

Chapter 10. ISDN 211

Introduction	211
What ISDN is	212
The Basic Rate Interface (BRI)	212
The Primary Rate Interface (PRI)	212
ISDN equipment	213
Network interfaces	213
An example of ISDN in action	213
Signaling System 7	215
ISDN and the OSI model	215
Integrated voice and data under ISDN	216
ISDN in action at McDonald's	217
Broadband ISDN	218
Who needs ISDN	219
Summary	219

Chapter 11. Gateways to the mainframe world 221

Introduction	221
The IBM mainframe world	222

The level of a gateway's functionality can vary	223
How gateways link hosts and LANs	224
Local DFT coaxial gateway	225
The Token Ring Interface Coupler (TIC) gateway	226
Remote LAN gateway	226
X.25 gateways	226
Gateways linking together LANs	226
Systems Network Architecture (SNA)	227
Network Addressable Units (NAUs)	228
Logical Units (LUs)	229
Physical Units (PUs)	229
System Service Control Points (SSCPs)	229
SNA's layered architecture	230
Systems Application Architecture (SAA)	232
NetWare 386 and mainframe connectivity	232
A checklist for IBM mainframe gateways	233
Number of simultaneous terminal sessions on a PC	233
Terminals supported	233
File transfer capabilities	234
Protocols supported	234
Support of programming interfaces	234
Dedicated and pooled LUs	235
Gateway management	235
LAN features supported	235
Remote speeds supported	236
3Com's Maxess SNA Gateway as an example	236
Apple gateways	236
Apple gateways to IBM mainframes via PC LANs	237
Direct AppleTalk gateways to IBM mainframes	237
AppleTalk gateways to IBM AS/400 minicomputers	238
MacAPPC	238
Linking Macs to the VAX world	239
Summary	239

Chapter 12. Major systems integration issues 241

Introduction	241
Incorporating faxes in an enterprise network	242
Some points to consider about fax gateways	242
LAN fax features worth considering	243
Using FaxPress on a NetWare LAN	243
New standards to improve fax transmission	244
Some problems associated with network fax gateways	244
Managing electronic mail on enterprise networks	244
Simple Mail Transfer Protocol (SMTP)	246
The X.400 standard	246
The LAN X.400 gateway server	248
Enterprise-wide E-mail by linking gateways	248
The X.500 directory	250

How X.500 works	250
3Com's directory services moving toward X.500	251
Novell's Name Service	252
The battle over network management protocols	252
Simple Network Management Protocol (SNMP)	252
SNMP running under NetWare	253
Common Management Information Protocol (CMIP)	254
Common management over TCP/IP (CMOT)	254
IBM and heterogeneous LAN management with OSI protocols	255
Network management systems	255
What a network management system is	255
IBM's NetView	256
NetView and the LAN Manager 2.0	257
IBM's SystemView	257
AT&T's network management	258
DEC's DECnet	261
DECnet Phase V	262
DEC's approach to enterprise network management	262
Summary	264

Appendix. Seminars on LANs, internetworking, and enterprise networks 267

Glossary 271

Bibliography 285

Index 289

1

CHAPTER

LAN hardware basics

In this chapter, you will explore the role of

- Local area network workstations.
- Network interface cards.
- File servers.
- Media.
- Network architecture.

Introduction

A *local area network* (LAN) is a group of computers that share hardware and software resources at the same physical location. This chapter examines a LAN's hardware building blocks. I describe the types of LAN workstations, the role of a disk server or file server, and the key functions performed by the network interface cards. Because LANs can be designed a variety of different ways to perform a wide range of different functions, you will explore some of the criteria network designers use when selecting the appropriate cabling or media as well as the network's architecture or topology.

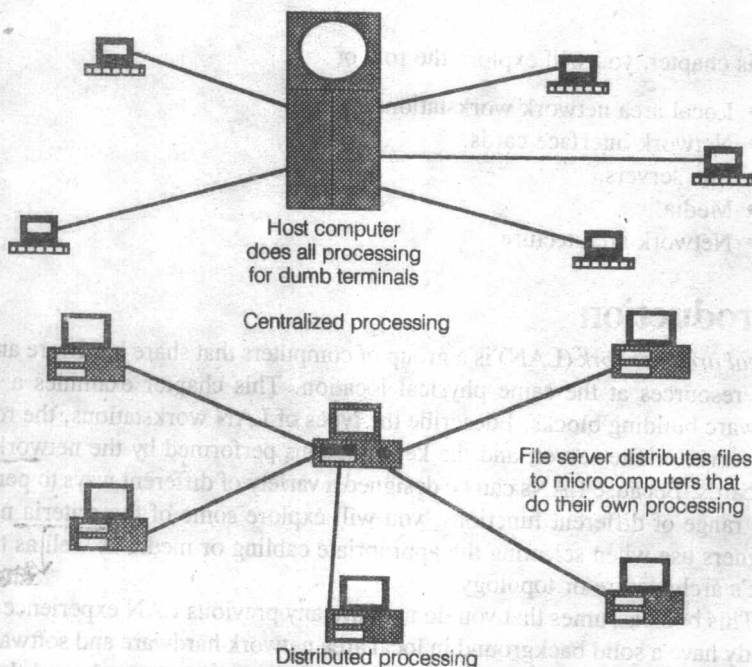
This book assumes that you do not have any previous LAN experience. If you already have a solid background in local area network hardware and software, you might want to skip ahead to chapter 3, which discusses protocols and the Open Systems Interconnect model for linking different computer networks.

Centralized and distributed processing

The first and second generations of computers developed during the 1950s and 1960s illustrate the principle of centralized processing. Mainframe computers and minicomputers used their powerful *central processing units* or *CPUs* to process all the work required by users connected by terminals. The number of users accessing the host computer has a direct correlation to the response time, so that more users resulted in slower computer response time. 终端

The microcomputer revolution

The development of microcomputers in the 1970s and 1980s meant that processing could be distributed rather than centralized. It is true that local area networks permit users to share the cost of expensive resources such as laser printers. Equally important, though, is that a distributed processing environment can be inherently more efficient. Figure 1-1 illustrates the key difference between centralized and distributed processing. Each workstation is a microcomputer with its own processing power so that users need not wait for a host computer to share some of its valuable processing time. A LAN is often faster than a minicomputer with the same number of terminals because the processing workload is distributed among several workstations.



1-1 Distributed processing and centralized processing.

With powerful new software such as LAN Manager version 2.0 and NetWare 386 and powerful new hardware such as Intel 80486 based file servers, local area networks are beginning to approach mainframe-like performance.

The network workstation

Network workstations, also sometimes referred to as network ^{终端} nodes, provide each network user with a display, a keyboard, and a microprocessor capable of running network programs. Today some diskless workstations utilize a computer chip known as an autoboot ROM to load programs directly from the network's file server into its own random access memory (RAM), meaning that it holds information as long as the computer is turned on. The lack of disk drives makes these nodes more secure because users cannot download network files to a floppy disk. Learning some of the terminology about workstation features will help you distinguish one workstation from another.

One of the problems a systems integrator faces is that with so many potential network workstations on the market it is necessary to establish a product matrix and do some careful comparisons and contrasts. In addition to raw processing speed, the type of workstation architecture and RAM can be very significant.

The workstation architecture

One major limitation of the original IBM PC was that while it contained a microprocessor capable of handling 16 bits at one time (a 16-bit word), it only utilized an 8-bit data bus, a data highway for moving the information from CPU to RAM or external devices. Perhaps an example will clarify this problem. Assume that during rush hour a Tokyo subway station utilizes sixteen turnstiles. In effect the station is processing sixteen people at a time. These sixteen people move to the train, which will carry them to their ultimate destinations. Unfortunately, though, these trains have only eight doors. A bottleneck probably will occur during rush hour as people have to wait their turns to enter through one of the eight doors.

The very same process occurred with the original IBM PC. The Intel 8088 microprocessor handled 16 bits of information while the data bus that was responsible for taking this information to the appropriate RAM or external location could not keep up with the flow of information from the microprocessor.

Network workstations also have an address bus and a control bus. The address bus serves as a highway of sorts through which travels the address (location in memory) of the next instruction to be executed or the next piece of data to be accessed. The control bus consists of a highway used for all timing and controlling function sent from the control unit to other parts of the computer system.

Micro Channel architecture

IBM's upper-range of PS/2 microcomputers feature a Micro Channel Architecture (MCA), an intelligent bus or data highway capable of handling high-speed traffic.