

# Expert SQL Server In-Memory OLTP

Revolutionizing OLTP Performance  
in SQL Server

—  
*Second Edition*

—  
Dmitri Korotkevitch

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# Expert Sql Server In Memory Oltp

**Dmitri Korotkevitch**



## **Expert Sql Server In Memory Oltp:**

**Expert SQL Server In-Memory OLTP** Dmitri Korotkevitch, 2017-09-02 Take a deep dive into one of the most significant SQL Server features support for In Memory Online Transaction Processing The latest developments are covered including support of off row storage columnstore indexes and operational analytics changes in programmability and native compilation and more This book describes the architecture and internals of the In Memory OLTP Engine and explains how to develop deploy and maintain systems using it With it you can dramatically increase transaction throughput to handle thousands of transactions per second supporting millions of customers Learn the architecture and the internals of In Memory OLTP in order to recognize when technology can make a difference Recognize opportunities for In Memory OLTP in new development and understand how to benefit from it in existing systems Don't be without Dmitri Korotkevitch and the deep expertise he imparts in Expert SQL Server In Memory OLTP 2nd Edition as you move forward in using SQL Server's In Memory OLTP technology Dmitri Korotkevitch is the five star author of Pro SQL Server Internals and brings the same combination of clear thinking and deep expertise to help you in this second edition The book Explains In Memory OLTP internals architecture and programmability including data storage indexing multi version concurrency control transaction logging and recovery and native compilation Covers SQL Server 2016 technology enhancements including columnstore indexes and off row storage Guides in using In Memory OLTP in new development and existing systems What You'll Learn Grasp how SQL Server stores and works with data in memory optimized tables Properly design and index memory optimized tables Plan successful deployments including the required memory size and I/O configuration Accelerate T-SQL processing through the creation of natively compiled modules Monitor and report on the benefits and performance of your In Memory OLTP solutions Benefit from the technology in existing systems and in the systems with the mixed workload Who This Book Is For Application developers and database administrators who create and manage online transaction processing OLTP systems in particular those wanting to take advantage of SQL Server's new offering of in memory OLTP to dramatically improve performance and throughput of their systems *SQL Server Advanced Troubleshooting and Performance Tuning* Dmitri

Korotkevitch, 2022-05-13 This practical book provides a comprehensive overview of troubleshooting and performance tuning best practices for Microsoft SQL Server Database engineers including database developers and administrators will learn how to identify performance issues troubleshoot the system in a holistic fashion and properly prioritize tuning efforts to attain the best system performance possible Author Dmitri Korotkevitch Microsoft Data Platform MVP and Microsoft Certified Master MCM explains the interdependencies between SQL Server database components You'll learn how to quickly diagnose your system and discover the root cause of any issue Techniques in this book are compatible with all versions of SQL Server and cover both on premises and cloud based SQL Server installations Discover how performance issues present themselves in SQL Server Learn about SQL Server diagnostic tools methods and technologies Perform health checks on SQL Server

installations Learn the dependencies between SQL Server components Tune SQL Server to improve performance and reduce bottlenecks Detect poorly optimized queries and inefficiencies in query execution plans Find inefficient indexes and common database design issues Use these techniques with Microsoft Azure SQL databases Azure SQL Managed Instances and Amazon RDS for SQL Server

**Pro SQL Server Internals** Dmitri Korotkevitch, 2016-11-29 Improve your ability to develop, manage and troubleshoot SQL Server solutions by learning how different components work under the hood and how they communicate with each other. The detailed knowledge helps in implementing and maintaining high throughput databases critical to your business and its customers. You'll learn how to identify the root cause of each problem and understand how different design and implementation decisions affect performance of your systems. New in this second edition is coverage of SQL Server 2016 Internals including In Memory OLTP, columnstore enhancements, Operational Analytics support, Query Store, JSON temporal tables, stretch databases, security features and other improvements in the new SQL Server version. The knowledge also can be applied to Microsoft Azure SQL Databases that share the same code with SQL Server 2016. Pro SQL Server Internals is a book for developers and database administrators and it covers multiple SQL Server versions starting with SQL Server 2005 and going all the way up to the recently released SQL Server 2016. The book provides a solid road map for understanding the depth and power of the SQL Server database server and teaches how to get the most from the platform and keep your databases running at the level needed to support your business. The book provides detailed knowledge of new SQL Server 2016 features and enhancements. Includes revamped coverage of columnstore indexes and In Memory OLTP. Covers indexing and transaction strategies. Shows how various database objects and technologies are implemented internally and when they should or should not be used. Demonstrates how SQL Server executes queries and works with data and transaction log. What You Will Learn: Design and develop database solutions with SQL Server. Troubleshoot design, concurrency and performance issues. Choose the right database objects and technologies for the job. Reduce costs and improve availability and manageability. Design disaster recovery and high availability strategies. Improve performance of OLTP and data warehouse systems through in-memory OLTP and Columnstore indexes. Who This Book Is For: Developers and database administrators who want to design, develop and maintain systems in a way that gets the most from SQL Server. This book is an excellent choice for people who prefer to understand and fix the root cause of a problem rather than applying a band aid to it.

**Expert SQL Server Transactions and Locking** Dmitri Korotkevitch, 2018-10-08 Master SQL Server's Concurrency Model so you can implement high throughput systems that deliver transactional consistency to your application customers. This book explains how to troubleshoot and address blocking problems and deadlocks and write code and design database schemas to minimize concurrency issues in the systems you develop. SQL Server's Concurrency Model is one of the least understood parts of the SQL Server Database Engine. Almost every SQL Server system experiences hard-to-explain concurrency and blocking issues and it can be extremely confusing to solve those issues without a base of knowledge in the

internals of the Engine While confusing from the outside the SQL Server Concurrency Model is based on several well defined principles that are covered in this book Understanding the internals surrounding SQL Server s Concurrency Model helps you build high throughput systems in multi user environments This book guides you through the Concurrency Model and elaborates how SQL Server supports transactional consistency in the databases The book covers all versions of SQL Server including Microsoft Azure SQL Database and it includes coverage of new technologies such as In Memory OLTP and Columnstore Indexes What You ll Learn Know how transaction isolation levels affect locking behavior and concurrency Troubleshoot and address blocking issues and deadlocks Provide required data consistency while minimizing concurrency issues Design efficient transaction strategies that lead to scalable code Reduce concurrency problems through good schema design Understand concurrency models for In Memory OLTP and Columnstore Indexes Reduce blocking during index maintenance batch data load and similar tasks Who This Book Is For SQL Server developers database administrators and application architects who are developing highly concurrent applications The book is for anyone interested in the technical aspects of creating and troubleshooting high throughput systems that respond swiftly to user requests

**Pro SQL Server Internals** Dmitri Korotkevitch, 2014-06-30 Pro SQL Server Internals explains how different SQL Server components work under the hood and how they communicate with each other This is the practical book with a large number of examples that will show you how various design and implementation decisions affect the behavior and performance of your systems Pro SQL Server Internals covers a multiple SQL Server versions starting with SQL Server 2005 all the way up to the recently released SQL Server 2014 You ll learn about new SQL Server 2014 features including the new Cardinality Estimator In Memory OLTP Engine codename Hekaton and Clustered Columnstore Indexes With Pro SQL Server Internals you have a solid roadmap for understanding the depth and power of the SQL Server database backend regardless of the version and edition of SQL Server you use Pro SQL Server Internals does the following Explains how to design efficient database schema indexing and transaction strategies Shows how various database objects and technologies are implemented internally and when they should or should not be used Demonstrates how SQL Server executes queries and works with data and transaction logs

**SQL Server Internals: In-Memory Oltp** Kalen Delaney, 2014-10-10 The SQL Server 2014 In Memory OLTP engine a k a Hekaton is designed from the ground up to exploit terabytes of available memory and high numbers of processing cores It allows us to work with memory optimized tables and indexes and natively compiled stored procedures in addition to the disk based tables and indexes and T SQL stored procedures that SQL Server has always provided Hekaton in memory data is accessible transparently using familiar interfaces such as T SQL and SSMS but Hekaton s internal behavior and capabilities are very different than those of the standard relational engine Everything you knew about how your SQL Server stores and accesses data is different in Hekaton Everything you understood about how multiple concurrent processes are handled needs to be reconsidered In this book Kalen Delaney explains how the new In Memory OLTP engine works how it stores and

manipulates data and how even with all data stored in memory and no locking or latching it can still guarantee the ACID properties of all transactions Kalen has been working with SQL Server since 1987 specializing in query performance tuning and SQL Server internals The Hekaton internals knowledge she provides in this book will help you migrate existing tables or databases to Hekaton and get faster performance from your SQL Server applications than you ever thought possible SQL Server In-Memory OLTP Jason Brimhall, Wayne Sheffield, 2014 SQL Server In Memory OLTP is your one stop resource for learning all about the new support in SQL Server 2014 for in memory online transaction processing You are now able to create tables and other objects such as indexes that exist only in memory and never on disk This is a game changing feature with ripple effects that extend across the domains of transaction management performance optimization and scalability and maintenance and troubleshooting and and application development Formerly known under the code name of Project Hekaton in memory support is the defining new feature of the 2014 release Database administrators and application designers must become familiar with the feature in order to know when it is best used and when it is best avoided Use of in memory tables and indexes can bring tremendous performance benefits but then you must know how to manage those objects and how to write applications against them in an optimal manner SQL Server In Memory OLTP provides several reference architectures to help you see how in memory objects can be implemented in different situations You ll learn how to monitor and troubleshoot in memory objects and how to optimize their performance You ll learn about programming caveats and transaction management Support for in memory objects is a game changer and their use must at least be considered in all new database and application design work and when attacking problems of performance and scalability It is a must learn feature and SQL Server In Memory OLTP provides what you need to know swiftly accurately and succinctly What you ll learn Understand the in memory architecture and its implications Create and manage tables and indexes using the new architecture Write applications and T SQL procedural code to best take advantage of in memory support Properly manage transactions under the new architecture Migrate to and from and interoperate between in memory and on disk tables Monitor and optimize performance improvements from in memory objects Who this book is for SQL Server In Memory OLTP is a must read book for SQL Server administrators and those who design and develop applications running against SQL Server databases Professionals working closely with SQL Server need to understand the new in memory support and its benefits to know when it should be used and be able to monitor and optimize the systems that use it *Advanced Tuning for JD Edwards EnterpriseOne Implementations* Michael Jacot, Allen Jacot, Gurbinder Bali, Frank Jordan, Patrick Scott, Kyle Kinder, 2013-07-16 Best Practices for JD Edwards Enterprise One Tuning and Optimization Achieve peak performance from your ERP platform while minimizing downtime and lowering TCO Advanced Tuning for JD Edwards Enterprise One Implementations shows how to plan and adopt a structured top to bottom maintenance methodology Uncover and eliminate bottlenecks maximize efficiency at every component layer troubleshoot databases and web servers automate system testing

and handle mobile issues This Oracle Press guide offers complete coverage of the latest cloud clustering load balancing and virtualization solutions Understand the components of a structured tuning plan Establish benchmarks and implement key industry practices Perform changes and accurately measure system wide impact Diagnose and repair HTTP web application and Java issues Troubleshoot Oracle Database connections and transactions Streamline Oracle s JD Edwards EnterpriseOne kernel and JDEnET processes Configure test and manage virtual machines and servers Work with Oracle Exadata Database Machine and Oracle Exalogic Elastic Cloud

### **SQL Server Internals: In-Memory Oltp: Inside the SQL Server 2016**

**Hekaton Engine** Kalen Delaney,2017-10-16 In this book Kalen Delaney explains how the new In Memory OLTP engine works how it stores and manipulates data and how even with all data stored in memory and no locking or latching it can still guarantee the ACID properties of all transactions

*Professional SQL Server 2012 Internals and Troubleshooting* Christian Bolton,Justin Langford,Glenn Berry,Gavin Payne,Amit Banerjee,Rob Farley,2012-11-06 Hands on troubleshooting methods on the most recent release of SQL Server The 2012 release of SQL Server is the most significant one since 2005 and introduces an abundance of new features This critical book provides in depth coverage of best practices for troubleshooting performance problems based on a solid understanding of both SQL Server and Windows internals and shows experienced DBAs how to ensure reliable performance The team of authors shows you how to master the use of specific troubleshooting tools and how to interpret their output so you can quickly identify and resolve any performance issue on any server running SQL Server Covers the core technical topics required to understand how SQL Server and Windows should be working Shares best practices so that you know how to proactively monitor and avoid problems Shows how to use tools to quickly gather analyze and effectively respond to the source of a system wide performance issue Professional SQL Server 2012 Internals and Troubleshooting helps you to quickly become familiar with the changes of this new release so that you can best handle database performance and troubleshooting

### **SQL Server 2014 Development Essentials**

Basit A. Masood-Al-Farooq,2014-07-25 This book is an easy to follow comprehensive guide that is full of hands on examples which you can follow to successfully design build and deploy mission critical database applications with SQL Server 2014 If you are a database developer architect or administrator who wants to learn how to design implement and deliver a successful database solution with SQL Server 2014 then this book is for you Existing users of Microsoft SQL Server will also benefit from this book as they will learn what s new in the latest version

*Advanced Transact-SQL for SQL Server 2000* Itzik Ben-Gan,Tom Moreau,2000 In Advanced Transact SQL for SQL Server 2000 authors Itzik Ben Gan and Thomas Moreau explore the powerful capabilities of Transact SQL T SQL Ben Gan and Moreau offer solutions to common problems encountered using all versions of SQL Server with a focus on the latest version SQL Server 2000 Expert tips and real code examples teach advanced database programmers to write more efficient and better performing code that takes full advantage of T SQL The authors offer practical solutions to the everyday problems programmers face and include in depth information on advanced T

SQL topics such as joins subqueries stored procedures triggers user defined functions UDFs indexed views cascading actions federated views hierarchical structures cursors and more

Microsoft SQL Server 2000 Database Administrator's Guidebook Carl H. Speshock,2002 This book will describe the skills needed to be a successful and productive Microsoft SQL database administrator It will also cover migration of DBA s from Oracle and Sybase to MS SQL

SQL Server Advanced Troubleshooting and Performance Tuning Dmitri Korotkevitch,2022-05-13 This practical book provides a comprehensive overview of troubleshooting and performance tuning best practices for Microsoft SQL Server Database engineers including database developers and administrators will learn how to identify performance issues troubleshoot the system in a holistic fashion and properly prioritize tuning efforts to attain the best system performance possible Author Dmitri Korotkevitch Microsoft Data Platform MVP and Microsoft Certified Master MCM explains the interdependencies between SQL Server database components You ll learn how to quickly diagnose your system and discover the root cause of any issue Techniques in this book are compatible with all versions of SQL Server and cover both on premises and cloud based SQL Server installations Discover how performance issues present themselves in SQL Server Learn about SQL Server diagnostic tools methods and technologies Perform health checks on SQL Server installations Learn the dependencies between SQL Server components Tune SQL Server to improve performance and reduce bottlenecks Detect poorly optimized queries and inefficiencies in query execution plans Find inefficient indexes and common database design issues Use these techniques with Microsoft Azure SQL databases Azure SQL Managed Instances and Amazon RDS for SQL Server

*Microsoft SQL Server 2000 Performance Tuning* Edward Whalen,2001 This test measures the ability to install configure and administer SQL Server 2000 Candidates can sharpen their skills save time and money and build their confidence for the real test with this book and CD ROM

*Professional Microsoft SQL Server 2012 Administration* Adam Jorgensen,Steven Wort,Ross LoForte,Brian Knight,2012-04-24 An essential how to guide for experienced DBAs on the most significant product release since 2005 Microsoft SQL Server 2012 will have major changes throughout the SQL Server and will impact how DBAs administer the database With this book a team of well known SQL Server experts introduces the many new features of the most recent version of SQL Server and deciphers how these changes will affect the methods that administrators have been using for years Loaded with unique tips tricks and workarounds for handling the most difficult SQL Server admin issues this how to guide deciphers topics such as performance tuning backup and recovery scaling and replication clustering and security Serves as a must have how to guide on the new features of the 2012 release of Microsoft SQL Server Walks you through ways to manage and monitor SQL Server and automate administration Guides you through SQL Azure for cloud computing data replication and data warehouse performance improvements Addresses client connectivity enhancements new features that ensure high availability of mission critical applications and tighter integration with Excel and SharePoint for data analysis and reporting Highlights major changes to the suite of SQL Server BI tools including integration reporting and



analysis services Includes real world case examples and best practices from Microsoft insiders If you re a database administrator eager to get started with the newest version of SQL Server then this book is essential reading *SQL Server 2014 Development Essentials* Basit A. Masood-al-farooq,2015-05-09 Design implement and deliver a successful database solution with Microsoft SQL Server 2014 Overview Discover SQL Server 2014 s new in memory OLTP engine and performance related improvements Explore the fundamentals of database planning and the Server Transact SQL language syntax Gain hands on experience with the use of scalar and table valued functions branching and more advanced data structures In Detail SQL Server 2014 Development Essentials is an easy to follow yet comprehensive guide that is full of hands on examples With Microsoft SQL Server 2014 you can design build and deploy mission critical database applications The variety of new in memory features enable you to design high performance database applications that can improve the performance of your applications making them as much as ten times more efficient in some cases Whether you are thinking about becoming a database developer architect or administrator or you are a seasoned database expert this book will provide you with all the skills you need to successfully create design and deploy databases using SQL Server 2014 You will also learn how to add modify and delete data stored within a database You will use Transact SQL statements to create and manage advanced database objects that include scalar and table valued functions views stored procedures and triggers Finally you will learn about how SQL Server works how indexes and statistics improve query performance and the new SQL Server 2014 in memory technologies What you will learn from this book Get introduced to SQL Server 2014 s new in memory database engine Understand SQL Server database architecture and relational database design Use joins subqueries CTEs and windowing functions to write advanced Transact SQL queries Learn about tools that let you monitor SQL Server database performance Identify and troubleshoot blocks or deadlocks that might slow down a system Design create and manage advanced database objects that include scalar and table valued functions views stored procedures and triggers Use SQL Server 2014 s structured error handling blocks to handle errors that occur in the Transact SQL batches and programmable objects Approach This book is an easy to follow comprehensive guide that is full of hands on examples which you can follow to successfully design build and deploy mission critical database applications with SQL Server 2014 Who this book is written for If you are a database developer architect or administrator who wants to learn how to design implement and deliver a successful database solution with SQL Server 2014 then this book is for you Existing users of Microsoft SQL Server will also benefit from this book as they will learn what s new in the latest version *Pro SQL Server Relational Database Design and Implementation* Louis Davidson,Jessica Moss,2017-01-07 Learn effective and scalable database design techniques in a SQL Server 2016 and higher environment This book is revised to cover in memory online transaction processing temporal data storage row level security durability enhancements and other design related features that are new or changed in SQL Server 2016 Designing an effective and scalable database using SQL Server is a task requiring skills that have been around for forty

years coupled with technology that is constantly changing Pro SQL Server Relational Database Design and Implementation covers everything from design logic that business users will understand all the way to the physical implementation of design in a SQL Server database Grounded in best practices and a solid understanding of the underlying theory Louis Davidson shows how to get it right in SQL Server database design and lay a solid groundwork for the future use of valuable business data The pace of change in relational database management systems has been tremendous these past few years Whereas in the past it was enough to think about optimizing data residing on spinning hard drives today one also must consider solid state storage as well as data that are constantly held in memory and never written to disk at all except as a backup Furthermore there is a trend toward hybrid cloud and on premise database configurations as well a move toward preconfigured appliances Pro SQL Server Relational Database Design and Implementation guides in the understanding of these massive changes and in their application toward sound database design Gives a solid foundation in best practices and relational theory Covers the latest implementation features in SQL Server 2016 Helps you master in memory OLTP and use it effectively Takes you from conceptual design to an effective physical implementation What You Will Learn Develop conceptual models of client data using interviews and client documentation Recognize and apply common database design patterns Normalize data models to enhance scalability and the long term use of valuable data Translate conceptual models into high performing SQL Server databases Secure and protect data integrity as part of meeting regulatory requirements Create effective indexing to speed query performance Who This Book Is For Pro SQL Server Relational Database Design and Implementation is for programmers and database administrators of all types who want to use SQL Server to store data The book is especially useful to those wanting to learn the very latest design features in SQL Server 2016 features that include an improved approach to in memory OLTP durability enhancements temporal data support and more Chapters on fundamental concepts the language of database modeling SQL implementation and of course the normalization process lay a solid groundwork for readers who are just entering the field of database design More advanced chapters serve the seasoned veteran by tackling the very latest in physical implementation features that SQL Server has to offer The book has been carefully revised to cover all the design related features that are new in SQL Server 2016 **Pro SQL Server**

**Administration** Peter Carter, 2015-11-16 Pro SQL Server Administration brings SQL Server administration into the modern era with strong coverage of hybrid cloud environments In Memory OLTP and installation on Server Core This comprehensive guide to SQL Server Administration for today's DBA helps you to administer the new and key areas of SQL Server including Columnstore indexes and the In Memory OLTP feature set introduced in 2014 You will also be guided through the administration of traditional areas of SQL Server including how to secure your instance monitor and maintain your instance and to use features such as AlwaysOn to make your instance highly available Also covered is the use of SQL Server features to scale out read only workloads Pro SQL Server Administration is an all new book taking up to date and modern approach

that you'll want and need to further your career as a SQL Server database administrator Extensive coverage of hybrid cloud environments involving Azure SQL Database Detailed discussions on all new key features including AlwaysOn and in memory support Comprehensive coverage of key skills such as monitoring maintenance and indexing **SQL Server 2014.**

**In-Memory Oltp, Business Intelligence and Big Data** Computing Books,2016-02-21 Microsoft SQL Server 2014 is the next generation of Microsoft's information platform with new features that deliver faster performance expand capabilities in the cloud and provide powerful business insights In this book we explain how SQL Server 2014 incorporates in memory technology to boost performance in online transactional processing OLTP and data warehouse solutions We also describe how it eases the transition from on premises solutions to the cloud with added support for hybrid environments SQL Server 2014 continues to include components that support analysis although no major new features for business intelligence were included in this release However several advances of note have been made in related technologies such as Microsoft Excel 2013 16 Power BI for Office 365 HDInsight and PolyBase and we describe these advances in this book as well

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