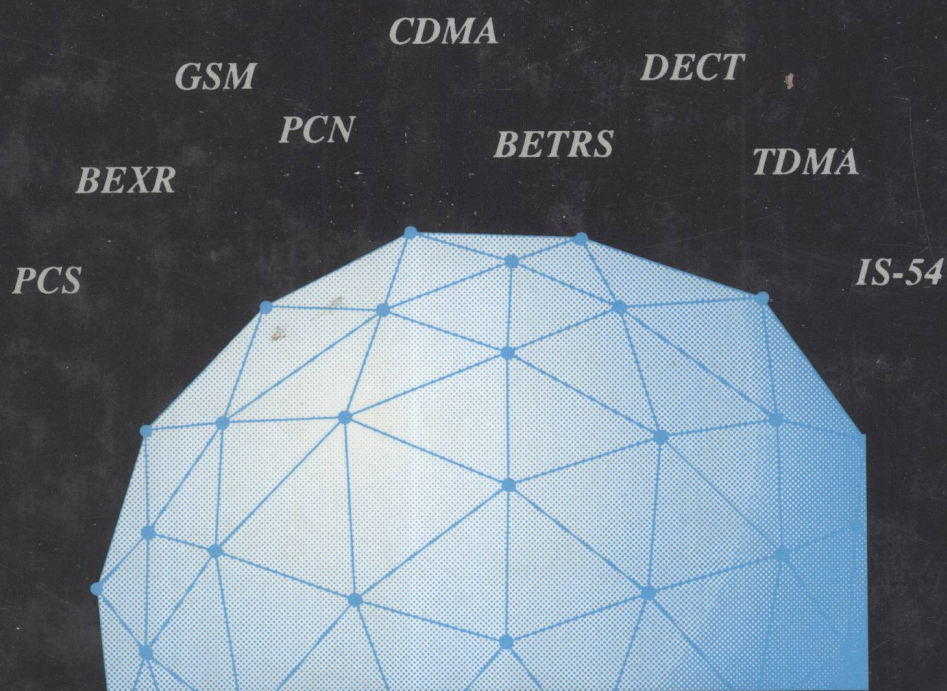


# **Wireless Access** and the **Local Telephone Network**



George Calhoun

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**George Calhoun**



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## PREFACE

This is a book about one of the most surprising and important trends in today's telecommunications industry: the emergence of advanced radio systems for providing access to the telephone network. *Wireless access*, as I use it here, is a generic term. It encompasses cellular mobile radio, personal communications concepts (PCN and PCS), the wireless local loop (BETRS and BEXR), wireless LANs, wireless PBXs, and other prospective applications, some of which appear to overlap one another. Collectively, these systems represent a vigorous challenge to the copper-based access facilities that have shaped telephony for more than 100 years. As but one indication of this challenge, consider that some forecasts now call for 40 million wireless access subscribers by 1999 *in the U.S. cellular radio market alone*. For comparison, the wireline telephone network did not reach 40 million subscribers in the U.S. until 1949—73 years after the invention of the telephone—and this forecast takes no account of the many other forms of wireless access now being discussed.

Actually, this volume really comprises *two* books, written for two rather different audiences. Parts I, II, and V are addressed to the “Big Picture”—what is happening to the telephone industry as wireless access muscles its surprising way towards center stage? These sections deal with issues of history, policy, and strategy, and may therefore be of interest to a general audience.

Sandwiched in between, in Parts III and IV, is a “textbook” for planners, managers, and applications-oriented engineers who are more concerned with the specifics of analyzing, evaluating, programming, and deploying wireless access systems in a telephony environment. Many of these readers may find the “Big Picture” sections in Parts I, II, and V to be of less immediate interest. One may certainly skip directly to the beginning of Part III for a more focused presentation of the technology, applications, economics, and engineering principles of wireless access.

To review briefly, Part I is an attempt to answer the questions: Why are we here? Why is wireless access, in its various guises (including cellular radio, PCN, and basic exchange radio), suddenly so prominent? Why is it “the most exciting development in the telephone industry since the break-up of AT&T” (in the words of a recent speaker at a standing-room-only session for the telephone industry)? In brief,

the coming of wireless access has much to do with the coming of the Information Age itself. It portends fundamental and even unsettling changes in the nature of the telephone business. I may allude to those changes here by suggesting that there are basic parallels between the introduction of radio technology (i.e., “microwave”) into the long-distance or interexchange business in the 1950s and 1960s (which led, I believe, in a direct causal chain to telecommunications competition, deregulation, and divestiture) and the imminent appearance of radio in the local exchange environment (which might be termed today the last bastion of the monopoly). Be forewarned, however, that in trying to encompass a number of very large issues, I find that the long first chapter has become itself a rather untethered dissertation, perhaps not every reader’s cup of tea.

Part II begins a more linear exploration of three basic aspects of the “problem of access” and forms the background against which wireless access is emerging. Chapter 2 deals with the quantitative dimensions of the access problem in today’s network. Chapter 3 addresses the costs and pricing of access—in short, the economics of access. Chapter 4 deals with the simultaneous “revolution” in telecommunication services that is redefining notions about “universal service” and the relation between enhanced access and enhanced economic and political opportunity.

Part III deals with the classification of the various applications of wireless access (Chapter 5), and provides a primer on the technologies that are making this all possible (Chapter 6).

Part IV is the most “nuts and bolts” section of the book, dealing with the methods for analyzing the economics of wireless (versus wireline) access facilities (Chapter 7) and with the issues raised during the actual engineering of a wireless access application, from radio propagation analysis to site preparation and generic installation procedures (Chapter 8). The material in Part IV is derived from practical experience with one of the pioneering companies in the entire field of wireless access and specifically from the problems encountered and solutions developed during the field deployment of more than 50 wireless access systems from 1986 through mid-1990 (serving several thousand users).

Finally, Part V returns to a consideration of some of the implications of the introduction of wireless access systems for the future of the local exchange environment. Chapter 9 discusses the complementarities of digital radio and fiber optics as the twin pillars of twenty-first-century access. Chapter 10 charts the course for the next few rounds of the PCN/PCS debate.

I have had the good fortune to play midwife to this new child of telephony. Beginning with IMM Corporation in 1980 (and with the assistance of M/A-COM and Hughes Network Systems), we developed a technological platform that brought advanced digital radio into the local exchange environment for the first time in the United States. We have worked through the arduous process of introducing a new approach to telephony to an industry that is steeped in traditional methods and procedures. I use the phrase “new approach” advisedly, for we have found that wireless

access encompasses far more than just technology. It is a new way of looking at the problem of providing telephone service.

We have had to walk our ideas through the labyrinths of telephone company “product evaluation” and “standardization,” develop multiple layers of documentation, prepare training cycles, and develop new planning tools. We have dealt with individuals at all levels and in all functions in the telephone business, from tariff experts and regulatory counsel to network planners and technologists, from chief executives to central office technicians and outside plant engineers. We have wandered the industry byways from the labs at Bellcore to rural “stepper” exchanges in Mississippi and Wyoming and Texas. In short, we had to confront the *culture of telephony*—still, overwhelmingly, a wireline-oriented culture where career paths often begin knee-deep in the mud, splicing cables. We have presented this culture with the first real alternative loop technology in 100 years. In doing so, we have learned that wireless access is both infinitely easier and, because it is so different, vastly more difficult than the comfortable “solution” of stringing more copper wire.

Nevertheless, wireless access is now well on its way. Almost every major telephone company has formed a wireless access group (under various names), and it is clear that many more will soon follow the paths that I have described here. It is my hope that in this book I’ve captured a significant number of lessons from our experience that may make this process a little easier for those who will follow.

Once again, as in my previous book, I must apologize for my ethnocentrism. The historical and political/regulatory context that has helped to create the “problem of access” is not entirely unique to the United States, but I must rely on the non-U.S. reader’s own insight to see where the parallels apply and where they do not. Certainly, I believe that most of the technical “textbook” on wireless access that is presented in Parts III and IV will be relevant wherever such systems may be evaluated and deployed.

Philadelphia  
August 13, 1991

## ***ACKNOWLEDGMENTS***

Some inventions are the work of an individual or a small team, but the invention of a whole industry is a collective accomplishment involving hundreds of enterprising people who are willing to go against the prevailing wisdom to bring forth something new under the sun. This book chronicles the invention of a new way of telecommunicating, and the ideas it contains are the coalescence of thousands of conversations and experiences contributed by the many coauthors of “wireless access.” I only regret that the list is too long to recognize everyone by name.

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# ***CONTENTS***

Preface	xv
Acknowledgments	xix
Part I Introduction: Beyond Copper	1
Chapter 1 The Not-So-All Encompassing Network	3
1.1 Looking Back: The Riddle of Modernity	3
1.2 Looking Ahead: The Information Age	9
1.3 Dialtone, A Parable	26
1.4 Wireless Access: To PCN and Back Again	32
1.5 Theories of History	42
Part II The Problem of Access	49
Chapter 2 The Evolution of the Telephone System and the Era of Access	51
2.1 The Era of Interconnection, 1876–1950	51
2.2 The Era of the Network, 1950–1990	56
2.3 The Era of Access: 1990 and Beyond	61
2.4 Terminology: Network and Access	65
2.5 The Dimensions of the Problem of Access	74
Chapter 3 The Costs of Access	83
3.1 A Pearl in the Oyster	83
3.2 Successful Socialism	93
3.3 The Unraveling of the Natural Monopoly	100
Chapter 4 The Service Revolution and the Uncompleted Network	109
4.1 The Voice-Optimized Network	109
4.2 The Explosion in Digital Services	110
4.2.1 Voiceband Services	110
4.2.2 Packet Data Networks	112
4.2.3 Narrowband Integrated Digital Services	113
4.2.4 Broadband Integrated Digital Services	115
4.3 The Information Rich and Poor	117

Part III	Wireless Access: Technologies and Applications	121
Chapter 5	Applications of Wireless Access	123
5.1	A Basic Model of Wireless Access	126
5.2	Alternative Service Models	135
5.2.1	Wireless Access as an Extension of the Network	136
5.2.2	Wireless Access as an Outgrowth of Cellular Radio	143
5.2.3	Wireless Access as PCN	147
5.2.4	Wireless Access in Private Networks	150
5.3	“Telephony-Derived” Applications of Wireless Access	151
5.3.1	Rural Radio	152
5.3.2	Thin-Route Microwave Subscriber Radio	153
5.3.3	Basic Exchange Radio—“Wireless Local Loop”	155
	5.3.3.1 Technical Outlines and Systems Concepts	156
	5.3.3.2 BETRS Regulatory Background	157
	5.3.3.3 Early Applications of BETRS	160
	5.3.3.4 Extensions of the BETRS Concept	162
	<i>Canada</i>	162
	<i>Japan</i>	163
	<i>CCIR</i>	163
	<i>Bellcore and BEXR</i>	163
	5.3.3.5 Advantages of BETRS	164
5.3.4	A Hierarchy of BETRS Applications	166
	5.3.4.1 Traditional “Rural Radio”	171
	5.3.4.2 Wireless Digital Loop Carrier	172
	5.3.4.3 Radio Carrier Serving Area	174
	5.3.4.4 Wireless Digital Access	176
	5.3.4.5 Transportable Applications	182
	5.3.4.6 Integrated Digital Radio (IDR)	183
5.3.5	Scope of the BETRS Applications	183
	5.3.5.1 Wireless Access Indices	183
	<i>Unserved Telephone Demand</i>	183
	<i>Party-Line Upgrade</i>	185
	<i>Growth in the Subscriber Base</i>	186
	<i>Replacement of Deteriorating Outside Plant</i>	186
	5.3.5.2 Top-Down Studies	186
	5.3.5.3 Bottom-Up Studies	188
5.4	Mobile-Oriented Applications of Wireless Access	189
5.4.1	Cellular Mobile Radio	191
	5.4.1.1 Improved Radio Transmission	191
	5.4.1.2 Cellular System Architecture	192
	5.4.1.3 Cellular Service Offerings	194
	5.4.1.4 Cellular Networks	194
5.4.2	Noncellular Mobile Radio	196

5.5	The PCN Set of Applications	197
5.5.1	Wireless Pay Phone (Telepoint)	201
5.5.2	Residential Cordless Telephony	202
5.5.3	Wireless PBX and Other Applications	205
5.5.4	Residential Neighborhood Access	205
5.5.5	Personal Communications	207
5.6	Private Network Applications	208
5.6.1	The Defining Characteristics of Private Carrier Applications	209
5.6.2	Wireless LANs	209
5.6.3	Wireless MANs	211
5.6.4	Wireless WANs: VSAT Networks	211
Appendix 5A:	A History of the Use of Radio in the REA Telephone Program (1985)	223
Appendix 5B:	Excerpts from A Report by the Mountain States Telephone and Telegraph Company, Northwestern Bell Telephone Company, and Pacific Northwest Bell Telephone Company	229
Appendix 5C:	A Pioneering Wireless Telephone Project	236
Chapter 6	Technology for Wireless Access	241
6.0	The End of FM	241
6.1	A Primer on Digital Radio	244
6.1.1	The Vocabulary of Radio	244
6.1.2	The Fate of the Radio Signal	249
6.1.2.1	Free Space Loss	250
6.1.2.2	Attenuation Effects	251
6.1.2.3	Reflection and Multipath Effects	253
	<i>Delay Spread</i>	254
	<i>Rayleigh Fading</i>	256
	<i>Doppler Shifts</i>	257
	<i>Importance of Multipath Effects</i>	258
6.1.3	The Vocabulary of Digital Communications	259
6.1.3.1	A/D Conversion	261
	<i>Sampling</i>	261
	<i>Quantization</i>	262
	<i>Coding</i>	263
6.1.3.2	Modulation	265
6.1.3.3	Transmission and Signal Processing	266
6.2	System Performance Objectives	267
6.2.1	Transmission Environments	267
6.2.2	Quality Objectives	268
6.2.3	Cost Objectives	271
6.2.4	Capacity Objectives	273

6.2.5	Spectrum Efficiency	274
6.2.5.1	Approaches to Increasing Spectrum Efficiency	275
	<i>Efficient RF Link Design</i>	275
	<i>Efficient System Design</i>	275
	<i>Improved Frequency Reuse</i>	275
	<i>Better Traffic Management</i>	275
6.2.5.2	Approaches to the Measurement of Spectrum Efficiency	276
	<i>Spectral Efficiency (b/Hz)</i>	276
	<i>Circuit Spectrum Efficiency (circuits/MHz)</i>	277
	<i>Geographical Spectrum Efficiency (circuits/MHzkm<sup>-2</sup>)</i>	277
6.2.6	Flexibility	281
6.2.7	Forward Compatibility	282
6.2.8	Portability	283
6.3	Muscular Software: Building the Digital Radio Circuit	284
6.3.1	Voice Coding: Bandwidth Reduction	289
6.3.1.1	Strategies for Efficient Voice Coding	291
	<i>Analysis of Inherent Redundancies in Speech Signals</i>	291
	<i>Analysis Aural Performance Characteristics</i>	292
	<i>Parametric Modeling of Speech Production</i>	292
	<i>Quantization of Block or Parametric Information</i>	294
6.3.1.2	Representative Coding Strategies	295
	<i>Continuously Variable Slope Delta Modulation (CVSD)</i>	295
	<i>Adaptive Subband Coding</i>	298
	<i>Residual-Excited Linear Predictive Coding</i>	301
	<i>Vector Quantization</i>	304
6.3.2	Modulation: Increasing Information Density	308
6.3.2.1	Information Density	308
6.3.2.2	Power Spectrum Considerations	313
6.3.2.3	Amplifier Considerations	314
6.3.3	Equalization: Recovering the Physical Code	317
6.3.4	Error Correction: Recovering the Logical Code	318
6.4	Ingenious Architectures: Building the Digital Radio System	320
6.4.1	The Concept of Multiple Access	321
6.4.2	Frequency-Division Multiple-Access Architecture	322
6.4.3	Time-Division Multiple-Access Architecture	325
6.4.4	Time-Division Duplex—"Ping Pong"	331

6.4.5	Code-Division Multiple-Access Architecture	334
6.4.5.1	Code Division Metaphors	334
6.4.5.2	Code Division Techniques	337
6.4.6	Packet-like Techniques: Digital Speech Interpolation	340
6.4.6.1	The Concept of Packet Transmission	340
6.4.6.2	Fast-Packet and Packet Voice	341
6.4.6.3	Digital Speech Interpolation	343
	<i>Advantages of DSI</i>	351
6.4.6.4	Packet Reservation Multiple-Access Concept	354
6.4.7	Channel Access Techniques	355
6.4.8	A Comparative Evaluation of Multiple-Access Architectures	357
Part IV	Wireless Access: Economics and Engineering	379
Chapter 7	The Economics of Wireless Access	381
7.0	"No More Copper"	381
7.1	Economic Models for Analyzing Access Plant Decisions	386
7.1.1	Elements of an Economic Model	387
7.1.2	Outputs of Access Plant Studies	389
7.1.3	Assumptions for Access Plant Studies	391
7.1.3.1	Service-Related Assumptions	391
7.1.3.2	Traffic-Related Assumptions	393
7.1.3.3	Regulatory Assumptions	394
	<i>Depreciation</i>	394
	<i>Pricing</i>	394
7.1.3.4	Technology-Related Assumptions The Copper Bias	395
7.1.4	Inputs for Access Plant Studies	398
7.1.4.1	Existing Plant	399
7.1.4.2	The Physical Environment	399
7.1.4.3	Spatial and Temporal Characteristics of Service Requirements	401
7.1.5	Structural Relationships for Access Plant Studies	401
7.1.5.1	Fixed and Variable Costs	402
7.1.5.2	Statistical Factors	403
7.1.5.3	Iteration, Optimization, and Simulation	404
7.2	Wireless and Wireline Architectures: the Basics	404
7.2.1	A Standard Wireline Access Architecture	405
7.2.1.1	Cost Structure of the Star Network	405
	<i>High Dedicated Costs</i>	405
	<i>Distance-Sensitive Costs</i>	405
	<i>Trade-offs</i>	406

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7.2.1.2	The Standard Exchange Configuration: Cable Routes	407
7.2.1.3	The Standard Loop	410
7.2.1.4	Alternative Wireline Loop Architectures	411
7.2.2	A Standard Wireless Access Architecture	412
7.2.2.1	The Exchange Configuration: Area Coverage	412
7.2.2.2	The Wireless Loop	416
7.2.2.3	The Cost Structure of a Wireless Network	417
	<i>Distance Insensitivity</i>	417
	<i>Shared and Dedicated Costs</i>	417
	<i>Clustered versus Distributed Systems</i>	418
7.2.2.4	Alternative Wireless Loop Architectures	418
7.2.3	Alternative Mappings between Wireless and Wireline Architectures	418
7.2.3.1	Drop Replacement Only: "PCN"	423
7.2.3.2	Distribution Replacement: Wireless DLC	426
7.2.3.3	Feeder Replacement: Radio Carrier Serving Area	427
7.2.3.4	Exchange Replacement/Consolidation: Wireless Overlay Network	429
7.3	Simplified Models of Wireless Access Costs	430
7.3.1	Modeling the Spatial Dimension I: Cable versus Radio	431
7.3.1.1	Cost and Distance	432
	<i>Per-Unit-of-Distance Costs</i>	432
	<i>Frequency Distribution of Loop Lengths</i>	433
	<i>Cost/Distance Indices</i>	433
7.3.1.2	Cost and Population Density	436
	<i>Cost/Density Functions for Wireline Systems</i>	436
	<i>Cost/Density Functions for Radio Access Systems</i>	440
	<i>Comparisons</i>	442
	<i>Clustering and Cost/Density Functions</i>	443
7.3.2	Modeling the Spatial Dimension II: The Problem of "Critical Mass"	445
7.3.3	Modeling the Spatial Dimension III: Consolidation of Feeders and Exchanges	447
7.3.3.1	Feeder Consolidation	447
7.3.3.2	Radio "Safety Nets"	449
7.3.3.3	Elimination of Exchanges	449
7.3.4	Modeling the Spatial Dimension IV: Beyond Basic Services	449
7.3.5	Modeling the Time Dimension of Access Economics	452
7.3.5.1	Modular Investments and Present Value	452
7.3.5.2	Operating Expenses: Maintenance Costs	453

7.3.5.3	Inflation and Deflation Effects	456
7.3.5.4	Recovery Value and Stranded Investment	459
7.3.6	“Intangibles:” Flexibility and Response Time	462
7.3.6.1	Overhead	462
7.3.6.2	Overtime	463
7.3.7	Summary	464
7.3.7.1	Greater Economic Efficiency	465
7.3.7.2	Greater Economic Flexibility	466
7.3.7.3	Freedom in Space: Area Coverage versus Cable-Route	467
7.3.7.4	Freedom in the Time Dimension: Life Cycle Economics	468
7.3.7.5	Flexible Deployment of Wireless Access	468
7.3.7.6	Redundant Networks	468
7.4	Planning a Wireless Access Program	470
7.4.1	Site Screening: Indices of Wireless Access Requirements	470
7.4.1.1	Individual Indices for Wireless Access	471
7.4.1.2	Composite or Weighted Indices	473
7.4.2	Single-Site Analysis: Evaluating the Radio/Cable Mix	473
7.4.2.1	External Constraints on the Use of Radio	474
7.4.2.2	Assessing the Existing Plant	474
7.4.2.3	Optimizing the Radio/Cable Mix	475
7.4.3	Area Analysis: Radio Overlay Networks	477
7.4.3.1	Siting Radio Base Stations	478
7.4.3.2	Administration of Overlay Networks	478
7.4.3.3	Network Interface or Interconnection	479
	<i>Interface Type</i>	479
	<i>Interface Level</i>	480
	<i>Interface Location</i>	480
	<i>Interface Facilities</i>	481
7.4.3.4	Inter-cell Trunking Facilities	481
7.5	“No More Exchange Boundaries”—The Impact of Competition	481
Chapter 8	Engineering for Wireless Access	487
8.0	“Making it Work!”	487
8.1	Service Requirements for Wireless Access	489
8.1.1	Types of Service	490
8.1.1.1	Voice Services	490
	<i>Analog Voice Circuits</i>	490
	<i>DS0 Digital Voice Circuits</i>	490
	<i>Low-Bit-Rate Voice Circuits</i>	491
	<i>Ancillary Voice-Oriented Services</i>	491

8.1.1.2	Data Services	492
	<i>Voiceband Data</i>	492
	<i>Direct Digital Transmission</i>	493
	<i>Integrated Voice and Data Networks</i>	494
8.1.1.3	Special Services	496
	<i>Alternative Signaling Formats</i>	496
	<i>Intelligent Network Capabilities</i>	497
	<i>Unique Radio-Based Services</i>	497
8.1.1.4	Summary: Mutual Adaptation	498
8.1.2	Quality of Service	498
8.1.2.1	Quality of Voice Services	499
	<i>Forms of Impairment: Digital versus Analog</i>	499
	<i>Measures of Codec Quality</i>	500
	<i>Modes of Codec Failure</i>	500
	<i>Measures of Codec Complexity</i>	501
	<i>Grade of Service</i>	501
8.1.2.2	Quality of Nonvoice Services	501
8.1.3	Service Availability	502
8.1.3.1	Equipment Availability	503
	<i>Reliability</i>	503
	<i>Testing and Diagnostics</i>	504
	<i>Repair and Service</i>	504
8.1.3.2	Circuit Availability	505
	<i>Blocking</i>	505
	<i>Offered Traffic</i>	506
	<i>More Complex Models</i>	506
	<i>Summary</i>	507
8.1.3.3	Signal Availability	507
8.1.3.4	The Crux of Service Availability—Blocking	507
8.2	Radio Engineering for Wireless Access—An Overview	509
8.2.1	The RF Budget: Analyzing Circuit Requirements	510
8.2.1.1	Circuit Quality, Reliability, and RSL	511
8.2.1.2	The BER Criterion	511
8.2.1.3	The SNR Criterion	512
8.2.1.4	The RSL Criterion	512
8.2.1.5	Signal Variations and Margin Requirements	513
8.2.2	Path Analysis: Predicting RF Circuit Characteristics	515
8.2.2.1	Components of Path Loss	515
8.2.2.2	Frequency-Related Effects	516
8.2.2.3	Distance-Related Effects	517
8.2.2.4	Terrain-Related Effects	517
8.2.2.5	Path Loss Models	518
8.2.3	Area-Coverage Analysis	518