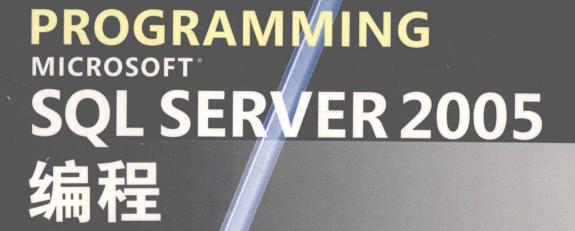
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Andrew J. Brust Stephen Forte

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# Programming Microsoft® SQL Server™ 2005

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Andrew J. Brust Stephen Forte



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### Microsoft SQL Server 2005 编程

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To my wife, Lauren and my son, Miles. Thank you for your love, your support and most of all, your patience.

- Andrew Brust

To CPT James M. Gurbisz: Your sacrifice will not be forgotten.

- Stephen Forte

# **Acknowledgments**

A number of people contributed to this book, both as technical experts and as providers of moral and logistical support. It's impossible to declare one category more important than the other, and so I'd like to thank people in both.

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I would also like to thank a number of people at my company, twentysix New York, for their patience and flexibility as I worked on "the book." Phil Eames, Dave Mittereder, and Jay Rabin were unbelievably tolerant of my erratic schedule and lent much needed moral support when things got really hectic. Lawrence De Voe pitched in numerous times to pick up things that would otherwise have fallen through the cracks. Elizabeth Donsky, although no longer with the company, helped me keep my life and my business in order for almost a decade; the very idea of the book would not have existed without her. On the technical side, Brian Schmitt helped me understand the realities of deploying OLAP into production and managing the process of near-real-time BI. Mark Frawley not only helped me better understand MDX, but he helped me explain it more simply and more precisely in Chapter 19. And all the cool stuff in Chapter 9 on remote debugging is there only because of the assistance and instruction provided by Zach Plevritis.

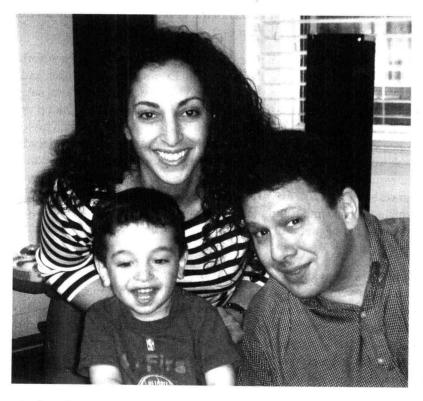
Other "twentysixers" to be thanked are Elsie Pan and Kent Brown, for lending their expertise to this book and each writing a stellar chapter. It's a thrill and an honor to have them as co-authors on this book. And while we're on the topic of coauthors, Sahil Malik, Bill Wolff, and especially Rob Walters have my deep gratitude for coming in late in the project and writing chapters of their own that were crucial to the effort of getting things *done*. Steven Forte gets double thanks: he worked hard on the book, and he worked even harder to hold our friendship sacred when the work got tough.

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#### xx Acknowledgments

And while they were not directly involved in this project, I feel it important to recognize all the good people at Fawcette Technical Publications (FTP) who gave me my "first break" as a technical author for *Visual Basic Programmer's Journal* (now *Visual Studio Magazine*) all the way back in 1994. The positive impact FTP has had on my career is immense, and it continues today. Jim Fawcette, Jeff Hadfield, Patrick Meader, and alumni Frank Moncrief, Lee Thé, and Matt Carter deserve very special thanks. It is rather fitting that Matt Carter, my first-ever editor, is now with Microsoft Press; I guess I need to thank him twice.

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-Andrew Brust

It's nice to have your name on the cover of a book, but without help from various people, this book never would have happened. I'll start with Andrew, since it was all his fault. He recruited me and, with the help of Eileen Crain, brokered the deal with Microsoft Press. He also went above and beyond the call of duty when some coauthors quit or went missing and deadlines loomed.

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We have also had tons of great reviewers. I was blessed to have folks like Kimberly Tripp, Peter DeBetta, and Roman Rehak help out with reading my chapters, as well as Richard Campbell, Goksin Bakir, Malek Kemmou, Jason Gideon, and Julie Lerman.

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Lastly, all of the coauthors made this project so much smoother, but two took time out to write chapters that were my responsibility: thanks to Patrick O'Toole for Chapter 5 on SQL Server Management Studio, and to Ted Lee and Sergei Ivanov for Chapter 16 on SQL Server Integration Services.

-Stephen Forte

### Introduction

When we started out with the idea of writing a book about the new version of Microsoft SQL Server, the notion seemed relatively straightforward. Our goal was to write a book that would provide exhaustive, comprehensive coverage of the product, and that goal seemed practical, for a number of reasons.

All of us involved with this book at its inception had worked with SQL Server for the better part of a decade and had been involved with Microsoft .NET since its early pre-release days. We knew that the next release of SQL Server, then code named "Yukon," would achieve a marriage of sorts between the database server and the .NET common language runtime (CLR).

We knew that the scalability story, which was already working out well with SQL Server 2000, would get better. We knew that post-release pieces of SQL Server 2000, such as Notification Services (and, later, Reporting Services) would be more integrated and feature-laden. We knew that Analysis Services would grow in importance and capability. We greeted these developments with great anticipation. This release of SQL Server would be cheered by database specialists and developer generalists alike; that made it unique and exciting.

With these assumptions, we knew we wanted to immerse ourselves in the product and write a book about it for Microsoft. We knew it would be hard work, but we wanted to understand the product at the level necessary to write the book, and we wanted to impart what we learned to the Microsoft developer community, for which we had been writing since the early 1990s. This seemed like a natural project—a "no brainer" in colloquial terms.

The truth is, we had no idea what we were in for. Bear with us here, because the outcome has been excellent and has given us an important vantage point on SQL Server 2005. But we must be honest: The journey we took in writing this book revealed some very important facts about SQL Server 2005 that we hadn't fully appreciated at the beginning of the project. That changed our approach to writing about SQL Server 2005, and we think it will affect the approach *you* take to learning it.

SQL Server 2005 is a huge release, and, to be truthful, SQL Server is now formidably vast and complex. It is no longer just a phenomenal enterprise relational database management system. It is now a *bona fide* middleware, service-oriented, message-based programming platform; an XML document repository; a desktop and mobile device database engine; a market-leading business intelligence (BI) platform; and a real-time alerting system all rolled into one. In fact, SQL Server isn't one product. It's a collection of products and technologies that, although related, should each be considered separately. How can such a massive product be covered comprehensively in a single book?

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To understand our approach, we ask that you consider likening SQL Server 2005 to, of all things, a Sunday newspaper. A Sunday newspaper is made up of multiple sections, each of which is written separately and appeals to a distinct audience. The sections do have overlapping content and share some readership, of course, but most people don't read the whole paper, and they don't need to. Meanwhile, the entire paper is considered a single publication and those who read it think of themselves as readers of the paper rather than of one or more of its sections. Likewise, SQL Server has many pieces to it; few people will use them all, and people will need to learn about them gradually, over time, as their business needs dictate.

Our book reflects this reality and in many ways replicates the structure of a Sunday newspaper. For one thing, a great number of authors have been involved in producing the book, drawing on their expertise in their chapters' specific subject matter. For another, the context and style of certain chapters differ markedly from those of other chapters. Some chapters cover specific subject matter deeply. Others cover a broader range of material, and do so at a higher level. That's an approach we didn't anticipate when we started the book. But it's the approach we found most effective by the time we finished. We think it makes an otherwise overwhelming set of technologies much more approachable and makes the learning process much more modular.

Make no mistake, though, the overall vision for the book is a cohesive one—to explore the numerous programmability points of SQL Server 2005 and, in so doing, provide widespread coverage of the great majority of the product's features, in a voice that caters to developers' interests.

Whether you read every chapter in the book or just some of them, whether you read the book in or out of order, our goal has been to provide you with practical information, numerous useful samples, and a combination of high-level coverage and detailed discussion, depending on how deep we thought developers would want to go.

Just as the Sunday newspaper doesn't cover everything that's going on in the world, this book won't teach you everything about SQL Server. For example, we don't cover high-availability/fault tolerance features such as replication, clustering, or database mirroring. We don't discuss query plans and optimization, nor do we provide extensive detail on SQL Server Profiler, SQL Trace, or the new Database Engine Tuning Advisor.

We discovered as we wrote the book that covering everything in the product would result in a book unwieldy in size and unapproachable in style. We hope we struck the right balance, providing a *digestible* amount of information with enough developer detail and enough pointers to other material to help you become a seasoned SQL Server professional.

#### Who This Book Is For

Now that we have established *what* the book does and does not cover, we'd like to clarify just *who* we believe will be most interested in it and best served by it. In a nutshell, this book is for

.NET and SQL Server developers who work with databases and data access, at the business logic/middle-tier layer as well as the application level.

In our perhaps self-centered view of the development world, we think this actually describes *most* .NET developers, but clearly some developers are more interested in database programming in general, and SQL Server specifically, than others, and it is this more interested group we want to reach.

We assume you have basic, working knowledge of .NET programming in C# on the client and Transact-SQL (T-SQL) on the server. We also assume you are comfortable with the basics of creating tables, views, and stored procedures on the server and working with ADO.NET Connection, Command, DataReader, and DataSet objects on the client using the SqlClient ADO.NET provider. On the tools side, we assume you are familiar with the prior generation of SQL Server and .NET tools—specifically, SQL Server Enterprise Manager, SQL Query Analyzer, and Visual Studio .NET 2002 or 2003. Having knowledge of these tools will better equip you to learn about their successors: SQL Server Management Studio and Visual Studio 2005.

Having said all that, we have a fairly liberal policy regarding these prerequisites. For example, if you've only dabbled with T-SQL or you're more comfortable with Visual Basic .NET than C#, that's OK, as long as you're willing to try and pick up on things as you read along. Most of our code samples are not that complex. However, our explanations assume some basic knowledge on your part, and you might need to do a little research if you lack the experience.

In addition to covering the SQL Server core relational engine and its ancillary services, this book also provides in-depth coverage of SQL Server's BI features, including Integration Services, Reporting Services, and the OLAP and Data Mining components of Analysis Services. Although ours is not a BI book per se, it is a database developer's book, and we feel strongly that all these features should be understood by mainstream database developers. BI is really one of the cornerstone features of SQL Server 2005, so the time is right for traditional database developers to "cross over" to the world of BI.

Realizing that these technologies, especially OLAP and data mining, will be new territory for many readers, we assume no knowledge of them on your part. Any reader who meets the prerequisites already discussed should feel comfortable reading about these BI features and, more than likely, feel ready and excited to start working with BI after reading the BI-focused chapters.

# **How This Book Is Organized**

This book is broken down into three parts. Each part follows a specific SQL Server "theme," if you will.

Part I covers topics relevant to work on the database server, including the creation, management, and maintenance of entities you will design into your databases. We cover topics relating to database design (including the new XML data type); T-SQL programming of views, stored procedures, triggers, and functions (including new XQuery extensions); and security-

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related entities. We also introduce you to SQL Server's new .NET CLR integration features, which cut across our discussions of data types and server-side programming.

In Part II, we move away from the server and discuss concepts relating to actual database software development, be it in the middle tier or at the application level. We also cover various topics relevant to extending your databases' reach with technologies such as HTTP endpoints, SQL Server Service Broker, SQL Server Notification Services, SQL Server Express Edition, and SQL Server Everywhere Edition.

Part III is our BI section. In it, we provide efficient, practical coverage of SQL Server Integration Services, Analysis Services, and Reporting Services. We are particularly proud of this section because we assume virtually no BI knowledge on your part and yet provide truly deep coverage of SQL Server BI concepts, features, and programming.

Together, the three parts of the book provide you with a broad inventory of a slew of SQL Server 2005 developer-relevant features and the conceptual material necessary to understand them. We don't cover everything in SQL Server 2005, but we will arm you with a significant amount of core knowledge and give you the frame of reference necessary to research the product further and learn even more.

# **System Requirements**

To follow along with the book's text and run its code samples successfully, we recommend that you install the Developer Edition of SQL Server 2005, which is available to a great number of developers through Microsoft's MSDN Premium subscription, on your PC. You will also need Visual Studio 2005; we recommend that you use the Professional Edition or one of the Team Edition releases, each of which is also available with the corresponding edition of the MSDN Premium subscription product.



**Important** To cover the widest range of features, this book is based on the Developer Edition of SQL Server 2005. The Developer Edition possesses the same feature set as the Enterprise Edition of the product, although Developer Edition licensing terms preclude production use. Both editions offer a superset of the features available in other editions (Standard, Workgroup, and Express). We believe it is in the best interest of developers for us cover the full range of developer features in SQL Server 2005, including those available only in the Enterprise and Developer editions.

Most programmability features covered in this book are available in every edition of SQL Server 2005. Notable exceptions include the lack of Notification Services and Analysis Services support in the Express and Workgroup editions. Users of production editions other than the Enterprise Edition should consult the SQL Server 2005 Features Comparison page at <a href="http://www.microsoft.com/sql/prodinfo/features/compare-features.mspx">http://www.microsoft.com/sql/prodinfo/features/compare-features.mspx</a> for a comprehensive list of features available in each edition, in order to understand which features covered in the book are available to them in production.

To run these editions of SQL Server and Visual Studio, and thus the samples in this book, you'll need the following 32-bit hardware and software. (The 64-bit hardware and software requirements are not listed here but are very similar.)

- 600-MHz Pentium III-compatible or faster processor (1-GHz or faster processor recommended).
- Microsoft Windows 2000 Server with Service Pack (SP) 4 or later; Windows 2000 Professional Edition with SP4 or later; Windows XP with SP2 or later; Windows Server 2003 Standard Edition, Enterprise Edition, or Datacenter Edition with SP1 or later; or Windows Small Business Server 2003 with SP1 or later.
- For SQL Server, at least 512 MB of RAM (1 GB or more recommended).
- For Visual Studio, 192 MB (256 MB recommended).
- For SQL Server 2005, approximately 350 MB of available hard disk space for the recommended installation. Approximately 425 MB of additional available hard disk space for SQL Server Books Online, SQL Server Mobile Everywhere Books Online, and sample databases.
- For Visual Studio 2005 without MSDN Library, 1 GB of available space required on system drive, 2 GB of available space required on installation drive. For Visual Studio 2005 with MSDN Library: 1 GB of available space required on system drive; 3.8 GB of available space required on installation drive with a full installation of MSDN; 2.8 GB of available space required on installation drive with a default installation of MSDN.
- CD-ROM or DVD-ROM drive.
- Super VGA ( $1024 \times 768$ ) or higher resolution video adapter and monitor.
- Microsoft Mouse or compatible pointing device.
- Microsoft Internet Explorer 6.0 SP1 or later.
- For SQL Server Reporting Services, Microsoft Internet Information Services (IIS) 5.0 or later and ASP.NET 2.0 or later.

# **Using the Samples**

All the code samples discussed in this book can be downloaded from the book's companion content page at the following address:

http://www.microsoft.com/mspress/companion/0-7356-1923-9/

The companion materials are supplied in the form of a single MSI file that you can run directly from the preceding URL or download and run later. The MSI allows you to install the companion materials in a folder of your own choosing.



**Important** This book and its sample code were written for, and tested against, the initial Release To Manufacturing (RTM) version of SQL Server 2005 Developer Edition. At press time, Microsoft had just released Service Pack 1 (SP1) of SQL Server 2005. Some of the book's sample code has been tested against SP1 and some of the text has been explicitly verified against it, but an exhaustive check of the book and its code was not feasible, given the near simultaneous release of SP1 and this book.

SP1 consists primarily of a combination of bug fixes to the RTM version of SQL Server 2005, as well as the commercial release of the SQL Server 2005 database mirroring functionality, which is not covered in this book. As such, we expect that very little, if any, content or sample code in the book will be incompatible with SP1.

If and when we discover any such incompatibilities, however, our intent is to update the sample code and post errata notes into the book's companion materials, available at <a href="http://www.microsoft.com/mspress/companion/0-7356-1923-9/">http://www.microsoft.com/mspress/companion/0-7356-1923-9/</a>. Please monitor that site for new code updates and errata postings. You might also want to visit <a href="http://spaces.msn.com/PSS2005CUpdt">http://spaces.msn.com/PSS2005CUpdt</a>, where we will post, in blog form, announcements about any such updates. For those of you who use RSS readers, you can subscribe to this blog's RSS feed at <a href="http://spaces.msn.com/PSS2005CUpdt/feed.rss">http://spaces.msn.com/PSS2005CUpdt/feed.rss</a>. SP1, its documentation, and a corresponding update to SQL Server 2005 Books Online can be downloaded from <a href="http://www.microsoft.com/sql/sp1.mspx">http://www.microsoft.com/sql/sp1.mspx</a>.

Because this is a developer book, we often include one or more Visual Studio projects as part of the sample code, in addition to SQL Server Management Studio projects containing T-SQL or Analysis Services script files. Within the companion materials parent folder is a child folder for each chapter. Each chapter's folder, in turn, contains either or both of the following two folders: SSMS and VS. The former typically contains a SQL Server Management Studio solution file with the filename ChapterXX.ssmssln; the latter typically contains a Visual Studio solution file with the filename ChapterXX.sln. After you've installed the companion files, double-click either solution file, or both, to open the sample scripts or code in the appropriate IDE.

The solution files might contain multiple projects. In such cases, each project, and usually each file within it, is referred to in the chapter that the code accompanies. Occasionally, multiple solution files, each in a separate folder, are included with the sample code. When this is the case, the text explains the differences between each solution or the project(s) it contains.

Because most of the code is explicated in the text, you might prefer to create it from scratch rather than open the finished version supplied in the companion sample code. However, the finished version will still prove useful if you make a small error along the way or if you want to run the code quickly before reading through the narrative that describes it.

Some of the SQL Server Management Studio projects contain embedded connections that are configured to point to a default instance of SQL Server running on your local machine. Some of the Visual Studio source code contains connections or default connection strings (sometimes in code, sometimes in settings or config files, other times in the *Text* property of controls

on the forms in the sample projects) that are configured likewise. If you have SQL Server 2005 installed as a default instance on your local machine, with the AdventureWorks sample database, the majority of the sample code should run without modification. If not, you'll need to modify the server name, add an instance name, or both. You'll also need to install Adventure-Works if you have not already done so.

Some chapters rely on the Northwind sample database, the AdventureWorksDW sample data warehouse database, and/or the Adventure Works DW Analysis Services sample database. Chapter 17 contains explicit directions on how to install the Northwind database. To install the AdventureWorksDW data warehouse database and the Adventure Works DW Analysis Services database, you must explicitly select the AdventureWorksDW Sample Data Warehouse and AdventureWorks Sample OLAP options in an advanced SQL Server install (these options appear under the Documentation, Samples, and Databases install option).

### **Support for This Book**

Every effort has been made to ensure the accuracy of this book and the companion content. As corrections or changes are collected, they will be added to a Microsoft Knowledge Base article.

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# **Contributing Authors**

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Kent has 17 years of experience in software development in the pharmaceutical, financial services, insurance, legal, and manufacturing industries. He has authored over 12 articles, primarily on enterprise integration technologies—service-oriented architecture (SOA), Microsoft BizTalk, and SOAP. He has been involved with Microsoft .NET since its early beta, and he spoke at VSLive! 2001 on .NET Remoting. He often plays a mentoring role, providing training, design, and team leadership to help teams establish correct architecture and best practices around new technologies (such as object-oriented programming in .NET and SOA).

Kent is the founder and leader of the New Jersey .NET Architecture and Development User Group (www.njevbug.org). He is also a leader of the NYC Connected Systems User Group (www.nyccsug.org).

Sergei Ivanov is a self-taught programmer who currently works as a software development lead at Microsoft. He started at Microsoft as a Volt contractor in 1998. For the past eight years, he has been on development teams for Windows 2000, Windows XP, SQL Server, and Office RTC. His current project is unannounced. Before joining Microsoft, Sergei was part of several research and development organizations in Europe. As a student at University of Paderborn in Germany, he wrote Windows front ends for the MuPAD computer algebra system and a V-Cam 2D and 3D plotting tool. In 1996, he wrote the first implementation of Public-Key Cryptography Standard #12 in collaboration with RSA, Netscape, and Microsoft, kick-starting adoption of the standard by the Netscape Navigator and Microsoft Internet Explorer browsers.

**Ted Lee** is currently a development lead at Microsoft on the SQL Server Integration Services team and has worked as a software design engineer on both Data Transformation Services (DTS) and SQL Server Integration Services. When not at work, he enjoys hiking and other outdoor activities in the Seattle area with his wife, Adrienne, and their German shepherd dog, Tausha.



**Sahil Malik** is a Microsoft MVP (*C*#), INETA speaker, author of a best-selling ADO.NET 2.0 book, ADO.NET trainer for Keystonelearning.com, and a telerik evangelist. He also works as a consultant, trainer, and mentor in various Microsoft technologies. He frequently speaks at local usergroup meetings and industry events on a variety of .NET-related topics. Sahil can be reached at *www.winsmarts.com*.



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**Patrick O'Toole** is a Visual Studio .NET programmer with 20 years of programming experience. A programmer by day and a writer by night, he has published technical articles online and in *Advisor Guide to Microsoft Visual Basic .NET* magazine. In addition, his screenplays have been pitched to and well received by Hollywood production companies. He currently works for Mercom Systems, Inc., in New Jersey, where his primary focus is developing new applications with AJAX technologies. Past projects have included a content management system and Web site for Zagat Survey, LLC. He resides in northern New Jersey with his wife, two stepdaughters, two cats, and three dogs.

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