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Microsoft® Big Data Solutions

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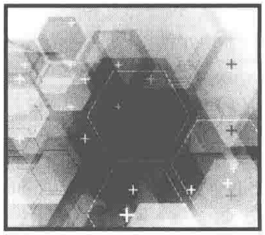

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I am honored to dedicate this book to my author team who pulled together and created a wonderful project for the community they love as I do.

— Adam Jorgensen

For my beautiful and eternally patient wife, Jane, and our three children Lucy, Kate, and Oliver. I will love you all forever.

— James Rowland-Jones

To my lovely wife, Marlana, and my children, Kayla and Michael, thanks for the support and understanding during the late nights while I was writing.

— John Welch

To my family, thank you for your unconditional support throughout this process. I'd especially like to thank my wife Shannon for believing in me.

— Brian Mitchell

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— Adam Jorgensen

I have come to know many people through the SQL community. Some I know professionally while others I know a bit better than that and consider friends. Adam definitely falls into the latter category. I'd like to start by thanking him not only for the opportunity to collaborate on this book, but also for his friendship, especially as we've journeyed on the PASS rollercoaster together.

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I'd also like to thank our oft-suffering editor Jennifer Lynn (www.pageoneediting.com). I know I didn't make your life very easy on this one, Jennifer, and would like to take this moment to both thank you and apologize for my seemingly never-ending list of excuses.

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—James Rowland-Jones

About the Authors

Adam Jorgensen is the president of Pragmatic Works and the executive vice president of the Professional Association for SQL Server (PASS). He has gained extensive experience with SQL Server, SharePoint, and analytics over the past 13 years. His primary focus is helping organizations and executives drive value through new technology solutions, management techniques, and financial optimization. He specializes in the areas of cloud and big data analytics and works on solutions to make those technologies real for enterprises. He lives in Jacksonville, Florida, with his wife, Cristina.

James Rowland-Jones is a principal consultant for The Big Bang Data Company. His focus and passion is to architect and deliver highly scalable, analytical platforms that are creative, simple, and elegant in their design. James specializes in big data warehouse solutions that leverage both SQL Server PDW and Hadoop ecosystems. James is a keen advocate for the SQL Server community, both internationally and in the United Kingdom. He currently serves on the board of directors for PASS and sits on the organizing committee for SQLBits (Europe's largest event for the Microsoft Data Platform). James has been awarded Microsoft's MVP accreditation since 2008 for his services to the community.

John Welch works at Pragmatic Works, where he manages the development of a suite of BI products that make developing, managing, and documenting BI solutions easier. John has been working with BI and data warehousing technologies since 2001, with a focus on Microsoft products in heterogeneous environments. He is a Microsoft Most Valued Professional (MVP), an award given due to his commitment to sharing his knowledge with the IT community, and an SSAS Maestro. John is an experienced speaker, having given presentations at PASS conferences, the Microsoft Business Intelligence conference, Software Development West (SD West), Software Management Conference (ASM/SM), and others. He has also contributed to multiple books on SQL Server, including *Smart Business Intelligence Solutions with Microsoft SQL Server 2008* (Microsoft Press, 2009) and the *SQL Server MVP Deep Dives* (Manning Publications) series.

John writes a blog on BI and SQL Server Information Services (SSIS) topics at `http://agilebi.com/jwelch`. He is active in open source projects that help ease the development process for Microsoft BI developers, including ssisUnit (`http://ssisunit.codeplex.com`), a unit testing framework for SSIS.

Dan Clark is a senior BI consultant for Pragmatic Works. He enjoys learning new BI technologies and training others how to best implement the technology. Dan is particularly interested in how to use data to drive better decision making. Dan has published several books and numerous articles on .NET programming and BI development. He is a regular speaker at various developer/BI conferences and user group meetings, and enjoys interacting with the Microsoft developer and database communities.

Chris Price is a senior consultant with Microsoft based out of Tampa, Florida. He has a Bachelor of Science degree in management information systems and a Master of Business Administration degree, both from the University of South Florida. He began his career as a developer, programming with everything from Visual Basic and Java to both VB.Net and C# as he worked his way into a software architect role before being bitten by the BI bug. Although he is still passionate about software development, his current focus is on ETL (extract, transform, and load), Data integration, data quality, MDM (master data management), SSAS (SQL Server Analysis Server), SharePoint, and all things big data.

He regularly speaks at SQL Saturdays, PASS Summit, conferences, code camps, and other community events. He blogs frequently and has also authored multiple books and whitepapers and has served as technical editor for a range of BI and big data topics. You can follow Chris on his blog at `http://bluewatersql.wordpress.com/` or on Twitter at `@BluewaterSQL`.

Brian Mitchell is the lead architect of the Microsoft Big Data Center of Expertise. Brian focuses exclusively on data warehouse/business intelligence (DW/BI) solutions, with the majority of his time focusing on SQL Server Parallel Data Warehouse (PDW) and HDInsight. He has spent more than 15 years working with Microsoft SQL Server and Microsoft Business Intelligence. Brian is a Microsoft Certified Master–SQL Server 2008. You can find his blog on topics such as Big Data, SQL Server Parallel Data Warehouse, and Microsoft Business Intelligence at `http://brianwmitchell.com`. Brian earned his Master of Business Administration degree from the University of Florida. When he is not tinkering with SQL Server or Hadoop, Brian enjoys spending time exploring his adopted home state of Florida with his wife, Shannon, and their kids.

About the Technical Editors

Rohit Bakhshi is a product manager at Hortonworks, a leading provider of support and services for Apache Hadoop. Hortonworks builds and distributes the Hortonworks Data Platform (HDP), which is a 100% open source data management software powered by Hadoop available on Windows and Linux OS platforms.

Rohit is responsible for the HDP for the Windows product line, core Apache Hadoop components, and Platform Services for HDP. He has worked with Microsoft to bring the entire stack of Apache Hadoop components to Windows to enable Windows developers and system administrators to harness the full power of Apache Hadoop. Before Hortonworks, Rohit was a consultant in the Accenture Technology Labs R & D consulting group, where he focused on architecting and delivering big data solutions to Fortune 500 clients.

John Hoang is a senior program manager based out of Aliso Viejo, California, on the Azure Customer Advisory Team (AzureCAT). He has more than 20 years of experience working in various roles, including developer, business analyst, and project manager implementing software solutions to manufacturing, retail, and healthcare. He currently specializes in the SQL Server PDW. In his free time, John enjoys bike riding, tennis, and spending time with his two children.

Josh Luedeman has been working with SQL Server for more than eight years. He is currently a solutions architect with Data Structures, Inc., where he is working with customers to help them utilize business intelligence (BI) tools and big data. He has worked in IT for more than 10 years, holding positions in application support, database administration, and BI. In these industries, Josh has held integral roles in Fortune 500 companies, major institutions of higher education, small-medium businesses, and startups. Josh is a speaker at software development and data conferences including Code On The Beach and multiple SQL Saturdays. He is originally from Corning, New York, and currently resides in Orlando, Florida, with his wife and children. Josh can be found online at `www.joshluedeman.com`, `josh@joshluedeman.com`, `www.linkedin.com/in/joshluedeman`, and `@joshluedeman` on Twitter.

Michael Reed has a long history of designing innovative solutions to difficult business problems. During the last 14 years, he focused on database development and architecture, and more recently business intelligence and analytics. He is currently employed by Pragmatic Works as a Senor BI Consultant. Previously he was director of Insight and Analytics at a healthcare claim processor. Prior to that he held operations, data, and information delivery centric roles in Microsoft's Online Services Division; specifically the AdCenter Behavioral Targeting group, which is the primary research unit for mining social behaviors at Microsoft supporting the Bing decision search engine and BingAds advertising services.

In a prior life, he was co-owner of a multimillion dollar manufacturing business, grown from a startup, where he gained much of the business knowledge and insight he employs in his work today.

Introduction

This book was built for those of you who are searching. Those of you who are wondering. Searching and wondering what on earth big data will mean for your data world. IT takes a different approach, however, than the litany of titles designed to spend hundreds of pages beating you over the head telling you that you need big data, that everyone is doing it, and that you have to be "cool," too!

This author team wanted to create something that would be your go-to resource for moving from your existing relational world and provide you not only the roadmap forward but also practical experience for those of you who don't need the click here, move the mouse to the left, and click again level of instruction. We do explain some things in greater detail, but these are things that require this due to their newness or relative complexity.

We are focused on making sure you can ease your transition to using these tools and technologies because we have been where you are. Your boss came back from a conference and said, "We need a big data solution." When you inquire what he would like it to solve, he doesn't really know, but he knows how critical it is that the organization have one. You will become the responsible party for making these big data dreams come true.

Normally, this would entail training classes and long hours combing the Internet like you did when they told you they needed a data warehouse or a cube, those other words once foreign to you. You will learn through this text that big data is really big—no pun intended. It can do big things, solve big problems, and is a big ecosystem of tools and platforms. However, like most other ecosystems (RDBMSs, programming languages, mobile, and cloud), there are really only a few foundational things, and if you can come up to speed on those, you will be rocking and rolling when you need to apply more advanced tools, or automation, and so on.

Our Team

We have assembled a strong international team of authors to make sure that we can provide a sound perspective and knowledge transfer on the right topics (we'll discuss those shortly). Those topics include:

1. Accelerated overview of Big Data, Hadoop, NoSQL, and key industry knowledge
2. Key problems people are trying to solve and how to identify them
3. Delivering big data in a Microsoft world
4. Tool and platform choice
5. Installation, configuration, and exploration
6. Storing and managing big data
7. Working with, adding structure, and cleansing your data
8. Big data and SQL Server together
9. Analytics in the big data world
10. How this works in the cloud
11. Case studies and real world applications
12. Moving your organization forward in this new world

This team includes members of Pragmatic Works, a global leader in information services, software, and training; Microsoft Research; Microsoft Consulting Services; Azure Customer Advisory Team; and some other industry firms making a big impact in this expanding space.

All Kidding Aside

Big data is coming on strong. You will have these solutions in your environment within 24 months, and you should be prepared. This book is designed to help you make the transition with practical skills from a relational to a more "evolved" view of the data worlds. This includes solutions that will handle data that does not fit nicely into a tabular structure, but is nonetheless just as or more important in some cases as the data that you have curated so carefully for so many years.

You will learn some new terms as well. This will be almost as much a vocabulary lesson as a technical lesson.

Who Is This Book For?

This book is for those data developers, power users, and executives looking to understand how these big data technologies will impact their world and how to properly approach solutions in this new ecosystem. Readers will need a basic understanding of data systems and a passion for learning new technologies and techniques. Some experience with developing database or application solutions will be helpful in some advanced topic areas.

What You Need to Use This Book

We have designed this book to make extensive use of cloud resources so, as the reader, you will need to have a newer model computer PC or Mac that can access the Internet reliably. In addition, you will want to be able to install additional programs and tools as advised by the authors, so please ensure you have that access on the machine you're using. Different chapters will have different tools or data sets, so please follow the authors' instructions in those chapters to get the most out of your experience. Having access to a SQL Server database will be required in certain chapters, and if you wish to set up your environment on premise, then a virtualization technology such as Hyper-V, VMWare, or Virtual box is recommended.

Chapter Overview

Now we'll go through the chapters in this text and discuss what you'll be learning from each one.

- **Chapter 1: Industry Needs and Solutions**
  No book on big data would be complete without some coverage of the history, origins, and use cases in this ecosystem. We also need to discuss the industry players and platforms that are in scope for the book. Other books spend 5 to 6 chapters rehashing this information; we have done it efficiently for you so you can get to work on more fun topics!
- **Chapter 2: Microsoft's Approach to Big Data**
  Doing this in a Microsoft world is a little different that the traditional UNIX or Linux deployment. We chose this approach since we feel it makes this technology more accessible to millions of windows administrators, developers and power users. Many of the folks were surveyed before this writing, we heard overwhelmingly that we needed a Windows-focused solution to help the largest population of enterprise users access this new technology.

- **Chapter 3: Installing HDInsight**
  In this chapter, you'll get started configuring your big data environment.
- **Chapter 4: HDFS, Hive, HBase and HCatalog**
  These are some key data and metadata technologies. We'll make sure you understand when to use each one and how to get the most out of them.
- **Chapter 5: Storing and Managing data in HDFS**
  A distributed file system might be a new concept for most readers, so we are going to make sure we go through this core component of Hadoop and ensure you're prepared for designing with this incredible feature.
- **Chapter 6: Adding Structure with Hive**
  We need to go deeper into Hive because you'll use it a lot. Let's dive in with this chapter to make sure you understand commands and the logic behind using Hive efficiently.
- **Chapter 7: Expanding your Capability with HBase and HCatalog**
  Dealing with large tables and metadata requires some new tools and techniques. HBase and HCatalog will help you manage these types of challenges, and we're going to take you through using them. Get ready to put the BIG in big data.
- **Chapter 8: Effective Big Data ETL with SSIS, Pig, and Sqoop**
  We have to load this data, and there is no better way to do it than with our ETL expert authors. Come along while they take you through using favorite and familiar tools, along with some new ones, to load data quickly and effectively.
- **Chapter 9: Data Research and Advanced Data Cleansing with Pig and Hive**
  Now we've installed, configured, explored, and loaded some data. Let's get buys researching and cleansing this data with our new tools and platform.
- **Chapter 10: Data Warehouses and Hadoop Integration**
  How do SQL Server and business intelligence fit in with big data? Very closely. Most of the time they will work in tandem. We will show you when to use each solution and how they work together in scale-up and scale-out solutions.
- **Chapter 11: Visualizing Big Data with Microsoft BI**
  Now that we have the analysis, how do we visualize this for our users? Do we have new tools? Do we use our familiar tools? Yes! Let's do this together so we can understand how to combine these solutions for the best results for our users and customers.

- **Chapter 12: Big Data Analytics**
  You've heard about analytics. This chapter includes advanced statistical analysis, social sentiment analysis, forecasting, modeling, and much more! No PhD required.
- **Chapter 13: Big Data In the Cloud**
  Do you need a lot of servers in your data center to do the things in this book? No way! We can do it in the cloud in an elastic and scalable fashion.
- **Chapter 14: SQL Server Big Data Case Examples**
  How are other firms succeeding and failing in this ecosystem. We will take you through some of the best wins and losses and why these outcomes happened so you can model after them or avoid them.
- **Chapter 15: Building and Executing your Big Data Plan**
  How do we take what we've done and make it real? This chapter will help you write your big data plan.
- **Chapter 16: Operational Big Data Management**
  Administering these technologies and integrating them into your existing infrastructure will take planning and careful execution, just like your other critical systems. Let's plan this out together!

Features Used in This Book

The following features and icons are used in this book to help draw your attention to some of the most important or useful information in the book:

WARNING **Be sure to take heed when you see one of these asides. When particular steps could cause damage to your electronics if performed incorrectly, you'll see one of these asides.**

TIP **These asides contain quick hints about how to perform simple tasks that might prove useful for the task at hand.**

NOTE **These asides contain additional information that may be of importance to you, including links to videos and online material that will make it easier to following along with the development of a particular project.**

SAMPLE HEADING

These asides go into additional depth about the current topic or a related topic.

Contents