

THE EXPERT'S VOICE® IN SQL SERVER

# Pro SQL Server 2005 Replication

*A comprehensive guide to developing, administering, and  
mastering the complexities of replication with SQL Server 2005*

Sujoy P. Paul

Apress®

# Pro SQL Server 2005 Replication



Sujoy P. Paul

## **Pro SQL Server 2005 Replication**

**Copyright © 2006 by Sujoy Paul**

All rights reserved. No part of this work may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying, recording, or by any information storage or retrieval system, without the prior written permission of the copyright owner and the publisher.

ISBN-13: 978-1-59059-650-0

ISBN-10: 1-59059-650-1

Printed and bound in the United States of America 9 8 7 6 5 4 3 2 1

Trademarked names may appear in this book. Rather than use a trademark symbol with every occurrence of a trademarked name, we use the names only in an editorial fashion and to the benefit of the trademark owner, with no intention of infringement of the trademark.

Lead Editor: Jim Sumser

Technical Reviewer: Judith Myerson

Editorial Board: Steve Anglin, Ewan Buckingham, Gary Cornell, Jason Gilmore, Jonathan Gennick,

Jonathan Hassell, James Huddleston, Chris Mills, Matthew Moodie, Dominic Shakeshaft,

Jim Sumser, Keir Thomas, Matt Wade

Project Manager: Sofia Marchant

Copy Edit Manager: Nicole Flores

Copy Editor: Andy Carroll

Assistant Production Director: Kari Brooks-Copony

Production Editor: Ellie Fountain

Composer: Dina Quan

Proofreader: Linda Seifert

Indexer: Carol Burbo

Artist: Kinetic Publishing Services, LLC

Cover Designer: Kurt Krames

Manufacturing Director: Tom Debolski

Distributed to the book trade worldwide by Springer-Verlag New York, Inc., 233 Spring Street, 6th Floor, New York, NY 10013. Phone 1-800-SPRINGER, fax 201-348-4505, e-mail [orders-ny@springer-sbm.com](mailto:orders-ny@springer-sbm.com), or visit <http://www.springeronline.com>.

For information on translations, please contact Apress directly at 2560 Ninth Street, Suite 219, Berkeley, CA 94710. Phone 510-549-5930, fax 510-549-5939, e-mail [info@apress.com](mailto:info@apress.com), or visit <http://www.apress.com>.

The information in this book is distributed on an “as is” basis, without warranty. Although every precaution has been taken in the preparation of this work, neither the author(s) nor Apress shall have any liability to any person or entity with respect to any loss or damage caused or alleged to be caused directly or indirectly by the information contained in this work.

The source code for this book is available to readers at <http://www.apress.com> in the Source Code section. You will need to answer questions pertaining to this book in order to successfully download the code.

*Dedicated to my parents, Subhendu and Kavita Paul*



# Contents at a Glance

About the Author .....	xv
About the Technical Reviewer .....	xvii
Acknowledgments .....	xix
<b>CHAPTER 1</b> Introduction: Distributed Data .....	1
<b>CHAPTER 2</b> Replication Basics .....	19
<b>CHAPTER 3</b> Types of Replication .....	63
<b>CHAPTER 4</b> Configuring Snapshot Replication Using the GUI .....	89
<b>CHAPTER 5</b> Configuring Snapshot Replication Using T-SQL .....	133
<b>CHAPTER 6</b> Snapshot Generation .....	161
<b>CHAPTER 7</b> Internals of Snapshot Replication .....	185
<b>CHAPTER 8</b> Configuring Transactional Replication Using the GUI .....	251
<b>CHAPTER 9</b> Configuring Transactional Replication Using T-SQL .....	301
<b>CHAPTER 10</b> Internals of Transactional Replication .....	357
<b>CHAPTER 11</b> Configuring Merge Replication Using the GUI .....	445
<b>CHAPTER 12</b> Web Synchronization with Merge Replication .....	491
<b>CHAPTER 13</b> Configuring Merge Replication Using T-SQL .....	525
<b>CHAPTER 14</b> The Internals of Merge Replication .....	583
<b>CHAPTER 15</b> Backup and Recovery of Snapshot and Transactional Replication .....	651
<b>CHAPTER 16</b> Backup and Recovery of Merge Replication .....	715
<b>CHAPTER 17</b> Optimizing Snapshot Replication .....	759
<b>CHAPTER 18</b> Optimizing Transactional Replication .....	803
<b>CHAPTER 19</b> Optimizing Merge Replication .....	867
<b>CHAPTER 20</b> Heterogeneous Replication .....	903
<b>APPENDIX A</b> E-R Diagram of the mysales Database .....	943
<b>APPENDIX B</b> SQL Code for the Database .....	947
<b>REFERENCES</b> .....	959
<b>INDEX</b> .....	961



# Contents

About the Author .....	xv
About the Technical Reviewer .....	xvii
Acknowledgments .....	xix
<b>CHAPTER 1 Introduction: Distributed Data .....</b>	<b>1</b>
Distributed Data .....	1
Methods of Distributing Data .....	5
Distributed Data Transactions .....	5
Replication .....	9
SQL Server 2005 Tools .....	14
Summary .....	18
Quick Tips .....	18
<b>CHAPTER 2 Replication Basics .....</b>	<b>19</b>
Publisher-Subscriber Model .....	19
Components of Replication .....	20
Distributor .....	20
Publisher .....	22
Subscriber .....	22
Publication .....	22
Article .....	22
Subscriptions .....	23
Agents .....	25
Physical Replication Models .....	27
Publisher/Distributor–Subscriber Model .....	27
Central Publisher–Multiple Subscribers Model .....	27
Central Subscriber–Multiple Publishers Model .....	29
Multiple Publishers–Multiple Subscribers Model .....	30
Installing and Configuring Replication .....	31
Installing SQL Server Replication .....	31
Configuring with the GUI .....	33
Configuring Database Properties .....	40
Configuring with T-SQL .....	52



Summary.....	60
Quick Tips.....	61
<b>CHAPTER 3 Types of Replication.....</b>	<b>63</b>
Snapshot Replication.....	63
The Snapshot Agent Profile.....	65
How Snapshot Replication Works.....	67
Transactional Replication.....	68
How Transactional Replication Works.....	69
Immediate Updating and Queued Updating Subscriptions.....	70
The Log and Queue Reader Agent Profiles.....	74
Peer-to-Peer Transactional Replication.....	77
Merge Replication.....	80
The Merge Agent Profile.....	83
Summary.....	86
Quick Tips.....	88
<b>CHAPTER 4 Configuring Snapshot Replication Using the GUI.....</b>	<b>89</b>
Configuring Publication.....	90
Configuring a Subscription.....	100
Configuring Push Subscriptions.....	100
Configuring Pull Subscriptions.....	111
Adding and Deleting an Article.....	129
Summary.....	130
Quick Tips.....	131
<b>CHAPTER 5 Configuring Snapshot Replication Using T-SQL.....</b>	<b>133</b>
Dropping Subscriptions and Publications.....	133
Dropping a Pull Subscription.....	134
Dropping a Push Subscription.....	136
Dropping a Publication.....	138
Configuring a Publication Using T-SQL.....	139
Creating a Publication.....	139
Creating a Snapshot Agent.....	142
Granting Publication Access.....	144
Creating Articles for Publication.....	144
Starting the Snapshot Agent.....	147

Configuring a Subscription Using T-SQL .....	150
Configuring Push Subscriptions .....	150
Configuring Pull Subscriptions .....	153
Configuring Anonymous Subscriptions .....	157
Snapshot Replication Stored Procedures .....	158
Summary .....	159
Quick Tips .....	160
<b>CHAPTER 6 Snapshot Generation .....</b>	<b>161</b>
Locating the Snapshot Folder .....	161
Securing Snapshot Data .....	162
Transmitting and Storing Snapshots .....	163
Transferring Compressed Files .....	164
Transferring a Snapshot with Other Methods .....	169
Locating the Snapshot Files .....	170
Determining the Types and Size of Snapshot Files .....	171
Transmitting Snapshots Using FTP .....	174
Summary .....	182
Quick Tips .....	183
<b>CHAPTER 7 Internals of Snapshot Replication .....</b>	<b>185</b>
On the Publisher Server .....	185
The Publication Access List .....	185
The Publication .....	190
The Snapshot Agent .....	199
The Distribution Agent .....	213
The Miscellaneous Clean Up Jobs .....	221
On the Distributor Server .....	224
The Distribution Database .....	224
The MSDB Database .....	236
On the Subscriber Server .....	243
Summary .....	248
Quick Tips .....	249
<b>CHAPTER 8 Configuring Transactional Replication Using the GUI ...</b>	<b>251</b>
Configuring Publications .....	252
Configuring Standard Transactional Publications .....	253
Configuring Transactional Publications with Updatable Subscriptions .....	264

Configuring Subscriptions .....	274
Configuring Updatable Subscriptions for Transactional Publication .....	274
Switching Update Modes .....	284
Configuring Peer-to-Peer Transactional Replication .....	286
Setting Up the Publication .....	286
Enabling the Publication for Peer-to-Peer Replication .....	288
Initializing the Database Schema .....	290
Configuring Peer-to-Peer Topology .....	292
Summary .....	299
Quick Tips .....	300

## CHAPTER 9 **Configuring Transactional Replication Using T-SQL** ..... 301

Configuring Publication .....	302
Configuring Standard Transactional Publication .....	303
Configuring a Push Subscription for Standard Publication .....	313
Configuring a Pull Subscription for Standard Publication .....	315
Configuring Transactional Publication with Updatable Subscriptions .....	316
Configuring a Pull Subscription for Immediate Updating .....	322
Configuring a Push Subscription for Immediate Updating .....	327
Configuring a Push Subscription for Queued Updating .....	329
Configuring a Pull Subscription for Queued Updating .....	330
Switching Between Immediate and Queued Updating Subscriptions .....	333
Configuring Peer-to-Peer Transactional Replication .....	335
Adding the Publication on Node A .....	335
Adding the Articles to the Publication on Node A .....	336
Adding the Subscription on Node A .....	337
Adding the Push Subscription Agent on Node A .....	337
Adding the Publication on Node B .....	338
Adding the Articles to the Publication on Node B .....	339
Adding the Subscription on Node B .....	340
Adding the Push Subscription Agent on Node B .....	340
Checking the Configuration for Peer-to-Peer Replication .....	341
Configuring Bidirectional Transactional Replication .....	343
Transactional Replication Stored Procedures .....	351
Summary .....	354
Quick Tips .....	355

<b>CHAPTER 10</b>	<b>Internals of Transactional Replication</b>	357
	Concurrent Snapshot Processing	357
	The Transaction Log	359
	The Log Reader Agent	365
	The Queue Reader Agent	376
	Transactional Replication with Queued Updating	383
	The Publication	384
	The Subscriptions	389
	Conflict Detection and Resolution	395
	Transactional Replication with Immediate Updating	399
	The Publication	399
	The Subscriptions	401
	Peer-to-Peer Replication	404
	Standard Transactional Publication	417
	The Publication	417
	The Distribution Database	428
	Summary	442
	Quick Tips	443
<b>CHAPTER 11</b>	<b>Configuring Merge Replication Using the GUI</b>	445
	Configuring Publication	446
	Configuring a Publication for Download-Only Articles	446
	Configuring a Publication for Standard Articles	454
	Adding Filters	458
	Configuring Subscriptions	472
	Configuring Pull Subscriptions	472
	Configuring Push Subscriptions	482
	Summary	489
	Quick Tips	490
<b>CHAPTER 12</b>	<b>Web Synchronization with Merge Replication</b>	491
	Web Synchronization Basics	491
	Configuring a Publication for Web Synchronization	492
	Configuring IIS for Web Synchronization	494
	Configuring SSL for Web Synchronization	495
	Configuring the IIS Server for Web Synchronization	504
	Setting Permissions for the SQL Server Replication Listener	512
	Running IIS in Diagnostic Mode	513

Configuring Subscriptions for Web Synchronization . . . . .	516
Summary . . . . .	524
Quick Tips . . . . .	524
<b>CHAPTER 13 Configuring Merge Replication Using T-SQL . . . . .</b>	<b>525</b>
Configuring Publications . . . . .	525
Configuring Publication with Download-Only Articles . . . . .	527
Configuring Publication with Standard Articles . . . . .	533
Configuring Subscriptions . . . . .	565
Configuring Client-Type Push Subscriptions for Download-Only Articles . . . . .	565
Configuring Pull Subscriptions for Standard Articles . . . . .	569
Identity Range Management . . . . .	572
Configuring Automatic Range Management . . . . .	573
Merge Replication Stored Procedures . . . . .	578
Summary . . . . .	581
Quick Tips . . . . .	582
<b>CHAPTER 14 The Internals of Merge Replication . . . . .</b>	<b>583</b>
The Merge Agent . . . . .	583
Subsystems and Proxies . . . . .	592
Using SQLCMD . . . . .	592
The Roles of Subsystems and Proxies . . . . .	597
Publication and Subscriptions . . . . .	610
Publication with Download-Only Articles . . . . .	611
Publication with Standard Articles and Parameterized Filters . . . . .	627
Conflict Detection and Resolution . . . . .	645
Summary . . . . .	649
Quick Tips . . . . .	650
<b>CHAPTER 15 Backup and Recovery of Snapshot and Transactional Replication . . . . .</b>	<b>651</b>
Snapshot Replication . . . . .	651
Backing Up the Publication Database . . . . .	653
Restoring the Publication Database . . . . .	663
Considerations for Other Databases . . . . .	668

Transactional Replication . . . . .	669
Validating Subscriptions . . . . .	669
Standard Read-Only Transactional Replication . . . . .	678
Transactional Publication with Updatable Subscriptions . . . . .	688
Peer-to-Peer Replication . . . . .	696
Log Shipping with Transactional Replication . . . . .	700
Summary . . . . .	711
Quick Tips . . . . .	713
<b>CHAPTER 16 Backup and Recovery of Merge Replication . . . . .</b>	<b>715</b>
Publication with Download-Only Articles . . . . .	715
Backing Up the Publication Database . . . . .	716
Restoring the Publication Database for Push Subscription . . . . .	716
Restoring the Publication Database for Pull Subscription . . . . .	722
Synchronizing Subscriptions with No-Sync Initialization Using T-SQL and SQLCMD . . . . .	740
Backing Up and Restoring Subscription Databases . . . . .	742
Validating Subscriptions for Merge Replication . . . . .	745
Log Shipping with Download-Only Articles . . . . .	750
Configuring Log Shipping on the Primary Server . . . . .	751
Configuring Log Shipping on the Secondary Server . . . . .	753
Adding the Secondary Server Information to the Primary Server . . . . .	756
Summary . . . . .	757
Quick Tips . . . . .	758
<b>CHAPTER 17 Optimizing Snapshot Replication . . . . .</b>	<b>759</b>
Optimizing Performance . . . . .	759
Using the System Monitor . . . . .	761
Using SQL Server Profiler . . . . .	784
Best Practices for Snapshot Replication . . . . .	798
Summary . . . . .	800
Quick Tips . . . . .	802
<b>CHAPTER 18 Optimizing Transactional Replication . . . . .</b>	<b>803</b>
Performance Considerations for the Transaction Log . . . . .	803
Using Tracer Tokens . . . . .	806
Using the System Monitor . . . . .	812
Using SQL Trace . . . . .	818

Using the Database Engine Tuning Advisor .....	841
Best Practices for Transactional Replication .....	860
Summary .....	865
Quick Tips .....	866
<b>CHAPTER 19 Optimizing Merge Replication .....</b>	<b>867</b>
Using the System Monitor .....	867
Using the SQL Server Profiler .....	869
Adjusting Publication Retention .....	894
Changing Merge Agent Parameters .....	895
Snapshot Considerations .....	897
Best Practices for Merge Replication .....	898
Summary .....	901
Quick Tips .....	902
<b>CHAPTER 20 Heterogeneous Replication .....</b>	<b>903</b>
Snapshot Replication from an Oracle Publisher to a SQL Server	
Subscriber .....	903
Configuring an Oracle Publication for Snapshot Replication .....	903
Configuring a SQL Server Subscription for Snapshot	
Publication .....	914
Monitoring Replication with Replication Monitor .....	920
Transactional Replication from an Oracle Publisher to a SQL Server	
Subscriber .....	923
Configuring an Oracle Publication for Transactional	
Replication .....	924
Configuring a SQL Server Subscription for Transactional	
Publication .....	931
Summary .....	940
Quick Tips .....	941
<b>APPENDIX A E-R Diagram of the mysales Database .....</b>	<b>943</b>
<b>APPENDIX B SQL Code for the Database .....</b>	<b>947</b>
<b>REFERENCES .....</b>	<b>959</b>
<b>INDEX .....</b>	<b>961</b>

# About the Author



**SUJOY PAUL** has a bachelor's degree in chemical engineering from the University of Toronto, Canada, and a postgraduate degree in the same discipline from the University of Strathclyde, Glasgow, UK. Since then, he has moved on to the software industry and has gained extensive experience in database management systems, such as Microsoft SQL Server 2000, Sybase ASA, and Sybase ASE; data modeling; and case-based tools like PowerDesigner and ERWIN. His background includes expertise in database replication, with a special interest in two-way replication, backup and recovery, performance and tuning, and troubleshooting. He is a Microsoft Certified Professional on SQL Server 2000. His other professional interests include knowledge management, semantic web, and bioinformatics, in which he also has a postgraduate diploma. Currently, he is working for a major consulting company in Toronto, Canada.

He is an avid fan of soccer and tennis. In his spare time he plays squash and enjoys reading literature, and he has also published poetry. He can be reached at [sujoyp@hotmail.com](mailto:sujoyp@hotmail.com).





# About the Technical Reviewer

■ **JUDITH M. MYERSON** is a systems architect and engineer. Her areas of interest include middle-ware technologies, application development, web development, software engineering, network management, servers, security management, information assurance, standards, RFID technologies, and project management. Judith holds a Master of Science degree in engineering, and is a member of the IEEE organization. She has reviewed/edited a number of books, including *Hardening Linux*, *Creating Client Extranets with SharePoint 2003*, and *Microsoft SharePoint: Building Office 2003 Solutions*.



# Acknowledgments

**F**irst of all, I would like to thank Mr. Jim Sumser, without whose constant encouragement and support this book would not have been possible. I would also like to thank Mr. Andy Carroll, Ms. Ellie Fountain, Ms. Kylie Johnson, Ms. Sofia Marchant, Ms. Judith Myerson, and the rest of the Apress team for their unending patience and superb professionalism in constantly striving for excellence. They also gave me sufficient time even when the deadlines had elapsed. I sincerely appreciate that.

I would like to thank my parents for helping me in pursuing my dreams, and my sister, Manashi, who taught me how to dream and helped develop the savoir faire in me. I would also like to thank Didi, Ajoyda, Mohor, Gogol, Ma, Anjanda, Shweta, and my dear friend Bob for being there for me. Finally, I would like to thank my wife, Aditi, who suffered the most during this venture. Her tireless support in proofreading my writing, editing the figures every day and night, and bearing all of this with a smile on her face made it all the more worthwhile.

