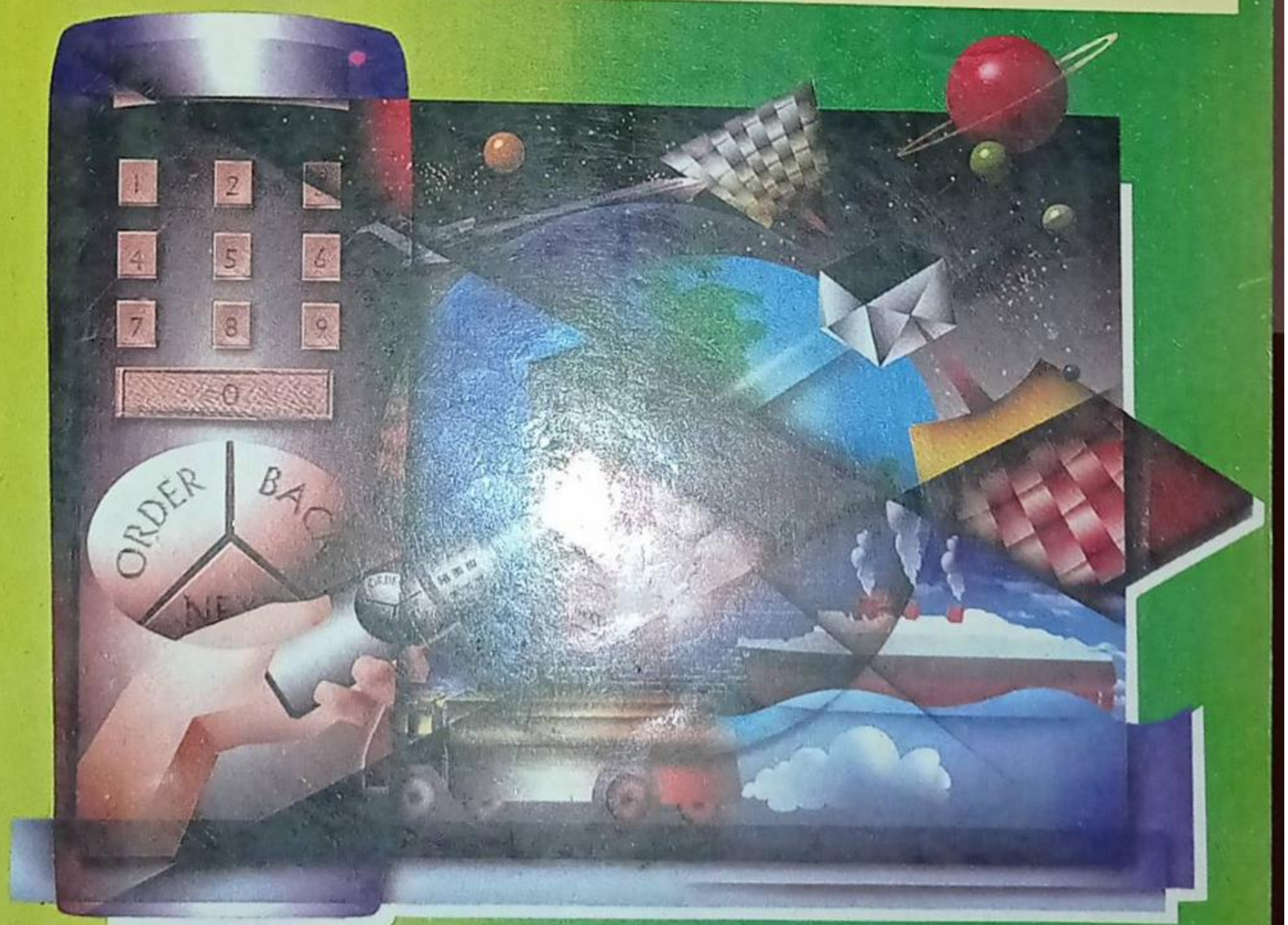
LOCAL AREA NETWORKS

5th Revised Enlarged And Updated Edition

▸ For New Network Users ▸ Find Out If You Need a Network ▸ How LANs Can Benefit Your Organisation ▸ Build Your LANs Knowledge - Basics and Advanced ▸ Wireless LANs ▸ Basics of LAN Hardware and Software ▸ Data Communications Concepts ▸ Topologies and Transmission Media ▸ Protocols, Architecture and Standards ▸ Evaluation, Selection, Planning, Installation and Management of LANs ▸ Packet Switch Stream (PSS) ▸ Mainframe Connection and Internetworking ▸ Client/Server, LAN Databases ▸ Novell NetWare, Ethernet, DECnet, SNA, TCP/IP, FTP, SMTP., NFS ▸ Applications of LAN, E-MAIL, EDI, X.25, ISDN, WANs ▸ Future Trends in LANs ▸ IPv6 ▸ Netware (IPX/SPX) ▸ DNA ▸ Appletalk ▸ SNA ▸ ATM ▸ Firewall ▸ User Datagram Protocol (UDP) ▸ ProNet Token Ring Technology ▸ Ethernet Technology ▸ Hubs, Bridges, Gateways ▸ Telnet, NetBIOS, and BOOTP ▸ Finger, Whois, Gopher, Veronica, Archie ▸ Wais & Ping ▸ World Wide Web ▸ X Window, RPC & XDR ▸ Port Mapper & Mount Protocol



S.K. BASANDRA
S.JAISWAL

GALGOTIA

Scanned by TapScanner

CONTENTS

PARTICULARS		PAGE NO.
PREFACE		*ix*
ILLUSTRATIONS		*xxxiii*
CHAPTER 1.	Local Area Networks	1
CHAPTER 2.	Data Communications	38
CHAPTER 3.	Topologies and Transmission Media	77
CHAPTER 4.	Protocols	119
CHAPTER 5.	Network Architecture and Standards	134
CHAPTER 6.	Cost Benefit Analysis of a LAN	162
CHAPTER 7.	Evaluating and Selecting a LAN	183
CHAPTER 8.	Evaluation and Selection of Software Packages	218
CHAPTER 9.	Planning and Installing a LAN	236
CHAPTER 10.	Utilising a LAN	265
CHAPTER 11.	Mainframe Connection	287
CHAPTER 12.	Network Security	311
CHAPTER 13.	Client/Server Computing	389
CHAPTER 14.	LAN Databases	344
CHAPTER 15.	An Overview of Novell Network	355
CHAPTER 16.	Ethernet	362
CHAPTER 17.	Digital Network Architecture	382
CHAPTER 18.	Systems Network Architecture	392
CHAPTER 19.	Transmission Control Protocol/Internet Protocol	402
CHAPTER 20.	Internetworking and Connectivity	417
CHAPTER 21.	Network Management	444
CHAPTER 22.	Office Automation	467
CHAPTER 23.	Electronic Mail	490
CHAPTER 24.	Electronic Data Interchange	501

Scanned by TapScanner

CHAPTER 25.	X.25 Overview	517
CHAPTER 26.	Integrated Services Digital Network	542
CHAPTER 27.	Wide Area Networks	556
CHAPTER 28.	Future Trends in Local Area Networks	574
CHAPTER 29.	Wireless LANs	587-1
CHAPTER 30.	Wireless LAN Media Components : AIR	587-19
CHAPTER 31.	Wireless LAN Operations & Connections	587-28
APPENDIX A	Questions and Answers on LANs	580
APPENDIX B	Selecting Personal Computers	616
APPENDIX C	Computer Viruses	638
APPENDIX D	Encoding Schemes	650
APPENDIX E	Standards Organisations	652
APPENDIX F	ISO OSI Standards Documents	654
APPENDIX G	Abbreviations and Acronyms	656
APPENDIX H	Glossary	667
APPENDIX I	List of Computer Journals	686
APPENDIX J	References	689
	Readers Comments Form	691

Scanned by TapScanner

DETAILED CONTENTS

Particulars	Page No.
ILLUSTRATIONS	
PREFACE	
CHAPTER 1. Local Area Networks	
Introduction	**1**
Defining the Issues	1
The Importance of Networking	2
Types of Networks	3
Private Networks	6
Value Added Networks	6
Local Area Networks	6
Switched Networks	7
What is a Local Area Network?	7
Features of Local Area Networks	8
Resource Sharing	11
Productivity	12
Communications	13
Management	13
Network Topologies	14
Bus Networks	16
Star Networks	17
Ring Networks	17
Hybrid Networks	18
Communication Techniques within Networks	18
LAN Components	19
Workstation	20
File Server	21
Gateway	23
Network Interface Unit	24
Active Hub	25
Passive Hub	29
LAN Cable	29
Networking Operating System	29
Sharing Data	29
File and Record Locking	30
Disk Space Allocation	31
Sharing the Printer	32
Applications Software	34
Comparison of Minicomputer with LAN	35
	36

Scanned by TapScanner

CHAPTER 2. Data Communications

Introduction
Data Communications
Data Communication System
Data Communication Software
Data Communication Concepts
- Common Ground: The ASCII Standard
- Units of Measure
- Communication Rate
- Digital and Analog Communication
- Parallel and Serial Communication
- Synchronous and Asynchronous Communication
- Protocols and Buffers
- Detecting Errors
- Simplex, Half-Duplex, and Full-Duplex Communication
- Multiplexing

Communication Hardware
- Communication Adapter
- Accoustic Couplers and Modems

Communication Procedures
- Communication Between Two Microcomputers
- Communication Between a Microcomputer and a Larger Computer
- Front-End Processors
- Going On-Line
- File Transfer
- Choosing Parameters
- Logging Off

Communication Processing
- Packets

Communication Channels
- Wired Transmission
  - Telephone Lines
    - Leased Lines
    - Switched Lines
  - Coaxial Cables
  - Optical Fibre Transmission
- Microwave Transmission
- Infrared Transmission
- Laser Transmission
- Radio Transmission
- Satellite Transmission

Applications of Data Communication

Scanned by TapScanner

	Using External Databases	75
	Sharing Data Files	75
	Electronic Mail	76
	Bulletin Board Systems	76
CHAPTER 3.	**Topologies and Transmission Media**	**77**
	Introduction	77
	LAN Topologies	79
	Topology Evaluation Factors	79
	Star or Radial Topology	80
	Advantages of the Star	82
	Disadvantages of the Star	83
	Star Evaluation Factors	83
	Bus Topology	84
	Advantages of the Bus	85
	Disadvantages of the Bus	85
	Bus Evaluation Factors	86
	Ring Topology	86
	Advantages of the Ring	87
	Disadvantages of the Ring	88
	Ring Evaluation Factors	88
	Hybrid Topologies	89
	Tree Topology	89
	Advantages of the Tree	91
	Disadvantages of the Tree	91
	Star-Ring Topology	91
	Advantages of the Star-Ring	91
	Disadvantages of the Star-Ring	93
	Choosing a Topology	93
	Transmission Media	93
	Media Evaluation Factors	94
	Twisted Pair Wire	97
	Components of a Twisted Pair Network	97
	Twisted Pair Evaluation Factors	98
	Baseband Coaxial Cable	99
	Components of a Baseband Coaxial Network	99
	Baseband Coaxial Evaluation Factors	100
	Broadband Coaxial Cable	100
	Components of a Broadband Coaxial Network	101
	Broadband Coaxial Evaluation Factors	103
	Fibre Optic Cable	104
	Components of a Fibre Optic Network	106
	Fibre Optic Evaluation Factors	107

Scanned by TapScanner

Relationship Between Medium and Topology 10
Communication Swithing Techniques 11
Circuit Switching 11
Message Switching 11
Packet Switching 11

CHAPTER 4. Protocols 11
Introduction 11
LAN Protocols 12
Protocol Evaluation Factors 12
Contention 12
Contention Evaluation Factors 12
Carrier Sense Multiple Access 12
Carrier Sense Multiple Access with Collision Detection 12
Carrier Sense Multiple Access with Collision Avoidance 12
Polling 12
Polling Evaluation Factors 13
Token Passing 13
Token Passing Evaluation Factors 13

CHAPTER 5. Network Architecture and Standards 13
Introduction 13
What is Network Architecture? 13
Standards 13
The Open Systems Interconnection Model 13
OSI Layers 13
Layer 1: Physical 14
Layer 2: Data Link 14
Layer 3: Network 14
Layer 4: Transport 14
Layer 5: Session 14
Layer 6: Presentation 14
Layer 7: Application 14
Operation of the OSI Model in a Network 14
IEEE 802 Project 14
802.1 - Higher Layer Interface Standard 14
802.2 - Logical Link Control Standard 14
802.3 - CSMA/CD Bus 14
802.4 - Token Passing Bus 14
802.5 - Token Passing Ring 14
New Committees 14
802 Reference Model 14
Ethernet 15
Ethernet Specification 15

Scanned by TapScanner

	Arcnet	154
	IBM PC Network	157
	IBM Token Ring	159
	Summary	161
CHAPTER 6.	**Cost Benefit Analysis of a LAN**	**162**
	Introduction	162
	Uses of a Network	163
	Cost Benefit Analysis	165
	The Costs	165
	Hardware and Software	166
	Personnel Costs	167
	Benefits of a Network	168
	Figuring Value	169
	Alternate Systems	171
	Sharing Hardware	172
	Sharing Information	173
	Network Application Software	175
	Connections to Other Networks	176
	Centralized Control and Distributed Computing	176
	Should You Wait to Buy a LAN?	177
	Size of Investment	177
	Standards	177
	Prices	178
	Software	179
	LANs and Multiuser Systems	179
	Conclusions	181
CHAPTER 7.	**Evaluating and Selecting a LAN**	**183**
	Introduction	183
	General	183
	Applications	184
	Existing Software	185
	New Software	185
	LAN Evaluation	185
	The Physical Site	187
	Network Functions	188
	Workstations	188
	Evaluating NICs	189
	Evaluating Servers	190
	Evaluating Operating Systems	194
	Connections	195
	Estimating Hardware Performance	201
	Standards	203

Scanned by TapScanner

Software 203
Hardware 204
Mainframe Connections 205
Gateways 205
Direct Connection 206
Message and File Transfer 206
Terminal Emulation 207
Data Extraction 207
Remote Job Entry 207
Program-to-Program Communication 207
Security 208
Hardware Compatibilty 208
What do you want from a LAN? 208
Specifying a LAN 210
Matching LANs to Users 211
Purchasing a LAN 215
LAN Acquisition Strategies 216

CHAPTER 8. Evaluation and Selection of Software Packages **218**
Introduction 218
Trends in Software Evolution 218
Systems Software 219
High Level Languages 219
Application Software 220
The Need for Softare 220
Software Packages 220
Software Packages and In-House Software 222
Software Package 223
In-House Developed Software 223
Software Development Costs 223
Software Package Costs 225
Software Quality 226
Assessing a Package 226
When to Select a Package 227
Areas of Concern for Management 230
Advantages and Disadvantages of Acquiring a Software Package 231
Advantages 231
Disadvantages 232
Software Vendor Checklist 233
Conclusion 234

CHAPTER 9. Planning and Installing a LAN **236**
Introduction 236
Planning the Installation 238

Scanned by TapScanner

Software Planning 239
Applications Software 242
Systems Software 247
Hardware Planning 251
Workstation Planning 251
Server Planning 253
Connection Planning 256
Doing the Installation 257
Hardware and Software Installation 258
Diagnosing Problems 258
Training Network Users 259
Managing the Networks 259
Common Problems in Physical Installation 260
Cabling 260
Operating Software 262
Expandability 262
Standardization 263

CHAPTER 10. Utilising a LAN 265
Introduction 265
Motivation 265
Advantages of LANs 266
Properties of Centralized Systems 268
Problems with LANs 268
Sharing 269
Spectrum of LAN Usage 269
Software Issues 271
Copy Protection 272
Disk Access 273
Printing 274
Shared Servers 278
Using Applications 278
Word Processing 279
Spreadsheets 279
Database Management System 279
Accounting Systems 280
Graphics Software 280
Electronic Mail 281
Electronic Calender 282
Multiuser Shared Databases 283
Backup Strategies 284
Software Licensing 285
Single User Licenses 285
Multiuser Licenses 285

Scanned by TapScanner

Site Licenses
Examples of LAN Usage

CHAPTER 11. Mainframe Connection
Introduction
What is a Mainframe?
Why Talk to Mainframe?
Brief History of IBM Data Communications
Office Software Protocols
Terminal Emulation
How to Evaluate an Emulator?
The Emulator on the Network
Mainframe Gateways: Alternatives to Terminal Emulation
PCs as Mainframe Workstations
Back-up On the PC
Reliability of Mainframe Connection
Connecting Mainframe to LANs
Mainframe Products for the Token Ring
System/370 Hardware for the Token Ring
System/370 Software for the Token Ring
System/36 Hardware for the Token Ring
System/36 Software for the Token Ring
Series/1 Hardware for the Token Ring
Mainframe Products for the PC Network
System/370 Hardware for the PC Network
System/370 Software for the PC Network
Series/1 Hardware for the PC Network
Series/1 Software for the PC Network
Future of Mainframe and LAN Communications
Potential Roadblocks to Peer-to-Peer Communications

CHAPTER 12. Network Security
Introduction
What Network Security Means?
Risk Analysis
Types of Threats
Passive Threats
Active Threats
Determining What Secure Means to You and Your LAN
Securing Workstations and Servers
Securing Network Passwords
Securing Files and Programs

Scanned by TapScanner

	Levels of Security	320
	Physical Security	321
	Access Controls	321
	Personnel Identification	324
	Passwords	324
	Securityin log-in	325
	Encryption	325
	Encryption Keys	326
	Conventional Encryption	327
	The data Encryption standard	328
	Commercial Communications security Endoresement programme	329
	Key Distribution	329
	Public Key Encryption	331
	On Line Coders	333
	The Diskless PC	334
	Protection Against Cable Radiation	334
	Call Back Security	335
	Management Level Concerns	336
	Securityin TCP/IP Networks	338
	Firewall-Friendly FTP	338-1
	Recommendation	338-2
	Security Considerations	338-2
	Circuit Gateways	338-3
	Conclusions	338-3
CHAPTER 13.	**Client/Server Computing**	**339**
	Introduction	339
	File Servers	340
	Central-File-Server Systems	341
	Peer-To-Peer LANs	341
	Print Servers	341
	Database Servers	342
	Facsimile Servers	342
	Batch-Processing Servers	342
	Communications Servers	342
	Which Services Go Where?	343
CHAPTER 14.	**LAN Databases**	**344**
	What To Look For In A LAN Database?	344
	What is a Database Management System?	345
	What are You Using the DBMS For?	346
	Database Service and Server-based Applications	348
	SQL DBMS Servers	352

Scanned by TapScanner

Novell Netware SQL 352
Gupta SQLBase 352
Fox Software FoxServer 353
Ashton-Tate/Microsoft SQL Server 353
Oracle 354

CHAPTER 15. An Overview of Novell Network 355
Components 355
Software 356
Working Copies 356
Software Options 356
File Servers 357
Computer Type 358
Hard Drives 358
File Server RAM 358
UPS 359
Workstations 359
Computer Types 359
Hard Drives 359
Workstation RAM 359
Network Interface Cards 360
Type of Cabling 360
Speed of Transmission 360
Method of Collision Control 360
Network Distance 361
Buffer Size 361
Data Base Size 361
Overall Speed 361

CHAPTER 16. Ethernet 362
Introduction 362
Evolution 363
Features of Ethernet 365
Medium Access Control Frame Formats 365
Components of Ethernet 368
Method of Operation 371
Ethernet IC Chips 373
Applications of Ethernet 373
System Limitations 373
Segment Configurations 373
10Base5 Extensions 374
Modification of Ethernet 376
Improving Ethernet for Manufacturing 378
Automation 378

Scanned by TapScanner

Ethernet for Data and Voice 378
Thin Wire CSMA/CD 379
Broadband CSMA/CD 380
Twisted Pair CSMA/CD 381
Conclusion 381

CHAPTER 17. Digital Network Architecture 382
Introduction 382
Historical Development 382
Phase I 384
Phase II 384
Phase III 385
Phase IV 386
Phase V 386
How Does DECnet Work? 387
DECnet Vs. SNA 391

CHAPTER 18. Systems Network Architecture 392
Introduction 392
Evolution 392
SNA Vs. DECnet 393
Network Space 394
SNA Layers 397
Physical Control Layer 397
Data Link Control Layer 398
Path Control Layer 398
Transmission Control Layer 398
Data Flow Control Layer 399
Presentation Services Layer 399
Transaction Services Layer 399
Network Topologies 399
SNA Directions 400
Summary 401

CHAPTER 19. Transmission Control Protocol/Internet Protocol 402
Introduction 402
Origin of TCP/IP 403
TCP/IP Communications Architecture 404
TCP/IP The complete suite 408
Upper Layer Protocols 409
Lower Layer Protocols 409
TCP/IP Protocol Set Structure 409
Internet Protocol 411
User Datagram Protocol 412

Scanned by TapScanner

Transmission Control Protocol 41
Ethernet Technology 41
ProNET Token Ring Technology 416-
Internet Architecture 416-
TCP/IP Network Planning 416-1
Size and Growth Rate 416-1
Existing Standards 416-1
Traffic Flows and Capacity 416-1
Partition the Network 416-1
Using Bridges 416-1
Bridges Filtering Rate 416-1
Limited Horizon 416-1
Broadcasts, Broadcast Storms and Multi-Cast Frames 416-1
Bridging to a Backbone 416-1
Hub Bridges 416-1
Identifying a Network connection 416-1
Planning the IP Address scheme 416-1
Internet Protocol 416-1
IP Addressing 416-1
MAC Addresses 416-1
Characteristics of the IP Address 416-1
Network Numbers and Host Numbers 416-2
Distinguishing the class address 416-2
IAB and Network Number Registration 416-2
Configuring the IP Address 416-2
Reserved IP Addresses 416-2
IP Addresses with routers and dialog devices 416-2
How TCP/IP works 416-2
What TCP was Built To Do 416-2
From One Socket to Another 416-2
TCP Sequencing 416-2
TCP Needs Not an IP 416-2
What in an IP 416-2
Gateways and IP 416-2
TCP/IP Applications 416-3
Telnet Protocol 416-3
Telnet Commands 416-3
Telnet Negotiation 416-3
Telnet Security 416-3
Rlogin Protocol 416-3
File Transfer Protocol 416-3
Data Representation 416-3
FTP Service Commands 416-4
FTP Replies 416-4

Scanned by TapScanner

Connection-Management	416-42
Trivial File Transfer Protocol	416-45
Bootstrap Protocol : BOOTP	416-47
Simple Mail Transfer Protocol : SMTP	416-49
SMTP Commands	416-51
SMTP Replies	416-52
SMTP Size Limitations	416-54
Relay Agents	416-55
E-Mail Pieces: Envelopes, Headers and Body	416-55
NetBIOS	416-56
Name Formate	416-57
General Format of Name Service Packets	416-59
Header	416-59
Question Section	416-62
Resource Reocrd (RR)	416-63
Finger Protocol	416-65
Whois Protocol	416-66
Gopher	416-67
Veronica	416-67
Archie	416-67
WAIS: Wide Area Information Servers	416-67
Ping	416-68
WWW: World Wide Web	416-68
X Window System	416-68
The X terminal	416-70
The X Window System	416-71
The Network File System	416-71
NFS Architecture	416-72
Remote Procedure Call (RPC)	416-74
eXternal Data Representation(XDR)	416-78
Port Mapper	416-79
Mount Protocol	416-79
Internet Protocol Version 6 : IPV6	416-80
Changes in IPV6	416-80
The IP Datagram	416-81
IP Extension Headers	416-84
Header Order	416-85
Hop-by-Hop Options	416-86
Routing Header	416-88
Fragment Header	416-88
Authentication Header	416-88
Destination Options	416-88
IP Security	416-88
Security Association	416-89

Scanned by TapScanner

Authentication 416-
Confidentiality 416-
The Future of TCP/IP 416-
FutureGrowth and Technology 416-
Future of Internet Architecture 416-
New Applications 416-
Uses of the Technology 416-
Challenges for the Future 416-
Other Protocol Stacks 416-
NetWare (IPX/SPX) 416-
Digital Network Architecture (DNA) 416-
DNA Protocol Summary 416-
AppleTalk 416-
Systems Network Architecture (SNA) 416-
Physical Units 416-
Logical Units 416-
Control Points 416-
ATM 416-
Topics and Methods of ATM 416-
Summary 416-

CHAPTER 20. Internetworking and Connectivity

LAN-to-LAN Connections
Repeaters
Bridges
Transparent Bridges
Source Routing Bridges
Routers
NetWare Routers
Bridge/Router Hybrids (Brouters)
Remote Bridges and Routers
Synchronous and Asynchronous Communication
Remote Communication Links
Remote Bridge and Router Performance
NetWare Asynchronous Remote Router
Microtest LANMODEM and Shiva Netmodem/E
NetWare Link/Newport LAN2LAN Routers
Novell's Packet Burst Technology
Asynchronous Communication Servers
Dial-Out Services (Modem Pooling)
Remote Login and Remote Access Services
LAN-to-Host Gateways and Communications Services
SNA and 3270
TCP/IP

Scanned by TapScanner

	Network Design	443
	Basic Models of Ethernet	443-1
	Addition of a Print Server	443-1
	Addition to the Network	443-2
	Polling Multiple Labs	443-5
	Expanding an Ethernet Segment Length	443-6
	Limitations of Coaxial Network	443-8
	An Improved Model for Single-Room Networks	443-8
	Preparation of Room	443-9
	Single-Floor Network Model	443-10
	Single-Floor Design Considerations	443-11
	Multiple-Floor Network Model	443-12
	Multiple-floor Equipment Design Issues	443-13
	Multiple-floor Physical Design Considerations	443-13
	Physical and Equipment Design	443-14
	Token Ring Networks	443-15
	Bridged Networks	443-17
	Bridging Ethernet Networks	443-18
	Bridging Networks to Extend Distances	443-19
	Router Applications	443-19
	Long Distance Communications Through Routers	443-23
	Comparision Between Routers and Bridges	443-24
	Intelligent Hubs	443-25
	Structure Networking	443-25
	Centralized Network Management	443-28
	Vertical and Horizontal Network Design	443-29
	Reconfiguring the Network Physically and Logically	443-29
	Segmenting the Network According to Work Patterns	443-29
	Redundancy	443-29
	High-speed Network Implementation	443-29
	Implementing Structured Networking Gradually	443-31
	Other Connectivity Options	443-32
CHAPTER 21.	**Network Management**	**444**
	Introduction	444
	Network Management Functions	445
	Elements of Network Management	447
	Test, Monitor and Control Equipment for Aiding Network Management	448
	Standards in Network Management	449
	Network Owners and Users	450
	Distribution of Management	450
	Control Mechanisms	454
	Management Modules	454

Scanned by TapScanner

Centralised Vs. Decentralised Management
Symmetrical Session Management
Permanent Sessions
Session Failure
The Network Operators
Network Operator Commands
Maintenance
Security
Other Administrative Functions
SNMP: Simple Network Management Protocol
The Internet Naming Hierarchy
Management Information Base
system Group
interface Group
address translation (at) Group
ip Group
icmp Group
tcp Group
udp Group
Structure of Management Information(SMI)
Simple Network Management Protocol (SNMP)
SNMPv1 and SNMPv2
Summary

CHAPTER 22. Office Automation
Introduction
Office Activities
Old and New Systems Perspective
Office System Elements
Common Office System Functions
Building an Automated Office
Equipment Needed
Strategies for Designing an Automated Office
Benefits
Communication Infrastructure to Support OA Actvities
Local Area Networking
A PABX Controlled Network
Optimum Approach for Next Five or Ten Years
Conclusion

CHAPTER 23. Electronic Mail
Introduction
What is Electronic Mail?
Uses for E-mail

Scanned by TapScanner

	Advantages	495
	Drawbacks	496
	Charges	497
	Using Electronic Mail	497
	Sending Messages	499
	Private E-mail	499
	International E-mail	499
	Summary	500
CHAPTER 24.	**Electronic Data Interchange**	**501**
	Introduction	501
	What is EDI?	502
	Why Use EDI?	504
	Advantages of EDI over a Paper-Based Document Transfer System	504
	How EDI Works?	505
	EDI Standards	508
	Variable-Length EDI Standards	509
	Motivation	510
	Cost Benefit Analysis of EDI	511
	EDI Strategy for Competitive Advantage	511
	Digital's Approach to EDI Implementation	513
	Beyond EDI: Electronic Trading Networks	514
CHAPTER 25.	**X.25 OVERVIEW**	**517**
	Introduction	517
	Permanent Virtual Circuits	520
	Access to the Network	520
	The PAD Interface	520
	Layers of Communication	523
	Layer 1: Physical Control	524
	Layer 2: Link Control	524
	Layer 3: Network Control	524
	Packet Format	525
	Local Channel Numbers	526
	Initiating a Virtual Call	527
	Priority	528
	The Flow of Packets	530
	Disconnecting a Virtual Call	530
	Data Transfer	531
	Sequence Numbers	533
	Interrupt Packets	534
	Reset	535
	Restart	536

Scanned by TapScanner

State Diagrams
Optional Facilities

CHAPTER 26. Integrated Services Digital Network
Introduction
Today's Telecommunications Networks
The Way to ISDN
Evolution of ISDN
Some Facts about ISDN
Other Considerations Relating to ISDN
Network Transitions
Multifunctional Terminals
Division of Functions Between Terminal and Network
ISDN for Wideband Communication
Telemetry and Remote Control
The ISDN Standards and Protocols
The ISDN Implementation
ISDN Chips
Standardization is Deciding

CHAPTER 27. Wide Area Networks
Introduction
Private Networks
Public Networks
Circuit-Switching and Packet-Switching
Packet-Switching Networks
Fast-Connect Circuit-Switching Networks
DTE's and DCE's
Connections Between Networks
Eight Types of Tariffs
Need of Packet Switching and X.25
Packet Switchstream (PSS) Service
Customer's Equipment
Permission to Connect
Access Facilities
Packets and Calls
Addressing
Interconnection of Public and Private Data Network.
Features of Public Packet Switched Network
Role of PSS
Benefits of PSS
Value Added Networks
Standards and Capability

Scanned by TapScanner

537 Common Principles 568
540 WAN Applications 568
542 Design Considerations 570
542 **CHAPTER 28. Future Trends in Local Area Networks 574**
543 Introduction 574
543 Compatibility 574
545 Standards and the High-Cost, Low-Cost Split 575
546 Future Open Systems Standards 576
547 Functional Standards 577
547 Manufacturing Automation Protocol 577
549 Technical and Office Protocol 579
Future Hardware 581
FDDI - a Future Fibre LAN 582
Integrated Services Digital Networks 584
549 Falling Costs and Chip Sets 585
549 Network-to-Network Connections 586
550 General 586
550 **CHAPTER 29 Wireless LANs 587-1**
553 Introduction 587-1
553 Need of Wireless LANs 587-2
555 Components of Wireless LANs 587-3
Equipments Levels 587-4
556 Mobile Equipments 587-5
556 Wireless Receiving Devices 587-6
556 Laptop or Notebook computers 587-6
557 Personal digital Assistants (PDAs) 587-7
558 Wireless resource Interfacing 587-8
558 Transceivers 587-8
561 Coupling Wireless LANs 587-8
562 Wireless LANs vs Wired LANs 587-9
563 Advantages of Wireless LANs 587-11
564 Disadvantages of Wireless LANs 587-13
4-1 Distance and Speed limitations 587-14
4-1 Costs and Benefits of Wireless
4-2 Uses of Wireless LAN Applic
4-2 Health Care
4-2 Educational System
4-2 Temporary Setup
4-3 General Services
4-4 Future Evolution of Wireless
4-6
4-6 **CHAPTER 30 Wireless LAN Media Comp**
4-7 Introduction
565
566

Scanned by TapScanner

Radio Wave LANs 587.
Frequency Hopping 587.
Direct Sequence Coding 587.
Directional and Omnidirectional Antennes 587.
Infrared LANs 587.
Microwave LANs 587.
587.

CHAPTER 31 Wireless LAN Operations an Connections 587.
One-to-one Operations 587.
One-to-many Operations 587.
Many-to-many Operations 587.
Planning of Wireless LAN 587.
Setup of Wireless LAN 587.
Installation of Wireless LAN 587.
Wireless-to-wire Connections 587.
Remote Access 587.
Resource Manager 587.
Bridging and Routing 587.
Central Servers 587.
Locations 587.
Loads 587.
Control 587.
LANE To LAN Operations 587.
Recognition 587.
Acceptance 587.
Speed matching 587.
Packet Conversion 587.
Flows 587.
Errors 587.
Losses and reconstitution 587.
LANE-To-LAN Couplings 587.
Cross Couplings 587.
Wireless-to-wireless to wired LANs 587
Multiple couplings 587
Protocol conversions 587
Security 587
Global Interconnecting 587
LAN-LAN Hopping 587
Interlining 587
Integration 587
Local to global 587
Mixing of technologies 587
Long-distance wireless LAN Technologies 587
Cellular connections 587

Scanned by TapScanner

Personal communication services	587-44
Low Earth Orbiting Satellites (LEOS)	587-46
Medium Earth Orbit Satellite (MEOS)	587-48
VSAT satellites	587-48

APPENDIX A Questions and Answers on LANs **588**

APPENDIX B Selecting Personal Computers **616**

APPENDIX C Computer Viruses **638**

APPENDIX D Encoding Schemes **650**

APPENDIX E Standards Organisations **652**

APPENDIX F ISO OSI Standards Documents **654**

APPENDIX G Abbreviations and Acronyms **656**

APPENDIX H Glossary **667**

APPENDIX I List of Computer Journals **686**

APPENDIX J References **689**

Readers Comments Form **691**

Scanned by TapScanner