



Beginning T-SQL

A Step-by-Step Approach

—

Fourth Edition

—

Kathi Kellenberger
Lee Everest



Apress®

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Kathi Kellenberger
Edwardsville, IL, USA

Lee Everest
Euleless, TX, USA

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For my parents, Bill and Marilyn, who have lived lives of joy, gratitude, love, and service. I'm proud to be your daughter.

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About the Authors



Kathi Kellenberger is an editor and DevOps advocate at Redgate Software and a Microsoft Data Platform MVP. She has been working with SQL Server for 22 years, starting with version 6.5. She has worked as a developer, database administrator, and consultant. Kathi has been involved with almost 20 book projects as an author, coauthor, or technical editor and enjoys presenting at events, webinars, and user groups. When not working, she teaches T-SQL to beginners at a nonprofit in St. Louis, Missouri, that helps people transition to tech careers. Kathi loves spending time with family and friends, cycling, and singing.



Lee Everest is a SQL Server developer who has worked with the product since version 6.5. He has taught part-time at Dallas College North Lake Campus for 18 years and has had several students move on to companies such as Microsoft, filling roles from support engineer to data scientist to vice president. When Lee isn't working, he enjoys computers, golf, and fishing.

About the Technical Reviewer



It was 2 a.m. when **Forrest McDaniel** looked at the clock again and realized he was hooked on this SQL thing. After years of teaching (and a failed finance career aborted by the Great Recession), this mathematician set his sights on SQL Server.

Forrest now gets to combine his love of teaching and passion for algorithms and is a self-confessed B-tree hugger. Weirdly addicted to SQL Server internals and performance tuning, his goal is to convince others that these things are actually fun or at least worth paying attention to!

Acknowledgments

This book would not be possible without the great team at Apress, especially Jonathan Gennick and Jill Balzano. I'm sure there are countless others working behind the scenes whose names I will never know. Thanks to all of you.

I would like to thank Forrest McDaniel for his wonderful technical review and Lee Everest for helping with the exercise questions. You have both made this book better, and I appreciate your work and commitment.

Most of all, I would like to thank you, the reader. I hope that this book is just the starting point for all you will learn about T-SQL, and I thank you for starting your journey with me.

Introduction

The card catalog at the local public library was my first database. The catalog made it possible to find books based on titles, authors, or subjects just like writing a SQL query. Of course, I could walk around and locate books because they were arranged thanks to the Dewey Decimal System, but having that old drawer-filled cabinet made it even easier.

Decades ago, most businesses did everything with paper stored in filing cabinets. Computers and databases existed, but they were not commonly used in schools or many businesses until the 1980s and 1990s. Now, it's easy for almost anyone to keep track of data in a local database or at least a spreadsheet.

The ability to query a database is vital for many professions. Of course, application developers, database administrators, business intelligence developers, database developers, and data scientists must be able to work with databases. What might be surprising is that professionals working in human resources, insurance, health care, government records, grant writing, publishing, real estate, and social work, to name a few, now must query databases. I often run into these “nontech” professionals at SQL Server events or the classes that I teach, so I know that SQL querying is an important in-demand skill in many industries and positions.

There are several database vendors, and this book is meant to teach T-SQL, the query language used for SQL Server and Azure SQL Database from Microsoft. Many professionals will find that they end up working with other databases such as Oracle or MySQL databases from time to time. The basics do carry from one system to another, but each vendor supports its own extensions, or flavor, of the SQL language. For SQL Server, it's T-SQL.

Who's This Book For?

This book is meant to teach T-SQL (Transact SQL) to absolute beginners. No database experience is required, but the reader should have at least average computer skills. The reader should be able to do a Google search, download files, install software, and follow instructions. The book starts out with the basics, and each chapter builds on the knowledge obtained in earlier chapters.

The book may also be used as a reference for others with intermediate or advanced skills who need to brush up on particular topics. It's easy to forget how to write certain queries if you don't do it often, and this book will reteach it to you!

What's in This Book?

This book starts with instructions for setting up your own SQL Server instance where you can practice writing queries, creating objects, and modifying data without the chance of causing issues in your company's production systems. (If you happen to be running a Linux or Mac, check out Appendix A for instructions on running a SQL Server inside a container.)

Following a discussion on database concepts, each chapter covers a new T-SQL topic that builds on the previous skills learned. You first must understand how to write queries involving one table before you can learn how to join tables, for example. The chapters contain many example queries that I encourage you to type out (or even write out!) and run. You will also find exercise questions to allow you to practice what you have learned. Because getting the right results is just part of the battle, you'll also find best practices and information about query performance.

The nice thing about T-SQL is that query writing basics haven't changed since SQL Server 2005 came out. Each new version of SQL Server has additional functionality that makes it even more powerful, and this book will include that functionality (up to SQL Server 2019 and the latest Azure SQL Database) when it makes sense for a beginner book.

The book is broken down like this:

- Chapters [1](#) and [2](#) provide an introduction to databases and some background information you'll need to understand to read the rest of the book.
- Chapters [3](#) through [9](#) cover how to write queries to retrieve data from SQL Server.
- Chapters [10](#) and [11](#) cover updating, deleting, and inserting data.
- Chapters [12](#) and [13](#) cover how to implement logic in the database.
- Chapters [14](#), [15](#), and [16](#) are bonus chapters with advanced querying topics.

- Chapter [17](#) contains many resources for learning more.
- Appendices A, B, and C contain information for alternate tools for running and querying SQL Server.

I expect beginners will want to start at the beginning and read each chapter in order. For those of you who are more advanced, this might be a good reference to keep handy. However you wish to read it, I hope it is the first step toward a fulfilling and fruitful career.

CHAPTER 1

Getting Started

T-SQL, also known as Transact-SQL, is Microsoft's implementation of the Structured Query Language (SQL) for SQL Server. Most database professionals pronounce SQL like the word "sequel," but you will occasionally hear someone say it as S-Q-L.

T-SQL is the language that is most often used to extract or modify data stored in a SQL Server database, regardless of which application or tool you use. SQL Server 2019 T-SQL is based on standards created by the American National Standards Institute (ANSI), but Microsoft has added several functionality enhancements. You will find that T-SQL is a very versatile and powerful language.

T-SQL consists of Data Definition Language (DDL), Data Manipulation Language (DML), Data Control Language (DCL), Transaction Control Language (TCL), and control-of-flow statements. Although the book focuses primarily on the DML statements, which you will use to retrieve and manipulate data, this book covers DDL statements and programming logic as well.

This chapter will explain how to install a free edition of SQL Server and get it ready for running the example code and performing the exercises in the rest of this book. This chapter also gives you a quick tour of Azure Data Studio (ADS). Database professionals have used another tool, SQL Server Management Studio (SSMS), for the past 15 years, but ADS is the new kid on the block which runs on Linux and macOS, not just on Windows. ADS is missing some of the functionality, especially for database administration that SSMS has, but Microsoft adds new features to ADS frequently. If you would prefer to use SSMS, take a look at Appendix B for more information.

Installing SQL Server Developer Edition

Microsoft makes SQL Server 2019 available in several editions depending on the needs and budget of the organization. As a learner or developer, you can download and install the free SQL Server Developer Edition from Microsoft’s website on your local computer. At the time of this writing, it can be found at www.microsoft.com/en-us/sql-server/sql-server-downloads, but be sure to search for it if the location has changed. Figure 1-1 shows the download link on the page.



Developer

SQL Server 2019 Developer is a full-featured free edition, licensed for use as a development and test database in a non-production environment.



Figure 1-1. SQL Server Developer Edition download link

Note The instructions for installing a local SQL Server in this chapter work for Windows. If you are running macOS or Linux, see Appendix A to install SQL Server in a container.

Before installing, make sure that your computer meets the requirements for SQL Server 2019. Search for the Microsoft page “SQL Server 2019: Hardware and software requirements” to find out.

You may hear someone refer to “instances” of SQL Server. An instance of SQL Server consists of all the files, settings, and services required to run SQL Server. You can have more than one instance of SQL Server running on one machine, and each instance has its

own databases. Follow these instructions to install a local SQL Server instance with just the features you'll need to follow along with this book as you learn T-SQL. The instructions here are not adequate for database administrators installing in a production environment.

1. After downloading the file, run it, and it will prompt you for the installation type (Figure 1-2). My advice is to choose Download Media because then the media will be available if you wish to install additional instances of SQL Server or add features.

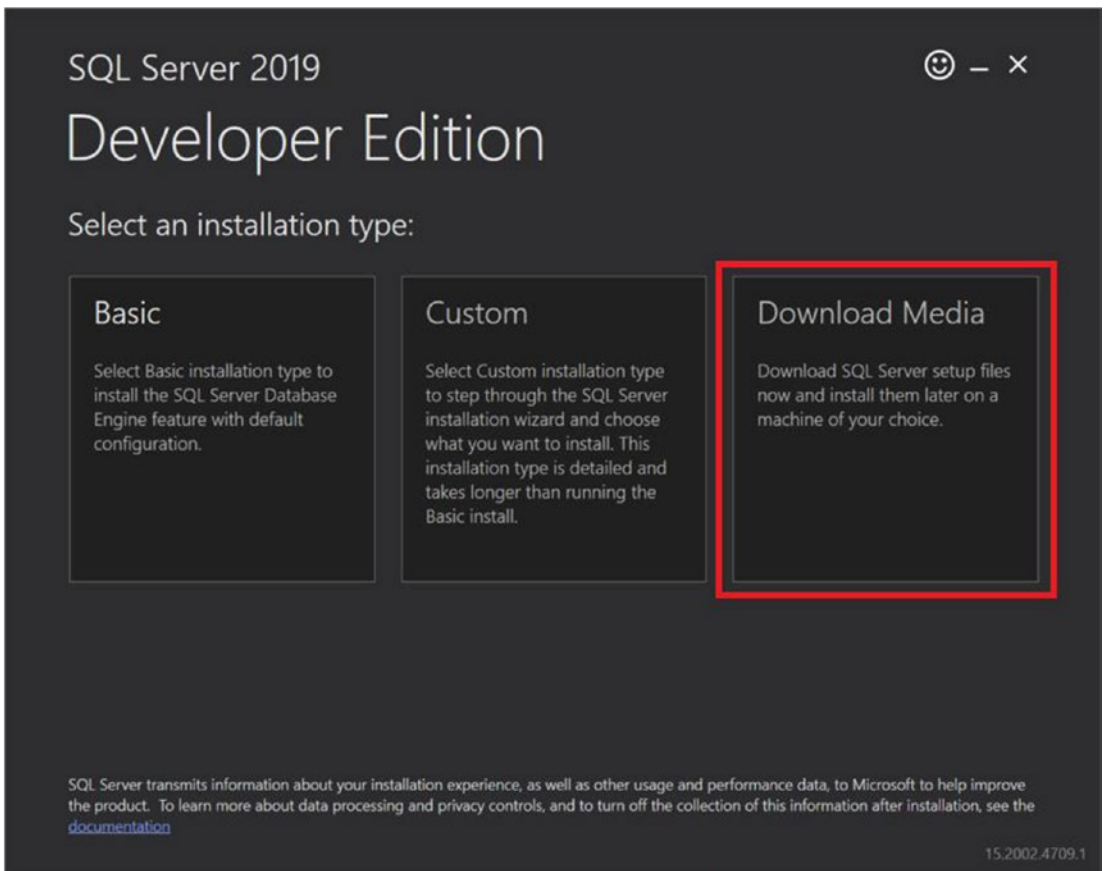


Figure 1-2. *Select an installation type*

2. The downloader will ask which type of file to download, ISO or CAB. The ISO file will look like a DVD to your computer, so that is what I recommend. Be sure to note the download location because that is needed in the next step. Figure 1-3 shows how this should look.

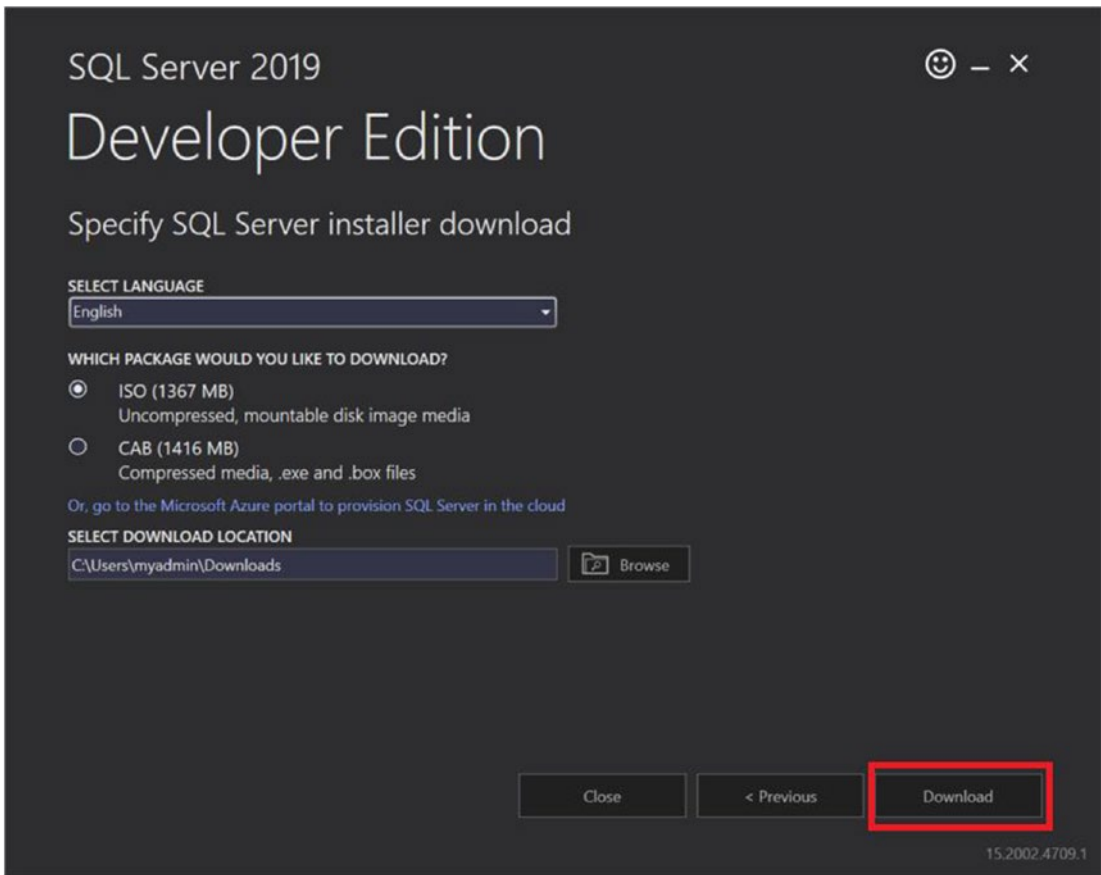


Figure 1-3. *The download properties*

3. Click Download. Once the download has completed, navigate to the folder by clicking the Open folder link shown in Figure 1-4.

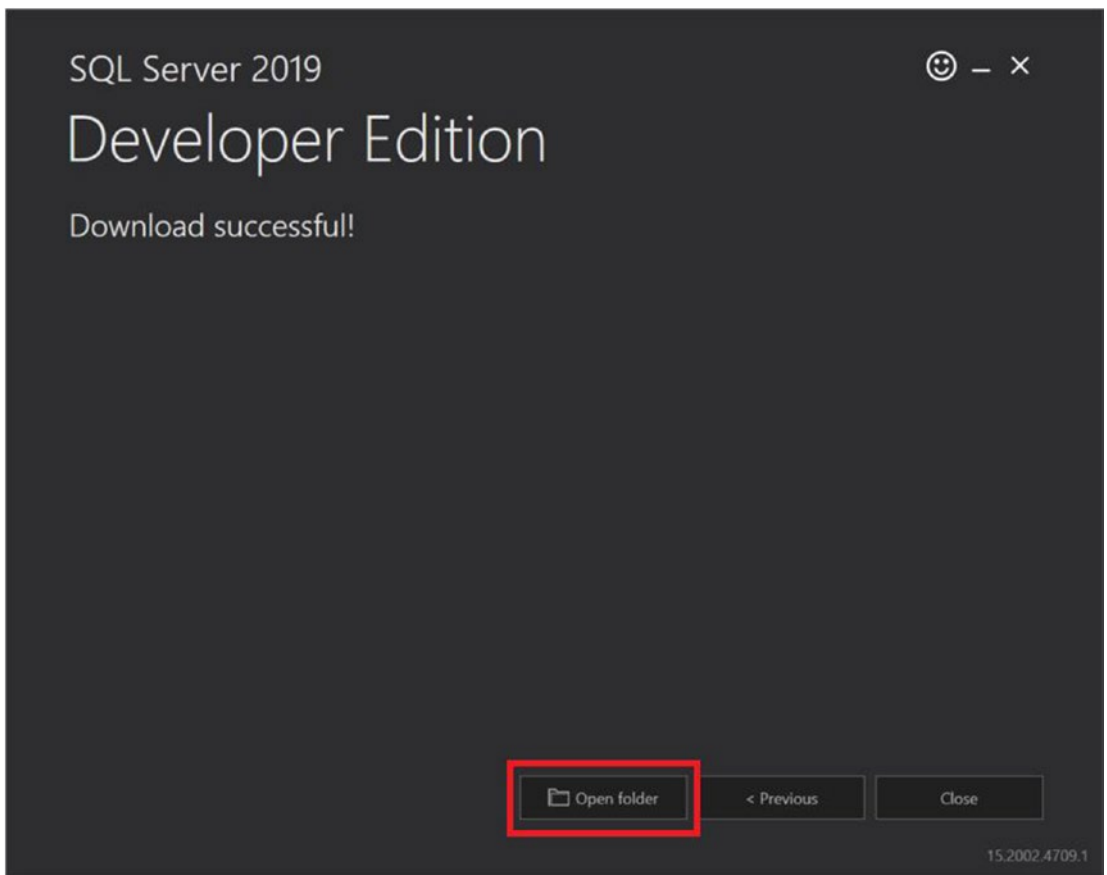


Figure 1-4. *The download is complete*

4. When the folder opens, look for `SQLServer2019-x64-ENU-Dev.ISO`. Double-click the file to navigate to the contents of the ISO shown in Figure 1-5. When teaching students over the years, I've seen situations where ISO utilities installed on their laptops required that the ISO file be mounted. If you get an error message at this point, right-click and select to mount the ISO file. Then try to double-click again.