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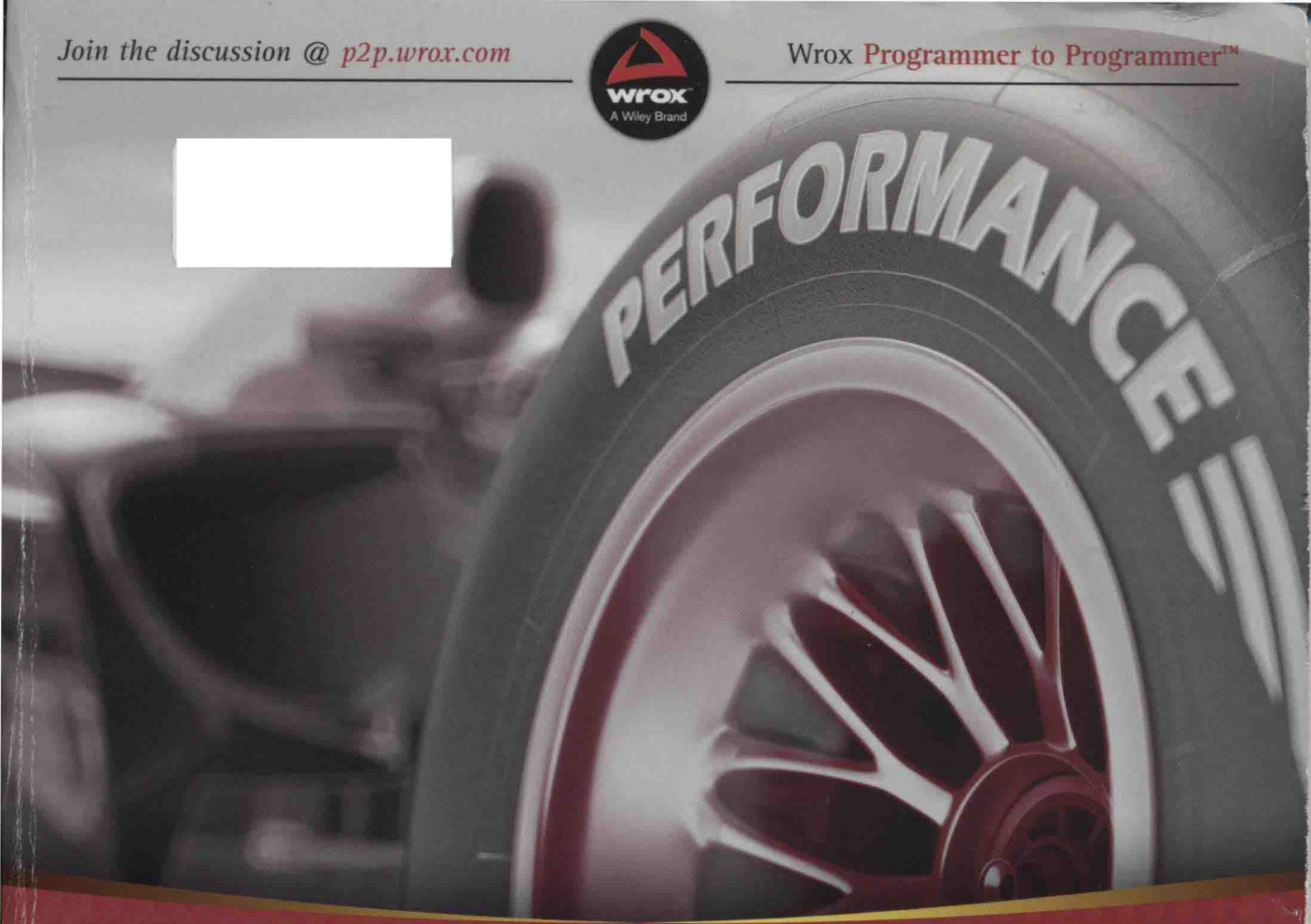

Professional Microsoft® SQL Server® 2014 Integration Services

Brian Knight, Devin Knight, Jessica M. Moss, Mike Davis, Chris Rock

PROFESSIONAL

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Microsoft® SQL Server® 2014 Integration Services

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To my great team and work family at Pragmatic Works

—Brian Knight

Proverbs 3:5-6

—Devin Knight

For Rich: Thank you for your support.

—Jessica M. Moss

To my kids, Gabriel and Sydney — they are the light of my life.

—Mike Davis

To the three girls in my life that mean more than anything to me, Tammy, Calista, and Callie

—Chris Rock

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JESSICA M. MOSS is a well-known practitioner, author, and speaker of Microsoft SQL Server business intelligence and has received a Microsoft MVP award for the past 6 years. She has created numerous data warehouse and business intelligence solutions for companies in different industries and has delivered training courses on Integration Services, Reporting Services, and Analysis Services. Jessica has authored technical content for multiple magazines, websites, and books, including the Wrox book *Professional Microsoft SQL Server 2012 Integration Services*, and has spoken internationally at conferences such as the PASS Community Summit, SharePoint Connections, and the SQLTeach International Conference. As a strong proponent of developing user-to-user community relations, Jessica actively participates in local user groups and code camps in central Virginia. In addition, Jessica volunteers her time to help educate people through the PASS organization.

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ABOUT THE TECHNICAL EDITOR

MICHAEL MCINTYRE recently progressed into the role of Consulting Sales Engineer with Pragmatic Works, coordinating solutions and engagements that utilize the Microsoft BI stack for customers with a variety of BI needs. Previously with Pragmatic Works, he was a BI Software Support Engineer focusing on ETL within SQL Server Integration Services. This transition provided the opportunity to relocate to Salem, New Hampshire, from Jacksonville, Florida. Michael spends his free time with his wife and 3-year-old daughter and enjoys keeping up with and "tinkering" with mobile technologies

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—Brian Knight

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—Devin Knight

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—Jessica M. Moss

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—Mike Davis

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—Chris Rock

INTRODUCTION

THE MOST IMPORTANT BUSINESS INTELLIGENCE TOOL in the Microsoft Swiss Army knife of tools is SQL Server Integration Services (SSIS). This is because the other tools would be nothing without the cleansing and movement of data into a presentable format. The product can extract, transform, and load (ETL) data astonishingly fast. A 2010 benchmark showed movement of more than a terabyte an hour with SSIS! If you're new to SSIS, you've picked a fantastic field to become involved in. The one consistent skill needed in today's technical job market is ETL. If a company wants to establish a partnership with another company, it'll need to communicate data back and forth between the two companies. If your company wants to launch new products, it'll need a way to integrate those products into its website and catalog. All of these types of tasks are going to require the skill set you are developing and will learn in this book.

Companies that had never used SQL Server before are now allowing it in their environment because SSIS is such an easy-to-use and cost-effective way to move data. SSIS competes with the largest ETL tools on the market like Informatica, DataStage, and Ab Initio at a tiny fraction of the price. SQL Server 2014 now offers more components that you use to make your life even easier and the performance scales to a level never seen on the SQL Server platform.

The best thing about SSIS is its price tag: free with your SQL Server purchase. Many ETL vendors charge hundreds of thousands of dollars, if not millions, for what you will see in this book. SSIS is also a great platform for you to expand and integrate into, which many ETL vendors do not offer. Once you get past the initial learning curve, you'll be amazed with the power of the tool, and it can take weeks off your time to market. This author team has trained hundreds of people over the years, and you'll find that the learning curve of SSIS is shallow relative to competing platforms. In SQL Server 2012, the product matured to its third major envisioning. In that release the focus was on scalability, management, and more advanced data cleansing. In SQL Server 2014 an incremental change has happened so new content focuses on patterns in SSIS.

WHO THIS BOOK IS FOR

Because we have used SSIS since the beta stages of SQL Server 2005 and through its evolution into its current form, the idea of writing this book was quite compelling. If you've never used SSIS before, we spend the first chapters focusing on lowering your learning curve on this product. If you've used SSIS in the past, we've added more patterns and best practices to this SQL Server 2014 version of the book to take your skills to the next level. If you're an SSIS 2005 or 2008 user, luckily the interface has not drastically changed, so you'll want to focus on advanced data cleansing and administration, which has gone through a drastic overhaul.

This book is intended for developers, DBAs, and casual users who hope to use SSIS for transforming data, creating a workflow, or maintaining their SQL Server. This book is a professional book, meaning that the authors assume that you know the basics of how to query a SQL Server and have

some rudimentary programming skills. Not many programming skills will be needed or assumed, but it will help with your advancement. No skills in the prior release of SSIS are required, but we do reference it throughout the book when we call attention to feature enhancements.

WHAT THIS BOOK COVERS

Whether you're new to SSIS or an experienced SSIS developer, there's something for you in this book. This book takes you from the architecture and basics of SSIS all the way through to developing hard-core SSIS solutions to solve many of the industry's common business scenarios. The book is tutorial based, meaning that it teaches you through simple examples.

By the time you complete this book, you'll know how to load and synchronize database systems using SSIS by using some of the new SQL Server 2014 features. You'll also know how to load data warehouses, which is a very hot and specialized skill. Even in warehousing, you'll find features in the new 2014 release that you'll wonder how you lived without like the Data Quality Services integration and CDC integration!

HOW THIS BOOK IS STRUCTURED

After discussing the architecture of SSIS, we'll start with the basics by introducing the fundamental concepts of SSIS: the Data Flow and Control Flow. We'll then build through the various other features, including the warehousing and scripting, and proceed to advanced topics like programming and extending the engine. SSIS is a very feature-rich product, and it took a lot to cover the product:

Chapter 1, "Welcome to SQL Server Integration Services," introduces the concepts that we're going to discuss throughout the remainder of this book. We talk about the SSIS architecture and give a brief overview of what you can do with SSIS.

Chapter 2, "The SSIS Tools," shows you how to quickly learn how to import and export data by using the Import and Export Wizard and then takes you on a tour of the SQL Server Data Tools (SSDT).

Chapter 3, "SSIS Tasks," goes into each of the tasks that are available to you in SSIS. These tasks are the building blocks for your SSIS workflow and are much like LEGO block programming.

Chapter 4, "The Data Flow," dives into the Data Flow components in SSIS. These components are where typical ETL developers will spend 75 percent of their time when loading a database.

Chapter 5, "Using Variables, Parameters, and Expressions," instructs you how to use the obscure expression language in SSIS by showing you many example use cases and how to solve them through the language. We also cover in the chapter a new concept of parameters and parameterization of a package.

Chapter 6, "Containers," covers how to use containers to do looping in SSIS and describes how to configure each of the basic transforms.

Chapter 7, "Joining Data," focuses on how to join systems together, whether those systems are two flat files or database platforms. Much of the chapter is spent showing the Lookup Transform.

Now that you know how to configure most of the tasks and transforms, **Chapter 8, "Creating an End-to-End Package,"** puts it all together with a large example that lets you try out your SSIS experience.

Chapter 9, "Scripting in SSIS," shows you some of the ways you can use the Script task in SSIS.

Chapter 10, "Advanced Data Cleansing in SSIS," walks through common patterns in data cleansing and how to accomplish them in SSIS. The chapter also covers Data Quality Services (DQS) and how to integrate it into SSIS.

Chapter 11, "Incremental Loads in SSIS," shows you common patterns you can use to incrementally refresh your data. It also shows you how to use and integrate Change Data Capture (CDC) into SSIS.

Chapter 12, "Loading a Data Warehouse," covers how to load a data warehouse from the ground up through example. Even smaller companies now are finding that to compete they need to make their data work for them by employing a data warehouse. In this chapter we show how to load dimension and fact tables and some of the common issues.

Chapter 13, "Using the Relational Engine," discusses other features in the SQL Server arsenal that can help you build robust and high-performance ETL solutions. The SQL Server relational database engine has many features that were designed with data loading in mind, and as such the engine and SSIS form a perfect marriage to extract, load, and transform your data.

Chapter 14, "Accessing Heterogenous Data," shows you how to connect to systems other than SQL Server like Excel, XML, and web services.

Chapter 15, "Reliability and Scalability," demonstrates how to scale SSIS and make it more reliable. You can use the features in this chapter to show you how to make the package restartable if a problem occurs.

Chapter 16, "Understanding and Tuning the Data Flow Engine," explains the architecture of the SSIS Data Flow engine in detail and how to tune your SSIS packages for maximum efficiency.

Chapter 17, "SSIS Software Development Life Cycle," introduces a software development life cycle methodology to you. It speaks to how SSIS can integrate with Visual Studio Team System.

Chapter 18, "Error and Event Handling," discusses how to handle problems with SSIS with error and event handling.

Chapter 19, "Programming and Extending SSIS," shows the SSIS object model and how to use it to extend SSIS. The chapter goes through creating your own task, and then . . .

Chapter 20, "Adding a User Interface to Your Component," adds a user interface to the discussion.

Chapter 21, "External Management and WMI Task Implementation," walks through creating an application that interfaces with the SSIS to manage the environment. It also discusses the WMI set of tasks.

Chapter 22, "Administering SSIS," shows you how to deploy and administer the packages that you've worked so hard to develop. Much of the work in SSIS in SQL Server 2014 has gone into modifying the way you deploy and administer SSIS packages.

Appendix A, "SSIS Crib Notes," provides solutions to common problems and a cheat sheet for the SSIS expression language.

Appendix B, "SSIS Internal Views and Stored Procedures," gives you a listing and way to use common stored procedures in the SSIS catalog.

Appendix C, "Interviewing for an ETL Developer Position, "is your interview coach to help you ace an interview where SSIS is part of your job description.

WHAT YOU NEED TO USE THIS BOOK

To follow this book, you will only need to have SQL Server 2014 and the Integration Services component installed. You'll need a machine that can support the minimum hardware requirements to run SQL Server 2014. You'll also want to have the AdventureWorks and AdventureWorksDW databases installed. You can find the versions of these databases we used for this book on the Wrox website (`www.wrox.com`). If you download the AdventureWorks databases from CodePlex, they will have a version number at the end of the database names. Make sure that you rename the database to take this version off the name.

CONVENTIONS

To help you get the most from the text and keep track of what's happening, we've used a number of conventions throughout the book.

> **WARNING** *Warnings hold important, not-to-be-forgotten information that is directly relevant to the surrounding text.*

> **NOTE** *Notes indicate notes, tips, hints, tricks, and asides to the current discussion.*

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