

Contents

Apply Wireless Technologies to Horizontal Applications

Along with the many vertical markets and applications, you can apply wireless technologies to horizontal applications, meaning that delivery services, public safety, finance, retail, and monitoring can all use and benefit from them.

Foreword

xxv

Chapter 1 Introduction to Wireless: From Past to Present

1

Introduction	2
Exploring Past Discoveries That Led to Wireless	4
Discovering Electromagnetism	4
Exploring Conduction	6
Inventing the Radio	6
Mounting Radio-Telephones in Cars	8
Inventing Computers and Networks	9
Inventing Cell Phones	11
Exploring Present Applications for Wireless	12
Applying Wireless Technology to Vertical Markets	13
Using Wireless in Delivery Services	14
Using Wireless for Public Safety	14
Using Wireless in the Financial World	15
Using Wireless in the Retail World	15
Using Wireless in Monitoring Applications	16
Applying Wireless Technology to Horizontal Applications	16
Using Wireless in Messaging	17
Using Wireless for Mapping	17
Using Wireless for Web Surfing	17
Exploring This Book on Wireless	18

Summary	19
Solutions Fast Track	20
Frequently Asked Questions	21

Chapter 2 Radio Elements and Frequency Spectrums 23

Learn the Properties of Waveforms

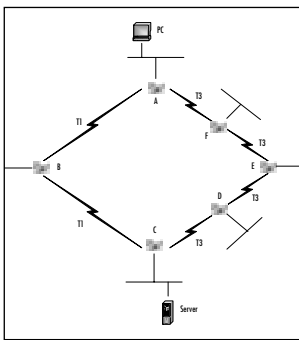


a = Amplitude
 v = Velocity of Propagation
 τ = Period
 λ = Wavelength
 f = Frequency

Introduction	24
Transmitting Radio Signals Over EM Waves	24
Anatomy of a Waveform	25
Modulating a Radio Signal	27
Propagating a Strong Radio Signal	34
Understanding Signal Power and	
Signal-to-Noise Ratio	35
Attenuation	36
Rain Attenuation	39
Bouncing	39
Refracting	41
Line of Sight	42
Penetration	43
Understanding the Wireless Elements	45
Generic Radio Components	45
Antennas	49
Omnidirectional Antennas	50
Directional Antennas	51
Base Stations and Mobile Stations	56
Access Points	57
Channelizing the Frequency Spectrum	57
Channelizing	59
Channel Bandwidth	59
Channel Spacing and Buffer Zones	60
Multichannel Systems and Channel	
Offsets	61
Extending the Number of Channels	
(Frequency Reuse)	61
Seven Cell Frequency Reuse	62
Multiple Accessing	63

Regulating Wireless Communications	64
Regulatory Agencies	64
The Need to Know	65
Regulations for Low Power, Unlicensed Transmitters	66
Summary	68
Solutions Fast Track	69
Frequently Asked Questions	71

Learn to Configure and Maintain Routes for Full Connectivity



Static Routing in a Multihop, Multipath Network

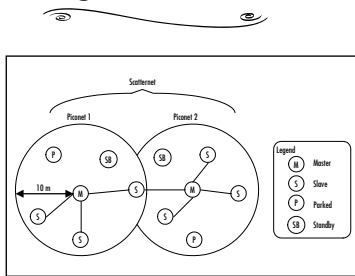
Chapter 3 TCP/IP and the OSI Model 73

Introduction	74
Exploring the OSI and DoD Models	74
Layer 1: The Physical Layer	75
Layer 2: The Data-Link Layer	75
Layer 3: The Network Layer	77
Layer 4: The Transport Layer	78
Layer 5: The Session Layer	78
Layer 6: The Presentation Layer	79
Layer 7: The Application Layer	80
OSI and DoD Correlation	81
Understanding the Network Access Layer	81
Using Bridging	82
The Ethernet Protocol	85
Understanding the ARP Process	86
Wireless Protocols	87
Other Network Access Protocols	88
Understanding the Internet Layer	88
The Internet Protocol	89
IP Addressing	91
Conserving Address Space with VLSM	93
Routing	95
The Internet Control Message Protocol	101
Understanding the Host-to-Host Layer	101
User Datagram Protocol	102
Transmission Control Protocol	102
Managing the Application Layer	105
Monitoring Tools: SNMP	105

Assigning Addresses with DHCP	105
Conserving with Network Address Translation	106
Summary	110
Solution Fast Track	111
Frequently Asked Questions	113

Chapter 4 Identifying Evolving Wireless Technologies and Standards 115

Understand Bluetooth Piconet and Scatternet Configuration



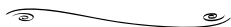
Introduction	116
Fixed Wireless Technologies	117
Multichannel Multipoint Distribution Service	117
Local Multipoint Distribution Services	119
Wireless Local Loop	120
Point-to-Point Microwave	121
Wireless Local Area Networks	122
Why the Need for a Wireless LAN Standard?	123
What Exactly Does the 802.11 Standard Define?	125
Does the 802.11 Standard Guarantee Compatibility across Different Vendors?	128
802.11b	130
802.11a	131
802.11e	132
Developing WLANs through the 802.11 Architecture	133
The Basic Service Set	133
The Extended Service Set	135
Services to the 802.11 Architecture	135
The CSMA-CA Mechanism	138
The RTS/CTS Mechanism	138
Acknowledging the Data	139
Configuring Fragmentation	140
Using Power Management Options	140
Multicell Roaming	140
Security in the WLAN	141

Developing WPANs through the 802.15	
Architecture	143
Bluetooth	144
HomeRF	147
High Performance Radio LAN	147
Mobile Wireless Technologies	148
First Generation Technologies	150
Second Generation Technologies	150
2.5G Technology	150
Third Generation Technologies	151
Wireless Application Protocol	151
Global System for Mobile Communications	153
General Packet Radio Service	155
Short Message Service	155
Optical Wireless Technologies	156
Summary	157
Solutions Fast Track	159
Frequently Asked Questions	163

Chapter 5 Designing a Wireless Network 165

Introduction	166
Exploring the Design Process	166
Conducting the Preliminary Investigation	167
Performing Analysis of the Existing Environment	168
Creating a Preliminary Design	169
Finalizing the Detailed Design	169
Executing the Implementation	170
Capturing the Documentation	171
Identifying the Design Methodology	172
Creating the Network Plan	173
Gathering the Requirements	173
Baselining the Existing Network	175
Analyzing the Competitive Practices	176
Beginning the Operations Planning	176
Performing a Gap Analysis	176
Creating a Technology Plan	177

Create a Detailed Physical Design



- Equipment model
- Cabling details
- Rack details
- Environment requirements
- Physical location of devices
- Detailed RF design

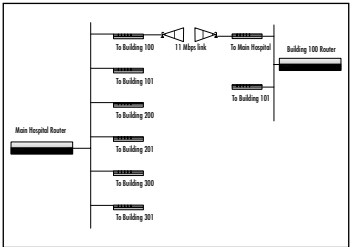
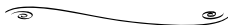
Creating an Integration Plan	178
Beginning the Collocation Planning	178
Performing a Risk Analysis	179
Creating an Action Plan	179
Preparing the Planning Deliverables	180
Developing the Network Architecture	180
Reviewing and Validating the Planning Phase	181
Creating a High-Level Topology	181
Creating a Collocation Architecture	182
Defining the High-Level Services	182
Creating a High-Level Physical Design	183
Defining the Operations Services	183
Creating a High-Level Operating Model	184
Evaluating the Products	184
Creating an Action Plan	185
Creating the Network Architecture Deliverable	186
Formalizing the Detailed Design Phase	186
Reviewing and Validating the Network Architecture	186
Creating the Detailed Topology	187
Creating a Detailed Service Collocation Design	188
Creating the Detailed Services	188
Creating a Detailed Physical Design	189
Creating a Detailed Operations Design	190
Creating a Detailed Operating Model Design	190
Creating a Training Plan	191
Developing a Maintenance Plan	192
Developing an Implementation Plan	192
Creating the Detailed Design Documents	192
Understanding Wireless Network Attributes from a Design Perspective	193
Application Support	194
Subscriber Relationships	196

Physical Landscape	197
Network Topology	200
Network Security	201
Summary	203
Solutions Fast Track	204
Frequently Asked Questions	206

Chapter 6 Designing a Wireless Enterprise Network: Hospital Case Study 209

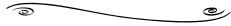
Introduction	210
Applying Wireless in an Enterprise Network	210
Introducing the Enterprise Case Study	211
Assessing the Opportunity	211
Evaluating Network Requirements	213
Assessing the Satellite Buildings' Physical Landscape	214
Evaluating the Outside Physical Landscape	214
Evaluating the Current Network	216
Evaluating the Hospital Conference Room Networking Landscape	216
Designing a Wireless Solution	217
Project 1: Providing Satellite Building Access	218
Project 2: Providing Wireless Technology to the Conference Rooms	219
Project 3: Providing Building-to-Building Connectivity	220
Describing the Detailed Design of the Building Links	222
Implementing and Testing the Wireless Solution	224
Project 1: Implementing the Satellite Building LAN Access	224
Project 2: Implementing the Hospital Conference Room	224
Project 3: Implementing the Building-to-Building Connectivity	225
Reviewing the Hospital's Objectives	227
Lessons Learned	228

Use Two Wireless Outdoor Routers to Create Redundancy



Summary	229
Solutions Fast Track	230
Frequently Asked Questions	232

Create an Installation Checklist and Verify the Steps on the List



- Set up the IP information
- Install the access points
- Install the AP Manager software
- Test the wireless network
- Review the client's objectives

Chapter 7 Designing a Wireless Industrial Network: Retail Case Study 233

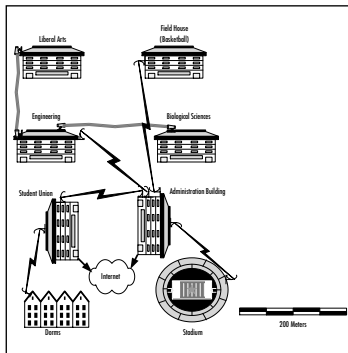
Introduction	234
Applying Wireless Technology in an Industrial Network	235
Introducing the Industrial Case Study	235
Assessing the Opportunity	236
Defining the Scope of the Case Study	238
Reviewing the Current Situation	238
Designing and Implementing the Wireless Network	239
Creating the High-Level Design	239
Creating a Detailed Design	240
Obtaining a Physical Map	242
Determining User Density	247
Identifying Constraints	248
Conducting the Walk-Through	249
Identifying RF Interface Sources	249
Plan the RF Pattern for the Network	249
Planning the Equipment Placement	250
Determining Where to Place the Access Points	251
Determining the RF Channel Optimization	254
Identifying IP Addresses	255
Implementing the Wireless Network	255
Selecting the Hardware	256
Installing the Wireless Components	258
Setting Up IP Information	258
Installing the Access Points	258
Install the AP Manager Software	260
Installing the PC Card in Shipping/Receiving	260

Testing the Wireless Network	260
Reviewing the Client's Objectives	261
Lessons Learned	262
Summary	263
Solutions Fast Track	264
Frequently Asked Questions	266

Chapter 8 Designing a Wireless Campus Network: University Case Study 269

Introduction	270
Applying Wireless Technology in a Campus Network	270
Introducing the Campus Case Study	271
Assessing the Opportunity	271
Defining the Scope of the Case Study	272
Designing the Wireless Campus Network	273
The Design Approach	273
Determining the Functional Design Requirements	273
Tracking the Administration Needs	274
Tracking the Athletic Needs	275
Tracking the Academic Department Needs	276
Tracking Student Union Needs	277
Tracking Student Needs	277
Constraints and Assumptions	277
Identifying the Assumptions	279
Identifying the Constraints	281
Planning the Equipment Placement: Detailed Design Requirements	283
Providing Detailed Administration Requirements	283
Providing Detailed Athletic Department Requirements	285
Providing Detailed Academic Department Requirements	288

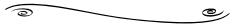
Establish High-Level Inter-Building Connectivity



Providing Detailed Student Union Department Requirements	290
Providing Detailed Student Requirements	291
Implementing the Wireless Campus Network	292
Implementing the Physical Deployment	293
Implementing the Logical Deployment	294
Lessons Learned	295
Summary	296
Solutions Fast Track	297
Frequently Asked Questions	299

Chapter 9 Designing a Wireless Home Network: Home Office Case Study 301

Learn to Build a Wireless Home Network



- Assembling the network components
- Determining Broadband configuration
- Installing the hardware
- Installing and configuring the software
- Testing the network

Introduction	302
Advantages of a Home Network	302
Advantages of a Wireless Home Network	304
Introducing the Wireless Home Network	
Case Study	305
Assessing the Opportunity	305
Defining the Scope of the Case Study	306
Designing the Wireless Home Network	306
Determining the Functional Requirements	307
Determining the Needs of Management	307
Determining the Needs of the Family	308
Talking to the IT Department	308
Creating a Site Survey of the Home	309
Assessing the Functional Requirements	310
Analyzing the Existing Environment	310
Identifying Current Technology Options and Constraints	312
Investigating Costs	313
Weighing Costs and Benefits	313
Assessing the Existing Environment	314
Developing a Preliminary Design	315
Choosing Vendor Solutions	317
Developing a Detailed Design	318
Implementing the Wireless Home Network	319

Assembling the Network Components	319
Determining Broadband Configuration	320
Installing the Hardware	321
Installing and Configuring the Software	322
Installing and Configuring the Software for the Home Firewall	322
Installing and Configuring the Software for the Wireless Access Point	324
Testing the Network	326
Designing a Wireless Home Network for Data, Voice, and Beyond	326
Current State of the Home Wireless Marketplace	327
A Proposed Solution for the Future	329
Lessons Learned	330
Summary	332
Solutions Fast Track	332
Frequently Asked Questions	335
Designing a Wireless Network Fast Track	337
Index	357