

DISTRIBUTED USER  
MANAGEMENT & BILLING  
SYSTEM

by  
Ashar Naseer



Supervised

by  
Professor Fazal Wahab

A report is submitted to the department of Computer Science,  
Bahria Institute of Management and Computer Sciences,  
Islamabad

In partial fulfillment of requirement for the degree of MCS

---

**Department of Computer Sciences**  
Bahria Institute of Management and Computer Sciences, Islamabad  
University of Peshawar, Peshawar

## TABLE OF CONTENTS

Acknowledgments .....	1
Certificate.....	2
Abstract.....	3
<i>Chapter 1. OVERVIEW</i> .....	4
1.1 Introduction.....	4
1.2 Requirement Analysis .....	6
1.3 System Design .....	8
1.3.1 Environment Setup.....	8
1.3.2 RADIUS Server.....	9
1.3.3 Administrative & User Front-End.....	9
1.3.4 Database Design & Implementation .....	10
1.4 Test Philosophy .....	10
1.4.1 Windows NT RAS Client.....	10
1.4.2 Web Client front-end.....	11
<i>Chapter 2. SYSTEM ENVIRONMENT</i> .....	12
2.1 Sun Solaris 8.....	12
2.1.1 Availability .....	12
2.1.2 Scalability.....	13
2.1.3 Reliability.....	13
2.1.4 Universal .....	14
2.1.5 Usability.....	14
2.1.6 Networking Enhancements.....	14
2.2 GNU Compiler Collection (GCC).....	15
2.2.1 Language Standards .....	16
2.3 Sudo.....	19
2.4 Apache Web Server.....	20
2.4.1 DBM databases for authentication .....	22
2.4.2 Customized responses to errors and problems .....	22
2.4.3 Multiple DirectoryIndex directives .....	22
2.4.4 Unlimited flexible URL rewriting and aliasing.....	22
2.4.5 Content negotiation .....	22
2.4.6 Virtual Hosts .....	22
2.4.7 Configurable Reliable Piped Logs .....	23
2.4.8 Implementation Specifics.....	23
2.5 PostgreSQL.....	24
<i>Chapter 3. RADIUS SERVER</i> .....	26
3.1 Overview .....	26
3.2 User Authentication with RADIUS.....	28

3.3	RADIUS Installation.....	30
3.4	RADIUS Enhancements.....	34
3.4.1	Database Connection.....	35
3.4.2	User Login Status Checks.....	36
3.4.3	Maximum Login Time Notification.....	37
3.4.4	Register Logon in Database.....	38
3.4.5	Logoff Activities.....	39
<i>Chapter 4. ADMINISTRATIVE &amp; USER FRONT-END.....</i>		41
4.1	Front-end Overview.....	41
4.2	PHP & HTML Development Philosophy.....	41
4.3	HTTP Authentication.....	43
4.4	Administrative Front-end Modules.....	44
4.4.1	Administrative Root.....	44
4.4.2	New User.....	45
4.4.3	Search User.....	47
4.4.4	Restricted Phone Numbers Module.....	51
4.4.5	Transaction Add Module.....	53
4.4.6	User Information Update Module.....	55
4.4.7	Package Add Module.....	57
4.4.8	Package Management.....	58
4.4.9	Dealer Add.....	60
4.4.10	Dealer Management.....	61
4.4.11	Logged In Users.....	64
4.5	Administrative Front-end Data Flow.....	65
4.6	Customer Front-end Modules.....	77
4.7	Customer Front-end Data Flow.....	79
<i>Chapter 5. PHYSICAL DATA MODEL.....</i>		81
5.1	Introduction.....	81
5.2	The Tables.....	84
5.2.1	Account Usage Information.....	84
5.2.2	User Credit Information.....	86
5.2.3	Dealer Information.....	87
5.2.4	Date Mark for Daily Reporting Module.....	89
5.2.5	Package Information.....	90
5.2.6	Phone Number Restriction Table.....	92
5.2.7	Current Logged In Users Table.....	93
5.2.8	Account Balance Update Transaction Log.....	95
5.2.9	User Information.....	98
<i>Chapter 6. SYSTEM UTILITIES.....</i>		102
6.1	Overview.....	102
6.2	Account Expiry Report.....	102
6.3	Package Usage and Remaining Balance Report.....	103

6.4	Bill Run Module .....	104
6.5	User Profile .....	105
6.6	Password Change Script .....	106
6.7	Daily Output Script .....	106
	<i>Chapter 7. CONCLUSION</i> .....	108
7.1	Ending Notes .....	108
7.2	Future Development .....	108
	<i>Chapter 8. APPENDICES</i> .....	110
	Appendix A: Source Code for Administrative Front End .....	110
	add_dealer.htm .....	110
	add_usr.php .....	110
	addmon.php .....	113
	addnumb.php .....	115
	addusr.php .....	116
	body.htm .....	119
	ch_dte.php .....	119
	chdte.php .....	120
	dealdel.php .....	120
	dealer.php .....	121
	dealeradd.php .....	123
	dealerman.php .....	124
	dealerup.php .....	125
	delete.php .....	126
	index.html .....	127
	left.htm .....	128
	pack.php .....	128
	packdis.php .....	130
	packen.php .....	131
	packman.php .....	132
	packup.php .....	132
	remphone.php .....	135
	resphone.php .....	136
	run.php .....	137
	tarifadd.php .....	140
	tarr.htm .....	141
	top.php .....	142
	ugrep.php .....	142
	ugrepc.php .....	144
	update.php .....	145
	updmon.php .....	146
	usage.php .....	149
	usage1.php .....	155

usr.htm .....	159
usr_mgt.php .....	159
welcome.txt .....	163
Appendix B: Source Code for Customer Front-end.....	164
index.html.....	164
usage.php .....	164
Appendix C: Schema Creation Scripts.....	171
Overview.....	171
Postgres Scripts.....	171
Appendix D: Configuration files for Environment.....	183
Overview.....	183
Sudoers File.....	183
Apache httpd.conf File.....	183
Appendix E: RADIUS Configuration and Source Files.....	194
Configuration Files .....	194
clients File.....	194
users File .....	194
Source Code.....	195
acct.c .....	195
attrprint.c .....	212
bulddb.c.....	215
conf.h.....	218
dict.c.....	219
Makefile.....	226
md5.c .....	227
md5.h.....	234
radiusd.h.....	236
radiusd.c .....	240
radpass.c.....	281
users.c .....	287
util.c.....	299
version.c .....	304
Appendix F: User Management Utilities .....	307
Overview.....	307
balance.c.....	307
billrun.c.....	309
.profile for Login User .....	311
prog.c.....	311
syspass.sh .....	314
usrmgt.sh.....	314

## List of Figures

<i>Figures</i>	<i>Description</i>	<i>Page</i>
1.	Architecture Design	8
2.	PostgreSQL Architecture	25
3.	RADIUS Architecture	27
4.	Formula for Calculating Session Timeout	38
5.	Formula for Calculating End Balance	39
6.	Login Screen	43
7.	Main Screen	44
8.	Add User Screen	46
9.	Successful User Add	47
10.	User Search Page	48
11.	Search Results Page	48
12.	User Properties Page	49
13.	Change Bill Run Date	50
14.	Usage & Transaction Report	51
15.	Restricted Phone Numbers Page	52
16.	Transaction Add Page	54
17.	Delete User Confirmations	55
18.	Package Add Page	57
19.	Package Selection Page	58
20.	Package Management	59
21.	Package Delete Error	60
22.	Add Dealers	61
23.	Dealer Selection Page	62
24.	Dealer Delete Confirmation	63
25.	Logged In Users	64
26.	Main Hierarchy for User Management and Billing System	66
27.	Data Flow Diagram for New User Addition	67
28.	Data Flow Diagram for Searching and Displaying Users	68
29.	Data Flow Diagram for Restricted Phone Numbers Module	69
30.	Data Flow Diagram for Transaction Addition	70
31.	Data Flow Diagram for User Information Update Module	71
32.	Data Flow Diagram for New Package Addition	72
33.	Data Flow Diagram for Package Management Module	73
34.	Data Flow Diagram for Adding New Dealer	74

35. Data Flow Diagram for Dealer Management	75
36. Data Flow Diagram for Logged In Users Modules	76
37. Customer Login Page	77
38. Data Flow Diagram for Customer Front End Module	80

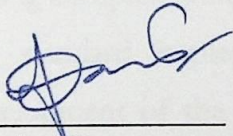
## Acknowledgments

The author wishes to express sincere appreciation to Mr. Fazal Wahab for his assistance in the preparation of this manuscript and much guidance in the project phases. In addition, special thanks to my teachers Mr. Shafaat Sharif, Mr. Asim Gudwara, Mr. Najam who have groomed me with knowledge of Software Engineering, Networking, Databases. Last but not least my acknowledgement to NCR where I have been working for two years, which has sparked a light of professional creativity in my thinking.



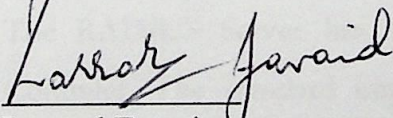
## Certificate

We accept the work contained in this report as a confirming to the required standard for the partial fulfillment of the degree of MCS in the subject of Networking.



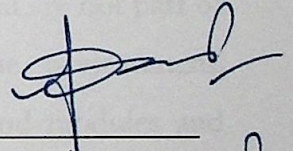
Head of Department

Fazal Wahid



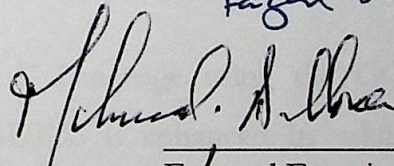
Internal Examiner

ZARRAR JAVAID

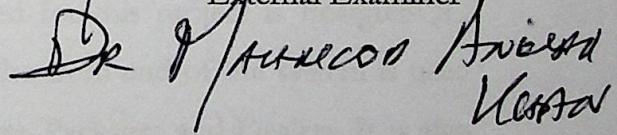


Supervisor

Fazal Wahid



External Examiner



DR. MUNIR AHMAD

## Abstract

The project is a complex Client/Server development that is designed to meet the needs of a billing system at an ISP (Internet Service Provider). The project has undertaken the RADIUS protocol as the core of the system, and deployed it by adding complex rating, credit checks and bill cycle capabilities, that are not part of the standard implementation. It involved the setup of the environment, development of the RADIUS modules, Administrative front-end modules and deployment of the host database.

The RADIUS Server has been coded in the C Language using the GCC Compiler. The standard implementation of RADIUS is enhanced by adding database connectivity to it. The database used for this project is PostgreSQL, which is an open-source database platform. The front-end of the system is used to manage the system activities, including Users, Packages and Dealers. It is also used to add money to the users accounts, and shows the current and historical user usage profiles.

The development of the system has been done on the Sun Solaris 8 for Intel platform. In addition, utilities such as SUDO and a webserver, Apache has also been deployed on this system. The coding of the Front-End is done using the PHP language on the Apache Web Server. This includes the Administrative and Customer Front-End modules. In addition, a number of utilities have also been developed that compliment the working of the system.