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Tested, Refined and Proven Content

Combining three textbooks formatted into a standard 7" x 9" softcover textbook with high-quality paper, a laminated cover and professional binding, 400 pages, over 177 diagrams and a full index, the Telecom 101 volume has three parts:

- Fundamentals of Telecommunications,
- Understanding Data Communications and
- Understanding IP and Networking,

with the same content as the three course workbooks for our three-day core training Course 101, "Telecom, Datacom and Networking for Non-Engineers", plus additional bonus sections.

This content, tuned and refined over the course of fifteen years, has been taught to thousands of people needing to build a solid, structured understanding of telecom, datacom and networking.

A high percentage of seminar attendees specifically praise the course materials on seminar evaluations – materials now available in softcover textbook format in Telecom 101.

An Invaluable Reference

The material covers telecom, datacom and networking from A-Z, organized in logical chapters covering all major topics, and written in our signature "telecom for non-engineers" style. It will be an invaluable day-to-day handbook, either on its own, or to complement instructor and DVD video training.

- As a companion to instructor-led training, Telecom 101 allows you to study before attending Course 101 or fill in gaps before attending one of our advanced courses.
- After DVD video or instructor-led training, it will serve as an invaluable day-to-day reference.
- On its own, Telecom 101 is used by many as an economical and convenient way to self-study... these are the materials to an instructor-led course that costs \$995 to attend.

Recently, a US Army communications specialist deployed to Iraq called it a "lifesaver" when contacting to us to order his own copy after the owner of the one he was borrowing demanded it back!

Up To Date

The third edition, published 2008, is completely revised and updated, with complete coverage of telecom, datacom, IP and networking fundamentals plus up-to-date information on VoIP, MPLS, IP, DSL, the latest wireless technologies and more.

Value Pricing

If sold separately, the price for these three books would be:

- Fundamentals of Telecommunications: \$118, plus
- Understanding Data Communications: \$118, plus
- Understanding IP and Networking: \$118

for a total of US\$354 for all three books if purchased separately.

Now, you can get all three books bound in one volume called Telecom 101 for the low price of US\$179. Plus, you get the electronic version of the first edition, a \$49 value, free! Compare this to hunting down and paying hundreds of dollars for multiple books by different authors that may or may not cover what you need to know - in plain English - and you'll agree this is a very attractive deal.

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Bonus!



Free electronic version allows instant reference on Windows computers. See order form for details.

At A Glance

Written by our top instructor, Eric C. Coll, M.Eng., P.Eng, Telecom 101 contain 25 years of knowledge and learning distilled and organized into an invaluable study guide and practical day-to-day reference for non-engineers.

Chapter list for Telecom 101:

PART 1: FUNDAMENTALS OF TELECOMMUNICATIONS

- Introduction
- Fundamentals of Telephony
- Telecom Equipment
- The Telecommunications Industry
- Digital Communications
- Transmission Systems
- T1
- Wireless Communications
- Voice Services and Jargon

PART 2: UNDERSTANDING DATA COMMUNICATIONS

- Introduction to Data Communications and Networking
- How Data is Formatted for Transmission
- Modems
- Broadband Modems
- Understanding LANs

PART 3: UNDERSTANDING IP AND NETWORKING

- Understanding Protocol Stacks
- IP Addressing
- Private Networks Using Routers and Dedicated Lines
- Bandwidth On Demand
- IP Network Services
- Understanding the Internet
- Wrapping Up

Ideal for anyone needing an authoritative, up-to-date reference covering all major topics in telecommunications, data communications, IP and networking... *in plain English*. A wealth of clear, concise, organized knowledge, impossible to find in one place anywhere else!

To Order

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Detailed Outline

Looking through this outline, you'll see that many of the chapters are actually self-contained references on subject areas such as telephony, T1, LANs, WANs and many more. Instead of having to purchase multiple books from different authors to explain each of these topics, you get them all, bound in a single volume, in a consistent style and quality, for one low price.

Order today to obtain this invaluable reference!

PART 1: FUNDAMENTALS OF TELECOMMUNICATIONS

The first part covers the Public Switched Telephone Network, equipment and call centers, the telecom business, carriers, digital voice transmission, T1, fiber and SONET backbones, how digital circuits and services are provided, muxes vs. switches vs. routers and wireless ... the groundwork for understanding everything.

1 INTRODUCTION

Chapter 1 is an introduction. We discuss the approach taken in organizing the topics, and suggestions for how to use the material. This chapter contains an initial framework for understanding telecom circuits and services, and introductory terminology, jargon and buzzwords.

- 1.1 Our Approach
- 1.2 How the Text is Organized
- 1.3 How to Use This Text
- 1.4 The Three Answers
 - 1.4.1 Answer Number 1: Money
 - 1.4.2 Answer Number 2: History
 - 1.4.3 Answer Number 3: It's All Pretty Much the Same Thing
- 1.5 Telecommunications Services from the User's Point of View
 - 1.5.1 Access Circuits
 - 1.5.2 Network Connection
 - 1.5.3 Billing Plan
- 1.6 The Network "Cloud"
- 1.7 Telecom Circuits from the Phone Company's Point of View
 - 1.7.1 Access Network
 - 1.7.2 Switching Centers
 - 1.7.3 Transmission Network
- 1.8 What's Next

2 FUNDAMENTALS OF TELEPHONY

Whether you're interested in telecom, datacom, wireless, Wide Area Networking or Voice over IP, everything begins with the Public Switched Telephone Network and Plain Ordinary Telephone Service. We'll begin with a model for the PSTN, explaining analog circuits and circuit switching, as well as common telephony buzzwords and jargon, and an overview of SS7.

- 2.1 History of Telecommunications
 - 2.1.1 Invention of the Telephone
 - 2.1.2 Local Phone Companies
 - 2.1.3 The Bell System
 - 2.1.4 The Rest of the World
- 2.2 PSTN: Public Switched Telephone Network
 - 2.2.1 Basic Model of the PSTN
 - 2.2.2 Loops
 - 2.2.3 Remotes
 - 2.2.4 Trunks and Circuit Switching

- 2.3 Analog Signals and Analog Circuits
- 2.4 Capacity Restrictions on the Loop
 - 2.4.1 What is Speech?
 - 2.4.2 The Voiceband
 - 2.4.3 Bandwidth
- 2.5 Problems with Analog Transmission
 - 2.5.1 Attenuation and Amplifiers
 - 2.5.2 Noise
- 2.6 Plain Ordinary Telephone Service
 - 2.6.1 Twisted Pair
 - 2.6.2 Components of a Telephone
 - 2.6.3 Supervision
 - 2.6.4 Call Progress Tones
- 2.7 Network Addresses: Telephone Numbers
 - 2.7.1 Area Codes
 - 2.7.2 Pulse Signaling
 - 2.7.3 DTMF Address Signaling
- 2.8 SS7: Signaling System 7
 - 2.8.1 Advanced Intelligent Network (AIN)
 - 2.8.2 AIN Services
- 2.9 Summary

3 TELECOM EQUIPMENT

We'll round out our discussion of telephony with a practical overview of different types of equipment that can be connected to the telephone network. Without bogging down on details, we'll sort out switches, PBXs, ACDs, IVRs, Call Centers and modems, including a discussion of DSL and how it is provided.

- 3.1 Telephone Switches
 - 3.1.1 PBXs
 - 3.1.2 Centrex
- 3.2 Computer-Telephony Integration
 - 3.2.1 Voice Mail
 - 3.2.2 IVR: Interactive Voice Response System
 - 3.2.3 ACD: Automated Call Distributor
 - 3.2.4 Inbound Call Centers
- 3.3 Modems and DSLAMs
 - 3.3.1 Voiceband Modems
 - 3.3.2 Bits per Hertz?
 - 3.3.3 DSL: "Digital Subscriber Lines"
 - 3.3.4 DSL Equipment

4 THE TELECOMMUNICATIONS INDUSTRY

A practical overview of the telecommunications industry: service providers and alliances, competitive forces, structure and regulation; resellers, IXCs, LECs and CLECs.

- 4.1 US Domestic Telcos
 - 4.1.1 LECs and LATAs: Local Exchange Carriers
 - 4.1.2 IXCs: Inter-Exchange Carriers
 - 4.1.3 Resellers
 - 4.1.4 Consolidation
- 4.2 Canadian Telephone Companies
- 4.3 Trunks and Switching Centers

- 4.4 Network Access for Long-Distance
 - 4.4.1 POP: Point of Presence
 - 4.4.2 Equal Access
- 4.5 CLECs: Competitive Local Exchange Carriers
 - 4.5.1 DSL from CLECs
 - 4.5.2 Voice over DSL

5 DIGITAL COMMUNICATIONS

This chapter will give you a real understanding of what "digital" means, and how it is implemented. We'll explain what a "DS0" is, and take a practical tour of digital circuits, including T1, T3, SONET and ISDN. At a high level, we'll see how voice, data and video can be integrated.

- 5.1 Why Digital?
 - 5.1.1 Multiplexing
 - 5.1.2 Noise Performance
 - 5.1.3 Storage and Processing
 - 5.1.4 Integration and Convergence
- 5.2 Analog and Digital: What do we really mean?
 - 5.2.1 Analog
 - 5.2.2 Bandwidth: Analog Circuits
 - 5.2.3 Digital
 - 5.2.4 Bandwidth: Digital Circuits
- 5.3 Continuous vs. Discrete Signals
 - 5.3.1 Continuous and Analog
 - 5.3.2 Discrete and Digital
- 5.4 Voice Digitization (Analog-Digital Conversion)
 - 5.4.1 Quantization
 - 5.4.2 Sampling
 - 5.4.3 Coding
 - 5.4.4 End to End: Analog-Digital-Analog
 - 5.4.5 Quantization Errors
- 5.5 DS0: Voice Digitization on the PSTN
 - 5.5.1 Quantization: 256 Levels
 - 5.5.2 Sampling: 8,000 Samples per Second
 - 5.5.3 Coding: 8 Bits Per Sample
 - 5.5.4 The DS0 Rate
- 5.6 The Digital Hierarchy: Standard Line Speeds
 - 5.6.1 DS1
 - 5.6.2 DS3
 - 5.6.3 STM
- 5.7 Technologies: Digital Carrier Systems
 - 5.7.1 T1
 - 5.7.2 T3: "Asynchronous" DS3 Multiplexing
 - 5.7.3 SONET: Synchronous DS3 Multiplexing
 - 5.7.4 SDH
 - 5.7.5 T1 vs. DS1 and T3 vs. DS3
- 5.8 ISDN
 - 5.8.1 ISDN Basic Rate Interface (BRI)
 - 5.8.2 ISDN Primary Rate Interface (PRI)
 - 5.8.3 PBX Trunks on T1 vs. ISDN PRI
- 5.9 Using Digital Circuits: Applications
 - 5.9.1 Voice on Digital Circuits

5.9.2 Voice Compression

5.9.3 Data Applications

5.9.4 Digital Video

5.10 Summary: Integration: Voice, Video, Data

6 TRANSMISSION SYSTEMS

Time Division Multiplexing (TDM) and digital carrier systems are the technologies at the heart of telecommunications networks. We'll provide you with a basic understanding of how transmission systems work, both over copper wires and over fiber, and an overview of SONET and optical networking. We'll explain the "network cloud": how circuits are actually provided by carriers, the difference between multiplexers, switches and routers and what services these are used for.

6.1 Time Division Multiplexing

6.1.1 Channelized or "Synchronous" TDM

6.1.2 "Statistical" TDM or "Bandwidth on Demand"

6.2 Channelized TDM: Channels and Framing

6.2.1 Subrate Multiplexing

6.3 Anatomy of a Service

6.3.1 Access Circuits

6.3.2 Network Connection

6.3.3 Billing Plan

6.4 Common Carriers' Transmission Networks

6.4.1 The Network "Cloud"

6.4.2 Fiber Optics

6.4.3 Representing Bits on Fiber

6.4.4 Fiber and Fiber Cable Construction

6.4.5 Redundancy and Protection: Rings

6.4.6 Dark Fiber

6.5 SONET: "Backbone" Transmission Networks

6.5.1 SONET and the Optical Carrier

6.5.2 SONET Rings

6.5.3 DWDM: Dense Wave Division Multiplexing

6.5.4 Next: Fiber Access

6.6 How Circuits are Actually Provided

6.6.1 Inside the Cloud: Core and Edge

6.7 Network Equipment

6.7.1 Multiplexers

6.7.2 Switches

6.7.3 Routers

6.8 Summary

7 T1

This chapter covers T1 technology and application in detail. We'll cover T1's origins, concepts such as framing and AMI line codes, and understand what repeaters are for and why this is superior to analog. We'll also cover B8ZS and clear channels, HDSL, cross-connects, fractional T1 and CSU/DSUs.

7.1 T1 History and Current Applications

7.2 Basic T1 Circuit Components

7.3 T1 Framing

7.3.1 Superframe Format

7.3.2 ESF

7.4 Pulses and Line Code: AMI

7.4.1 Repeater

7.5 Synchronization: Bit-Robbing

- 7.5.1 56 kb/s for Data
- 7.6 B8ZS and 64 kb/s Clear Channels
- 7.7 How T1 Is Provided
 - 7.7.1 HDSL
- 7.8 Fractional T1 and Cross-Connects
- 7.9 Subrate Data Circuits 1.2 kb/s to 56 kb/s
 - 7.9.1 CSUs, DSUs and CSU/DSUs

8 WIRELESS COMMUNICATIONS

We'll round out your knowledge of telecom fundamentals with wireless. We'll cover jargon and buzzwords in the mobility business, the idea of cellular, and sort out different cellular technologies, understand CDMA vs. TDMA/GSM and 3G 1x vs. UMTS and 1XEV-DO vs. HSPA. We'll conclude with an overview of satellite communications, Wi-Fi and WiMAX.

- 8.1 Radio Transmission
- 8.2 Mobile Networks
- 8.3 AMPS: Analog Cellular
- 8.4 PCS: Personal Communication Services
- 8.5 Digital Cellular: Voice Communications
- 8.6 Sharing the Radio Bands
 - 8.6.1 AMPS
 - 8.6.2 TDMA, GSM and GPRS
 - 8.6.3 CDMA
- 8.7 3G
- 8.8 Satellite-Based Services
 - 8.8.1 Geosynchronous Satellites
 - 8.8.2 Low Earth Orbit
- 8.9 Wireless LANs
 - 8.9.1 IEEE 802.11 Standards
- 8.10 802.16 WiMAX

9 VOICE SERVICES AND JARGON

This chapter provides a summary and overview of voice communication services from carriers, and explains jargon like VPNs, WATS and AIN.

- 9.1 Local Voice Services
 - 9.1.1 POTS and Party Lines
 - 9.1.2 CLASS Services
 - 9.1.3 Local Measured Service
 - 9.1.4 Public Coin Telephone Service
 - 9.1.5 Directory Services
 - 9.1.6 Business Services
 - 9.1.7 Access
- 9.2 Long Distance Voice Services
 - 9.2.1 Operator Services
 - 9.2.2 Foreign Exchange
 - 9.2.3 OPX: Off-Premise Extension
 - 9.2.4 Tie Line
 - 9.2.5 Private Networks
 - 9.2.6 WATS
 - 9.2.7 AIN Services
 - 9.2.8 Virtual Private Voice Networks

PART II: UNDERSTANDING DATA COMMUNICATIONS

The second part covers datacom basics including the crucial concepts of IP packets and LAN frames; all about modems including DSL and cable modems, data over digital cellular and finishes with LANs: building blocks for Part III.

10 INTRODUCTION TO DATA COMMUNICATIONS AND NETWORKING

We'll start off on the right foot with a solid grounding in data communications and networking basics, introducing and defining key concepts explored in subsequent chapters. We'll start at the beginning, reviewing the components of a data circuit: DTEs, DCEs and physical connections, then explore practical examples of circuits and networks, allowing you to categorize and compare the different types of equipment and circuit configurations.

- 10.1 Information Theory
- 10.2 Data Circuit Model
- 10.3 DTE: Data Terminal Equipment
 - 10.3.1 Dumb Terminals
 - 10.3.2 Intelligent Terminals
- 10.4 Analog and Digital Data Circuits
 - 10.4.1 Analog Data Circuits
 - 10.4.2 Unloaded Circuits
 - 10.4.3 Wet vs. Dry Circuits
 - 10.4.4 Broadband or Wideband Analog
 - 10.4.5 Digital Circuits
 - 10.4.6 Fiber: Analog or Digital?
- 10.5 DCE: Data Circuit-Terminating Equipment
 - 10.5.1 Analog DCE: Modems
 - 10.5.2 Digital DCE: CSUs, DSUs, and More
- 10.6 Point-to-Point Circuits
 - 10.6.1 Parallel
 - 10.6.2 Serial
- 10.7 Multidrop Circuits
 - 10.7.1 IBM Mainframe Circuits
 - 10.7.2 Cable Television Distribution
- 10.8 LANs: Local Area Networks
- 10.9 Wide Area Networks
 - 10.9.1 Basic Components of a WAN
 - 10.9.2 Routers, Network Addresses and Packets
- 10.10 TCP/IP for Networking

11 HOW DATA IS FORMATTED FOR TRANSMISSION

In this chapter, we'll put in place a solid understanding of the key concepts of IP packets and LAN frames, beginning with the fundamentals, to ensure that you have a solid foundation on which to build an understanding of routers, bandwidth-on-demand services and the Internet.

- 11.1 Basics
 - 11.1.1 Bits
 - 11.1.2 Bytes
 - 11.1.3 Words
 - 11.1.4 Control and Data
- 11.2 Number Systems
 - 11.2.1 Decimal
 - 11.2.2 Binary
 - 11.2.3 Hexadecimal
 - 11.2.4 Common Use for Hexadecimal
- 11.3 "Asynchronous"

- 11.3.1 Coding, Framing and Error Control
- 11.3.2 ASCII Code Set
- 11.3.3 Extended ASCII
- 11.3.4 EBCDIC
- 11.3.5 Framing: Start and Stop Bits
- 11.3.6 Parity Checking
- 11.3.7 No Parity
- 11.4 Frames: “Synchronous”
 - 11.4.1 Exchanging Frames
 - 11.4.2 Components of a Frame
 - 11.4.3 CRC: Cyclic Redundancy Checking
- 11.5 Packets
- 11.6 Packets vs. Frames
- 11.7 IP Packets

12 MODEMS

Understand how modems transmit 1s and 0s over analog circuits. We'll explain the techniques all modems use, jargon like baud rate and half duplex, and review current voiceband modem standards and what connection speeds to expect.

- 12.1 Data over the PSTN
 - 12.1.1 Recap: Circuit-Switching and the PSTN
 - 12.1.2 Recap: The Voiceband
 - 12.1.3 Why Not Use Pulses?
- 12.2 Representing Data in the Voiceband
 - 12.2.1 Amplitude Shift Keying (ASK)
 - 12.2.2 Frequency Shift Keying (FSK)
 - 12.2.3 Phase Shift Keying (PSK)
 - 12.2.4 Quadrature PSK
 - 12.2.5 Quadrature Amplitude Modulation
 - 12.2.6 Trellis-Coded Modulation
 - 12.2.7 Theoretical Maximum
- 12.3 Modulation Summary
- 12.4 Voiceband Modem Standards
 - 12.4.1 V.34 Modems
 - 12.4.2 “56K” Modems
- 12.5 Negotiation and Handshaking
- 12.6 Modem Control and the AT Command Set
- 12.7 Modem Jargon and Buzzwords
 - 12.7.1 Baud vs. Bits/Second
 - 12.7.2 Half-Duplex and Full-Duplex
- 12.8 Factors Limiting Modem Data Rates
 - 12.8.1 Crosstalk and NEXT
 - 12.8.2 Harmonics
 - 12.8.3 A/D Conversion Noise
 - 12.8.4 Voice Compression
 - 12.8.5 Impulse Noise: Spikes

13 BROADBAND MODEMS

An in-depth overview of high-capacity or "broadband" technologies: DSL and Cable modems, and discuss the age-old question: which is faster? We'll also explore the next generations of DSL, how data over digital cellular works as well as reviewing broadband wireless.

- 13.1 DSL

- 13.1.1 ADSL vs. SDSL vs. XDSL
- 13.1.2 DSLAMs and Co-Location
- 13.1.3 "Always On"
- 13.1.4 Advantages of DSL
- 13.1.5 DSL Modulation Techniques
- 13.1.6 Loop Length Limitations
- 13.1.7 Next Generations of DSL
- 13.1.8 VDSL and OPI DSLAMs
- 13.2 Cable Modems
 - 13.2.1 CATV Network Architecture
 - 13.2.2 Two-way Communications
 - 13.2.3 Sharing the Access Circuit
- 13.3 Which Is Faster, Cable Modem Or DSL?
- 13.4 Data over Analog Cellular
- 13.5 Data over Digital Cellular
 - 13.5.1 Recap: Digital Cellular for Voice
 - 13.5.2 Communicating Data Instead of Voice
 - 13.5.3 Navigation Servers
 - 13.5.4 WAP and XML
 - 13.5.5 3G
- 13.6 WiFi and WiMAX

14 UNDERSTANDING LANS

LANs: Local Area Networks are the technology used to connect computers - and in the future telephones - inside the building. We'll complete this module with a basic, solid understanding of LANs: Ethernet and the original idea of a bus, how this changed to 100 Mb/s and now Gigabit Ethernet connected with LAN switches. You'll learn about categories of cables, hubs and switches, and as a preview of Part III, how to interconnect LANs using routers and TCP/IP.

- 14.1 Categories of Cables
 - 14.1.1 TIA-568A vs. TIA-568B
- 14.2 Bus Topology
 - 14.2.1 Network Interface Cards and MAC Addresses
 - 14.2.2 Frames and Logical Link Control
 - 14.2.3 What Makes a LAN a LAN
 - 14.2.4 Access Control: CSMA-CD
- 14.3 802.3 and Ethernet
- 14.4 Evolution of Ethernet
 - 14.4.1 10BASE-5
 - 14.4.2 10BASE-2
 - 14.4.3 10BASE-T and Hubs
 - 14.4.4 "Fast Ethernet": 100BASE-T
 - 14.4.5 Half-Duplex vs. Full Duplex
 - 14.4.6 Gigabit Ethernet
- 14.5 "Gig-E" Applications
 - 14.5.1 Gigabit Ethernet Passive Optical Network (EPON)
 - 14.5.2 GPONs
- 14.6 802.5 / IBM Token-Passing Ring
- 14.7 Repeaters and Bridges
 - 14.7.1 Old-Style Bridged LANs
- 14.8 Ethernet Switches
- 14.9 Interconnecting LANs with Routers

PART III: UNDERSTANDING IP AND NETWORKING

The third part brings it all together with a structured discussion of networking: protocol stacks, routers, IP addresses, bandwidth-on-demand services, Voice over IP (VoIP) and IP VPNs, the Internet, and finishes with a top-down review and templates for mainstream solutions.

15 UNDERSTANDING PROTOCOL STACKS

We start by building a foundation for understanding networking by defining what needs to be done, and putting in place a structure for discussing how systems can interoperate via protocol stacks. We'll review the ISO Open Systems Interconnect (OSI) 7-layer reference model, give examples and explanations of protocols like SMTP, ASCII, HTTP, TCP, IP, 802.2 and 802.3 used for each layer, and practical insight into how a protocol stack works.

- 15.1 Choices for Connecting Systems
- 15.2 Protocols and Standards
- 15.3 ISO OSI Reference Model
- 15.4 OSI 7-Layer Model
- 15.5 Physical Layer
 - 15.5.1 Physical Layer: Digital Technology Roundup
- 15.6 Data Link Layer
- 15.7 Network Layer
- 15.8 Transport Layer
- 15.9 Session Layer
 - 15.9.1 Cookies: Session Restoration
 - 15.9.2 Navigation and Profiling
- 15.10 Presentation Layer
 - 15.10.1 Encryption
- 15.11 Application Layer
- 15.12 Protocol Stack in Operation
- 15.13 OSI Summary
 - 15.13.1 Separability of the Layers
 - 15.13.2 Peer Protocols
- 15.14 Standards Organizations

16 IP ADDRESSING

Obtain concise, detailed understanding of how IP addressing works: IP address classes, dynamic and static addresses, public and private addresses, Network Address Translation to connect multiple computers to one Internet connection, and IP version 6.

- 16.1 IP Version 4
 - 16.1.1 Dotted-Decimal Notation
 - 16.1.2 Address Classes
- 16.2 Dynamic IP Addresses
- 16.3 Static Addresses
- 16.4 Private IP Addresses
- 16.5 Network Address Translation
- 16.6 IP Version 6 (IPv6)
 - 16.6.1 IPv6 Notation and Address Classes

17 PRIVATE NETWORKS USING ROUTERS AND DEDICATED LINES

The best way to understand routers and networks is with private networks, composed of routers connected with dedicated lines like T1s. We'll understand the functions routers perform, edge routers and packet filtering, and practical guidelines on how to order circuits and deal with carriers.

- 17.1 Chapter Roadmap
- 17.2 Traffic Aggregation via Channelized TDM

- 17.3 Statistical TDM Concepts
 - 17.3.1 Overbooking
 - 17.3.2 Addressing
- 17.4 T1 WAN: Integrated Data, Voice, Video
- 17.5 Edge Routers
 - 17.5.1 Routing vs. Bridging
 - 17.5.2 Packet Filtering
- 17.6 Private Wide-Area Packet Network
- 17.7 Dealing with Carriers
- 17.8 Troubleshooting
 - 17.8.1 Fault Sectionalization
 - 17.8.2 Bit Error Rate Testing (BERT)
 - 17.8.3 In-Service Monitoring
 - 17.8.4 Monitoring Higher Layers

18 BANDWIDTH ON DEMAND

Bandwidth on demand or "packet-switched" services have strong cost and flexibility advantages over dedicated lines. We'll understand packet network concepts, how and why Virtual Circuits are implemented, and what the jargon and buzzwords really mean. You will understand the widely-used TCP/IP over Frame Relay and performance issues... which leads into understanding the need for Quality of Service (QoS) guarantees, ATM and MPLS.

- 18.1 Bandwidth on Demand Service Concepts
 - 18.1.1 Advantages
 - 18.1.2 Disadvantages
- 18.2 Virtual Circuits
 - 18.2.1 Switched Virtual Circuits (SVCs)
 - 18.2.2 Permanent Virtual Circuits (PVCs)
 - 18.2.3 Connection-Oriented Network Services
 - 18.2.4 Connectionless Network Services
 - 18.2.5 Connection-Oriented, Connectionless and Virtual Circuits
 - 18.2.6 Reliable Network Service
 - 18.2.7 Unreliable Network Service
- 18.3 X.25
 - 18.3.1 X.25 Network and Packets
 - 18.3.2 Packet Switches vs. Routers
 - 18.3.3 PADs: Network Interface Devices
 - 18.3.4 X.25 Protocol Stack
 - 18.3.5 X.25 Performance
- 18.4 Frame Relay
 - 18.4.1 Improvements on X.25
 - 18.4.2 Relaying Frames Instead of Switching Packets
 - 18.4.3 Unreliable Service
 - 18.4.4 TCP/IP and Frame Relay
 - 18.4.5 Frame Relay Performance
 - 18.4.6 Committed Information Rate (CIR)
 - 18.4.7 Burst Information Rate (BIR)
- 18.5 QoS Requirement for Voice in Packets
- 18.6 ATM
- 18.7 MPLS
- 18.8 TCP/IP Over MPLS

19 IP NETWORK SERVICES

In this chapter, we focus on two primary services that can run on an IP/MPLS network: voice and secure data communications. We'll begin with an introduction to Voice over IP components, jargon and buzzwords, and understand how VoIP will mesh with the PSTN covered in Part 1. You'll also understand how IPsec protocols and equipment implement IP VPNs for secure business data communications over IP networks.

- 19.1 VoIP System Components
- 19.2 VoIP over the Internet: VSPs
 - 19.2.1 Why Internet Telephony is Cheaper than POTS
 - 19.2.2 DS0 Interconnect to the PSTN
- 19.3 Internet Telephony from LEC / CATV
- 19.4 Managed-IP Telephone Service (MIPT)
- 19.5 VPNs
 - 19.5.1 Customer-Premise-Based VPNs
 - 19.5.2 Carrier VPN Service

20 UNDERSTANDING THE INTERNET

Let's not forget the Internet! This chapter provides a concise explanation of the Internet, reviewing past and present, ISPs, who pays for it, TCP and IP, SMTP and MIME for e-mail, HTML, Web servers and browsers, the Domain Name System and more. We'll complete the picture with practical guidelines for connecting.

- 20.1 Internet History
 - 20.1.1 Philosophy Behind the Internet
 - 20.1.2 How Al Gore Invented the Internet
 - 20.1.3 Historical Limitations
- 20.2 Internet Basics
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The final chapter brings all of the concepts together with a top-down review. You'll learn valuable insight in how technology *should* be deployed, and review mainstream services and solutions. We'll conclude with a view toward the future: the IP Packet-Switched Telecommunications Network... the first diagram from the next Teracom textbook "IP Telecom".

21.1 System Development Methodology

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ACRONYMS AND ABBREVIATIONS

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About the Author



Eric Coll is an international expert in telecommunications, data communications and networking and has been actively involved in the industry since 1983. He holds Bachelor's and Master of Engineering (Electrical) degrees, and is licensed as a Professional Engineer in his home jurisdiction.

Mr. Coll has taught telecommunications technology training seminars to wide acclaim across North America since 1992, and has broad experience working as an engineer in the telecommunications industry.

He has worked for Nortel's R&D labs as a design engineer on projects including digital voice and data communications research and digital network equipment design; and on satellite radar systems; consulting on Wide Area Network design for HMO applications; and many other projects in capacities ranging from detailed design and implementation to systems engineering, project leader and consultant.

In addition to being a Course Director for Teracom Training Institute, Mr. Coll provides consulting to the telecommunications industry as a subject matter expert in tax matters.

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