



Table of Contents

Introduction	1
Part I - Securing Local Networks	3
1 Dealing with Local Network Security in the Real World	15
1.1 Introduction	15
1.2 Security Challenges	18
1.2.1 Hijacking and Espionage of Computer Networks	18
1.2.2 Monster DDOS Attacks	19
1.2.3 IT Consumerization and the Loss of Visibility	20
1.2.4 Issue of Password Fault	20
1.3 References	21

2	Networking Basics in Detail	24
2.1	Basics of Networking	24
2.2	Network Nodes	25
2.2.1	Switches	25
2.2.2	Network Interfaces	28
2.2.3	Repeaters and Hubs	28
2.2.4	Bridges	30
2.2.5	Routers	32
2.2.6	Modems	33
2.2.7	Firewalls	34
2.2.8	Access Points	34
2.3	Campus Area Networks or Corporate Area Networks (CANs)	35
2.4	Metropolitan Area Network(MAN)	37
2.5	Wireless Local Area Network (WLANs)	40
2.6	Storage Area Network (SANs)	40
2.7	The OSI Model in Detail	42
2.7.1	Hardware Layers	43
2.7.2	Software Layers	49
2.8	Data Transmission Packets	51
2.8.1	Ethernet Packet Format and Routing	52
2.8.2	Addressing of Devices	53
2.9	Packet Switched Network	55
2.10	Network Topologies	58
2.10.1	Bus Topology	60
2.10.2	Ring Topology	62
2.10.3	Star Topology	65
2.10.4	Mesh Topology	67
2.10.5	Logical Topology	70
2.11	References	72
3	Detailed Overview of Network Protocols	76
3.1	Introduction	76
3.2	Fundamentals of Network Protocols	77
3.2.1	Internet Protocols (IP)	77
3.2.2	Wireless Network Protocols	78
3.2.3	Network Routing Protocols	79
3.3	How to implement Network Protocols?	80

3.4	MAC Addresses	81
3.4.1	The Open System Interconnection Model	81
3.4.2	Address Details	83
3.4.3	Usage in Hosts	85
3.5	TCP/IP	86
3.5.1	Network Access Layer	87
3.5.2	Internet Layer	87
3.5.3	Transport Layer	88
3.5.4	Application Layer	88
3.6	Detailed Overview of Ethernet	89
3.6.1	Ethernet	89
3.6.2	Fast Ethernet	89
3.6.3	Gigabit Ethernet	90
3.6.4	10 Gigabit Ethernet	91
3.6.5	Asynchronous Transfer Mode (ATM)	91
3.6.6	Power over Ethernet (PoE)	92
3.6.7	Token Ring	92
3.7	Network Control Strategies	93
3.7.1	About Network Infrastructure Devices	93
3.7.2	Threats to Network Infrastructure Devices	94
3.7.3	How to Improve Security in Network Infrastructure Devices	94
3.7.4	Separate and Segment Networks along with the Functions	95
3.7.5	Separating the Sensitive Information Physically	95
3.7.6	Separating Sensitive Information Virtually	95
3.7.7	Restrict Lateral Communications which are not Necessary	96
3.7.8	Harden Network Devices	96
3.7.9	Provide Secured Access to Infrastructure Devices	97
3.7.10	Perform Out-of-Band Management	98
3.7.11	Validate Authenticity of both Software and Hardware	99
3.8	References	100
4	Detailed Overview of Network Servers	103
4.1	Introduction	103
4.2	Basics of Network Server	104
4.3	Key Components of a Server	105

4.3.1	Processor	105
4.3.2	RAM	105
4.3.3	Power Supply	106
4.3.4	Hard Disk	106
4.4	Server Security	107
4.4.1	SSH Keys	107
4.4.2	Brief About Firewalls	108
4.4.3	Private Networking and VPNs	109
4.4.4	Using PKI (Public Key Infrastructure) as well as SSL/TLS Encryption	109
4.4.5	Service Auditing	110
4.4.6	File Auditing and IDS	110
4.4.7	Isolated Execution Environments	110
4.5	Network Administrator	111
4.6	User Accounts	111
4.7	Network Authentication Options	112
4.7.1	Biometrics	112
4.7.2	Token Authentication	112
4.7.3	Transaction Authentication	113
4.7.4	Multi-factor Authentication	113
4.7.5	Out of band Authentication	114
4.8	Establishing Resource Controls	114
4.9	Vulnerability Scanning	115
4.9.1	Authenticated Scans	115
4.9.2	Unauthenticated Scans	116
4.10	References	116
5	Detailed Overview of Network Connectivity Devices	120
5.1	Overview	120
5.1.1	The Network Interface Card (NIC)	122
5.1.2	Hub	122
5.1.3	Switch	123
5.1.4	Bridge	124
5.1.5	Gateways	124
5.1.6	Router	125
5.1.7	Other Devices	126
5.2	Network Switches	129

5.2.1	Classification	130
5.2.2	Configuration of Switches	130
5.2.3	Roles and Functions	131
5.3	Routers	132
5.3.1	Types of Message Deliver	133
5.3.2	Routing Concepts	134
5.3.3	Adaptive and Non-adaptive Routing	135
5.3.4	Routing Protocols	136
5.4	Gateway	141
5.4.1	Types of Gateways	141
5.5	Network Bridges	143
5.5.1	Types of Bridging	143
5.6	Wireless Network Connectivity	146
5.6.1	Types of Wireless Networks	146
5.7	Vulnerabilities of Network Connectivity Device	153
5.7.1	Vulnerability	153
5.7.2	Vulnerability Assessment	154
5.7.3	Penetration Testing	154
5.8	Network Connectivity Device Attacks	156
5.8.1	Attack on Switches	156
5.8.2	Attacks on Routers	161
5.8.3	Attacks on Wireless Network	163
5.9	Network Connectivity Defense	165
5.10	Network Hardening	169
5.10.1	Resetting Default Account Settings	169
5.10.2	Password Phrasing	169
5.10.3	Shut Unnecessary Ports	170
5.10.4	Remove Rogue Connections	170
5.10.5	Debloating	170
5.10.6	Implementing Security Patches	170
5.10.7	Installing an IDS	170
5.10.8	Setting Up Intrusion Prevention System	171
5.10.9	Backup and Restoration of Data	171
5.10.10	Disabling Cookies	171
5.10.11	Using Virtual Machines	171
5.10.12	Using Anti-malware	172
5.10.13	Installing Firewalls	172
5.11	References	172

6	Network Transmission Media Security	177
6.1	Overview	177
6.2	Essentials of Network Transmission Media	178
6.3	Types of Transmission Media	179
6.4	Media Selection	180
6.4.1	Copper Media	181
6.4.2	Wireless Media	181
6.5	Guided Media or Bound or Wired Transmission Media	182
6.5.1	Twisted Pair Cable	183
6.5.2	Coaxial Cable	185
6.5.3	Optical Fiber Cable	186
6.6	Unguided Media or Unbound or Wireless Transmission Media	188
6.6.1	Radio Waves	189
6.6.2	Microwaves	189
6.6.3	Infrared	190
6.7	Bandwidth	191
6.8	Light Waves	192
6.9	Wireless Communication Technologies	193
6.9.1	Radio Frequency Transmission	193
6.9.2	Infrared Transmission	193
6.9.3	Microwave Transmission	193
6.9.4	Light Wave Transmission	194
6.10	Wireless Signals	195
6.10.1	What are Wireless Signals?	196
6.10.2	Types of Wireless Signals	196
6.11	Transmission Media Vulnerabilities	200
6.11.1	Vulnerabilities (Computing)	200
6.11.2	Causes of Vulnerabilities and Prevention	200
6.12	Security for Various Types of Transmission Media	201
6.12.1	Securing Wireless Network	202
6.12.2	Working of a Wireless Network	202
6.12.3	Types of Attacks Generally Wireless Network Posses	203
6.12.4	Ways to Improve Wireless Security	203
6.13	Technology as a Saving Mode	204
6.14	References	205

Part II - Securing The Perimeter	209
7 Real World Perimeter Security Threats and How to Deal With Them	214
7.1 What is Perimeter Security?	214
7.2 Perimeter Security Fundamentals	215
7.3 The Perimeter	215
7.4 Security Challenges	216
7.5 Security Scenario 1	216
7.6 Security Scenario 2	217
7.7 References	219
8 Understanding the Environment	222
8.1 Essentials of Internet Security	222
8.2 Understanding the Environment	223
8.3 Basic Internet Concepts	223
8.4 How do Hackers Hack your Passwords?	225
8.4.1 How to Enhance your Safety by an Excellent Passcode	226
8.4.2 Understanding Identity Theft	226
8.4.3 What do Identity thieves do?	227
8.4.4 How to Prevent It?	227
8.5 Internet Services	228
8.5.1 Types of Internet Services	228
8.6 Standards & RFCs	230
8.6.1 Standardization Process	230
8.6.2 Proposed Standard	231
8.7 References	232
9 How to Hide the Private Network?	234
9.1 Introduction	234
9.2 History of Private Networks	235
9.2.1 Enterprise Private Network (EPN)	235
9.2.2 Virtual Private Network (VPN)	236
9.3 Evolution of IP Address that Private Networks Use	238
9.3.1 IPv4	238
9.3.2 IPv6	239
9.4 Network Address Translation (NAT)	240

9.4.1	IP Masquerading	240
9.4.2	Advantages of NAT	240
9.4.3	Disadvantages of NAT	240
9.4.4	Types of NAT	241
9.4.5	Network Address Translation in IPv6	243
9.4.6	Problems and Limitations	243
9.5	Port Address Translation (PAT)	243
9.5.1	Difference between NAT and PAT	244
9.6	Port Forwarding or Mapping	245
9.6.1	Applications of Port Forwarding or Mapping	245
9.6.2	Types of Port Forwarding or Mapping	246
9.7	Network Segmentation	249
9.7.1	Improving Security	249
9.7.2	Importance of Network Segmentation	250
9.7.3	Demerits of Network Segmentation	250
9.8	Software Defined Networking (SDN)	251
9.8.1	SDN Control Plane	253
9.8.2	Applications of SDN	254
9.8.3	Disadvantage of SDN	255
9.9	References	255

10 Everything You Should Know About Securing the Perimeter 259

10.1	Understanding the Perimeter	259
10.1.1	Physical Defense at the Perimeter	260
10.1.2	Perimeter Security for Data Centres	261
10.2	Detailed Overview of Firewalls	262
10.2.1	History of Firewalls	262
10.2.2	Categories of Firewall	263
10.2.3	Limitations of Firewalls	264
10.2.4	Firewall Software & Tools	264
10.2.5	Steps of Installing Firewalls	266
10.3	Firewall Considerations	268
10.4	Extranets	270
10.4.1	How does it Work?	271
10.4.2	Difference Between Extranet and Intranet	271
10.4.3	Advantages of Extranet	272
10.4.4	Disadvantages of Extranet	273

10.4.5	History of Extranet	273
10.4.6	How to Use it?	274
10.5	Network Appliances	274
10.5.1	Advantages of Network Appliances	275
10.5.2	Components of Network Perimeter	275
10.6	Network Perimeter Requirements	277
10.6.1	Network Perimeter Guidelines	277
10.7	Proxy Server	278
10.7.1	Uses of Proxy Servers	279
10.7.2	Benefits of Proxy Server	279
10.7.3	How does it Work?	280
10.7.4	Types of Proxy Servers	280
10.7.5	Proxy Hacking	283
10.7.6	Proxy Server Security	284
10.8	Demilitarized Zones (DMZs)	284
10.8.1	Purpose of DMZ	285
10.8.2	Importance of DMZ	285
10.8.3	Services Provided By DMZ	286
10.8.4	Demilitarized Zone Designs	286
10.8.5	DMZ Placement and Function	287
10.8.6	Benefits of Demilitarized Zone	287
10.8.7	Weakness of DMZ	288
10.9	Single Firewall DMZ	288
10.10	Dual Firewall DMZ	291
10.11	Honeypots	293
10.11.1	Mechanism of Honeypots	294
10.11.2	Benefits and Drawbacks of Honeypots	294
10.11.3	Types of Honeypots	295
10.12	References	296
11	How to Protect Moving Data on Internet?	299
11.1	Secure the Moving Data	299
11.2	Confine Cloud Sharing or Elective Exchange Techniques	300
11.3	Distinguish Basic Resources and Vulnerabilities	300
11.3.1	Execute Security Structure for Information	301
11.3.2	Data in Transit and Data in Motion	301
11.4	Authentication	302

11.5	Cryptography	303
11.6	Digital Certificates	304
11.6.1	Who can Issue a Computerized Declaration?	307
11.6.2	Contrast between Computerized Endorsement and Advanced Mark	307
11.7	Hash Tables	307
11.7.1	Basics of Hash Table	307
11.7.2	Hash Work	309
11.8	Cookies	309
11.8.1	What do Web Cookies Do?	309
11.8.2	Data Obtained by Cookies	310
11.9	Captcha	311
11.9.1	Know the Importance of Captcha	311
11.9.2	Instructions to Create CAPTCHA	311
11.9.3	Why CAPTCHA is Important?	312
11.10	Virtual Private Networks (VPN)	312
11.10.1	Remote Access VPN	312
11.10.2	Site-to-site VPN	313
11.10.3	Portable VPN	313
11.10.4	Equipment VPN	313
11.10.5	VPN Apparatus	314
11.10.6	How can it Help?	314
11.11	References	314

12 Utilities and Tools for Securing the Perimeter 317

12.1	Introduction	317
12.2	Using Basic Tools	318
12.3	Ifconfig/Ipconfig	319
12.3.1	Ifconfig	319
12.3.2	Ipconfig	321
12.4	Whois	324
12.5	Nslookup	325
12.6	PING	327
12.7	Traceroute	330
12.8	Telnet	332
12.9	Secure Shell	333
12.10	Monitoring Tools and Software	335
12.10.1	How is Network Threat Visibility Important?	335

12.10.2	Network Security Monitoring Tools into Action	336
12.10.3	New Technologies in the Market	337
12.10.4	The Best Network Security Monitoring Tools Available	337
12.11	Introducing Nagios	338
12.11.1	Nagios Core and Nagios XI	338
12.11.2	Working of Nagios	339
12.11.3	Features	340
12.12	Solarwinds	340
12.12.1	What are the Problems that Solarwinds Help to Resolve?	343
12.12.2	How Templates Help to Simplify Monitoring?	343
12.12.3	Solarwinds Monitoring on Orion Platform	344
12.12.4	Solar Winds Licensing	344
12.13	Wireshark	344
12.13.1	Purpose	345
12.13.2	Features	345
12.13.3	Do not get Confused Wireshark with	347
12.14	SNORT	347
12.14.1	Uses of Snort	347
12.14.2	Third Party Tools interfacing with Snort	348
12.14.3	Business Benefits of Snort	348
12.15	NMap	349
12.16	Nikto	350
12.16.1	How does the Scan on Nikto Work?	351
12.17	OpenVAS	351
12.18	Mestaspolit	353
12.18.1	Metasploit Framework Edition	354
12.18.2	Metasploit Community Edition	354
12.18.3	Metasploit Express	354
12.18.4	Metasploit Pro	354
12.18.5	Armitage	355
12.18.6	Cobalt Strike	355
12.19	The Browser Exploitation Framework (BeEF)	355
12.19.1	User Interface	356
12.19.2	A Communication Server	356
12.20	Other Products	357
12.20.1	Cacti	357

12.20.2 Zabbix	357
12.20.3 Ntop	357
12.20.4 Icinga	358
12.20.5 Spiceworks	358
12.20.6 Observium	359
12.21 References	359

13 Identify Vulnerabilities and How to Defend them 364

13.1 Introduction	364
13.2 Malware Attacks	365
13.2.1 Proactive Solutions	365
13.2.2 How Proactive Malware Defense should be?	366
13.3 Botnets, Malware, & Known vs Unknown Vulnerabilities	367
13.4 Zero-day Vulnerability	368
13.4.1 Example of a Zero-day Attack	370
13.4.2 Few Facts about Zero-day Vulnerabilities	371
13.5 Software Exploit	371
13.5.1 Where do Exploits come from?	372
13.5.2 How do you Recognize Exploits?	372
13.5.3 How do you Fix Exploits?	373
13.5.4 How to Prevent Hackers from using Exploits?	373
13.5.5 Easily Protect yourself from Exploits	373
13.6 SQL Injection	373
13.6.1 How and Why is an SQL Injection Attack Performed	374
13.6.2 How to Prevent an SQL Injection?	375
13.7 Java Vulnerabilities	375
13.7.1 Java-specific Vulnerabilities	376
13.7.2 Top Java Vulnerabilities	376
13.8 Social Engineering Exploits	378
13.8.1 A brief about Social Engineering	378
13.8.2 Lifecycle of Social Engineering Attack	379
13.8.3 Social Engineering Prevention	382
13.9 Phishing Attacks	382
13.9.1 Phishing Attack Examples	383
13.9.2 Phishing Techniques	383
13.9.3 Phishing Protection	384
13.10 Network Threats	385
13.11 Broadcast Storm	386

13.11.1 What does Broadcast Storm mean?	386
13.12 Dictionary Attacks	388
13.12.1 Two Counter-measures against Dictionary Attacks	388
13.13 Freak Exploits	389
13.14 Logjam Exploits	389
13.15 Spams	391
13.16 Session Hijacking Attack	392
13.16.1 Examples	393
13.17 Tarpitting	394
13.17.1 The Tarpit Idea	394
13.17.2 SMTP Tarpit	395
13.18 Denial of Service	396
13.19 Transport Layer Security Vulnerability	397
13.19.1 POODLE	398
13.19.2 Prevention	399
13.20 References	399
Appendix A: Figures	407
Appendix B: Tables & Graphs	415
Tables	415
Graphs	416
Appendix C: Glossary	417
Index	432