



# WRITING HIGH-PERFORMANCE .NET CODE

2<sup>ND</sup>  
EDITION

BEN WATSON

# Writing High Performance Net Code

**Ben Watson**



## **Writing High Performance Net Code:**

*Writing High-Performance .NET Code, 2nd Edition* Ben Watson, 2018-04-16 Take performance to the next level This book does not just teach you how the CLR works it teaches you exactly what you need to do now to obtain the best performance today It will expertly guide you through the nuts and bolts of extreme performance optimization in NET complete with in depth examinations of CLR functionality free tool recommendations and tutorials useful anecdotes and step by step guides to measure and improve performance This second edition incorporates the advances and improvements in NET over the last few years as well as greatly expanded coverage of tools more topics more tutorials more tips and improvements throughout the entire book New in the 2nd Edition 50% increase in content New examples code samples and diagrams throughout entire book More ways to analyze the heap and find memory problems More tool coverage including expanded usage of Visual Studio More benchmarking New GC configuration options Code warmup techniques New NET features such as ref returns value tuples SIMD and more More detailed analysis of LINQ Tips for high level feature areas such as ASP NET ADO NET and WPF Also find expanded coverage and discover new tips and tricks for Profiling with multiple tools to quickly find problem areas Detailed description of the garbage collector how to optimize your code for it and how to diagnose difficult memory related issues How to analyze JIT and diagnose warmup problems Effective use of the Task Parallel Library to maximize throughput Which NET features and APIs to use and which to avoid Instrument your program with performance counters and ETW events Use the latest and greatest NET features Build a performance minded team and so much more

**Writing High-Performance .Net Code** Ben Watson, 2018-04-16 Take performance to the next level This book does not just teach you how the CLR works it teaches you exactly what you need to do now to obtain the best performance today It will expertly guide you through the nuts and bolts of extreme performance optimization in NET complete with in depth examinations of CLR functionality free tool recommendations and tutorials useful anecdotes and step by step guides to measure and improve performance This second edition incorporates the advances and improvements in NET over the last few years as well as greatly expanded coverage of tools more topics more tutorials more tips and improvements throughout the entire book New in the 2nd Edition 50% increase in content New examples code samples and diagrams throughout entire book More ways to analyze the heap and find memory problems More tool coverage including expanded usage of Visual Studio More benchmarking New GC configuration options Code warmup techniques New NET features such as ref returns value tuples SIMD and more More detailed analysis of LINQ Tips for high level feature areas such as ASP NET ADO NET and WPF Also find expanded coverage and discover new tips and tricks for Profiling with multiple tools to quickly find problem areas Detailed description of the garbage collector how to optimize your code for it and how to diagnose difficult memory related issues How to analyze JIT and diagnose warmup problems Effective use of the Task Parallel Library to maximize throughput Which NET features and APIs to use and which to avoid Instrument your program with performance counters and ETW

events Use the latest and greatest NET features Build a performance minded team and so much more Writing  
High-Performance .NET Code Ben Watson,2014 Do you want your NET code to have the absolute best performance it can  
This book demystifies the CLR teaching you how and why to write code with optimum performance Learn critical lessons  
from a person who helped design and build one of the largest high performance NET systems in the world This book does not  
just teach you how the CLR works it teaches you exactly what you need to do now to obtain the best performance today It will  
expertly guide you through the nuts and bolts of extreme performance optimization in NET complete with in depth  
examinations of CLR functionality free tool recommendations and tutorials useful anecdotes and step by step guides to  
measure and improve performance Among the topics you will learn are how to Choose what to measure and why Use many  
amazing tools freely available to solve problems quickly Understand the NET garbage collector and its effect on your  
application Use effective coding patterns that lead to optimal garbage collection performance Diagnose common GC related  
issues Reduce costs of JITting Use multiple threads sanely and effectively avoiding synchronization problems Know which  
NET features and APIs to use and which to avoid Use code generation to avoid performance problems Measure everything  
and expose hidden performance issues Instrument your program with performance counters and ETW events Use the latest  
and greatest NET features Ensure your code can run on mobile devices without problems Build a performance minded team  
and much more **High-Performance Programming in C# and .NET** Jason Alls,2022-07-29 Enhance your applications  
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6 Next you ll learn how to use tracing and diagnostics to track down performance issues and the cause of memory leaks The  
chapters that follow then show you how to enhance the performance of your networked applications and various ways to  
improve directory tasks file tasks and more Later you ll go on to improve data querying performance and write responsive  
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**C# 7 and .NET Core 2.0 High Performance** Ovais Mehboob Ahmed Khan,2018-04-25 Improve the speed of your code and optimize the performance of your apps Key Features Understand the common performance pitfalls and improve your application s performance Get to grips with multi threaded and asynchronous programming in C Develop highly performant applications on NET Core using microservice architecture Book Description While writing an application performance is paramount Performance tuning for realworld applications often involves activities geared toward finding bottlenecks however this cannot solve the dreaded problem of slower code If you want to improve the speed of your code and optimize an application s performance then this book is for you C 7 and NET Core 2 0 High Performance begins with an introduction to the new features of what explaining how they help in improving an application s performance Learn to identify the bottlenecks in writing programs and highlight common performance pitfalls and learn strategies to detect and resolve these issues early You will explore multithreading and asynchronous programming with NET Core and learn the importance and efficient use of data structures This is followed with memory management techniques and design guidelines to increase an application s performance Gradually the book will show you the importance of microservices architecture for building highly performant applications and implementing resiliency and security in NET Core After reading this book you will learn how to structure and build scalable optimized and robust applications in C 7 and NET What you will learn Measure application performance using BenchmarkDotNet Explore the techniques to write multithreaded applications Leverage TPL and PLinq libraries to perform asynchronous operations Get familiar with data structures to write optimized code Understand design techniques to increase your application s performance Learn about memory management techniques in NET Core Develop a containerized application based on microservices architecture Learn tools and techniques to monitor application performance Who this book is for This book is for NET developers looking at improving the speed of their code or simply wanting to take their skills to the next level Basic C knowledge is assumed

**Visual C# 2005 Demystified** Jeff Kent,2005-12-19 There s no easier faster or more practical way to learn the really tough subjects Visual C 2005 Demystified explains the language and its libraries and applications as well as how to use the integrated development environment This self teaching guide comes complete with key points background information

quizzes at the end of each chapter and even a final exam Simple enough for beginners but challenging enough for advanced students this is a lively and entertaining brush up introductory text or classroom supplement

**Professional C# 7 and .NET Core 2.0** Christian Nagel,2018-04-17 The professional s guide to C 7 with expert guidance on the newest features Professional C 7 and NET Core 2 0 provides experienced programmers with the information they need to work effectively with the world s leading programming language The latest C update added many new features that help you get more done in less time and this book is your ideal guide for getting up to speed quickly C 7 focuses on data consumption code simplification and performance with new support for local functions tuple types record types pattern matching non nullable reference types immutable types and better support for variables Improvements to Visual Studio will bring significant changes to the way C developers interact with the space bringing NET to non Microsoft platforms and incorporating tools from other platforms like Docker Gulp and NPM Guided by a leading NET expert and steeped in real world practicality this guide is designed to get you up to date and back to work With Microsoft speeding up its release cadence while offering more significant improvement with each update it has never been more important to get a handle on new tools and features quickly This book is designed to do just that and more everything you need to know about C is right here in the single volume resource on every developer s shelf Tour the many new and enhanced features packed into C 7 and NET Core 2 0 Learn how the latest Visual Studio update makes developers jobs easier Streamline your workflow with a new focus on code simplification and performance enhancement Delve into improvements made for localization networking diagnostics deployments and more Whether you re entirely new to C or just transitioning to C 7 having a solid grasp of the latest features allows you to exploit the language s full functionality to create robust high quality apps Professional C 7 and NET Core 2 0 is the one stop guide to everything you need to know

Performance Tuning and Optimizing ASP.NET Applications Kenneth Tu,Jeffrey Hasan,2003-04-01 The authors make performance issues the central topic with very in depth discussion and examples

**VB.NET CODE LV**, LIPPERT,2002-08-23 This title is for VB NET programmers who want to write secure code which should be all of them NET provides a powerful framework in which to write secure code but unless you understand how attackers think and how the NET security systems works your code will still be vulnerable NET helps reduce the likelihood of common vulnerabilities such as buffer overruns and provides an extremely powerful code access security system when it is used properly Writing secure NET code requires three things an understanding of the NET code security system attention to detail and the ability to think from the point of view of an attacker Many security vulnerabilities in fact have little to do with the security system but rather are a result of treating hostile input as non hostile This book is a practical reference of the NET security framework and demonstrates best practices that will go a long way towards making your code secure in the face of attacks It also provides plenty of examples of common mistakes enabling you to spot them in your own and others code

*Maximizing .NET Performance* Nick Wienholt,2003-11-10 Foreword by NET Remoting guru Ingo Rammer BACK IN

1999 the ACM published a study that presented a comparison of 40 independent implementations of a computationally intensive problem created by different programmers in either Java the then current managed runtime environment or C C It concluded with the finding that interpersonal differences between the developers are much larger than the average difference between Java and C C and that performance ratios of a factor of 30 or more are not uncommon between the median programs from the upper half versus the lower half This should teach you something If you are not a guru level C programmer then the chance is quite high that a managed code implementation performs as well as the average C solution especially given the fact that most NET languages simply allow you fewer possibilities to introduce subtle memory related or performance related issues And keep in mind that this study was conducted several years ago and that Just In Time Compilation JIT as well as memory management and garbage collection GC technologies have been improved in the meantime This however doesn't mean that you can't create horribly slow memory eating applications with NET That's why you should be really concerned about the other part of the study's conclusion namely that interpersonal differences are much larger In essence this means that you have to know about how to optimize your applications so that they run with the expected performance in a managed environment Even though NET frees you from a lot of tasks that in C would have been your responsibility as a developer these tasks still exist these little puppets have only cleared the main stage and now live in some little corner behind the scenes If you want your application to run in the top performance range you will still need to find the right strings to pull to move these hidden figures and to basically keep them out of the way of negatively affecting your application's performance Lutz Prechtelt Comparing Java vs C C Efficiency Differences to Interpersonal Differences Communications of the ACM 42 no 10 October 1999 109 112 But knowing about the common language runtime's internals is still not enough as lots of performance issues actually turn up during application design and not just during the coding stage Collections remoting interoperability with unmanaged code and COM components are not the only things that come to my mind in this regard It is the aim of Nick's book to enable you to understand the design issues as well as the underlying CLR mechanisms in order to create the programs that run on the better side of the 30 times performance difference quoted in the ACM study Nick really managed to create a book that addresses these issues which will otherwise turn up when carelessly coding to a managed environment This book will allow you to get into the details without being overwhelmed by the underlying complexity of the common language runtime The only thing you have to resist after reading the book is the urge to over optimize your code I was delighted to see that Nick begins with a discussion of identifying an application's performance critical sections and only later turns towards isolating and resolving these real performance bottlenecks This is in my opinion one of the most important tasks and also one of the most complex ones when working with large scale applications And now read on and enjoy the ride to the better side of a 30 fold performance difference Ingo Rammer author of Advanced NET Remoting Vienna Austria <http://www.ingorammer.com> About the Book Maximizing NET Performance is the

first book dedicated entirely to providing developers and architects with information on NET Framework performance NET is a technology with a vast surface area and coverage of every aspect of performance relevant to all NET technologies is not possible within a single volume This book concentrates on the performance of NET Framework technologies like garbage collection NET Remoting and Code Access Security Because these technologies form the building blocks upon which all NET applications run the information in this book is relevant to all NET developers In addition to providing high level material on achieving software with good performance characteristics the books aims to enhance your knowledge of the design and implementation of the framework and to provide the tools and techniques to allow you to conduct your own investigation into performance problems Rather than taking a tips and tricks approach the book aims to provide a detailed exploration of each topic and explore the why and by how much aspects of performance that are often overlooked Table of Contents Introduction Investigating Performance Type Design and Implementation Strings Text and Regular Expressions Collections Language Specifics Garbage Collection and Object Lifetime Management Exceptions Security Threading IO and Serialization Remoting Unmanaged Code Interoperability The Common Language Runtime Solving Performance Problems **PPoPP '08**,2008

**Introducing Microsoft .NET** David S. Platt,2003 What problems can NET solve What architectural approaches does it take to solve them How do you start using NET and how do you profit from it Get the answers to these questions and more in this entertaining third edition of the popular NET walk through now expanded to cover NET Framework version 1.1 The well known author and consultant expertly covers every topic from the top down introducing simpler concepts first and progressing into greater technical detail By the end of this illuminating NET walk through you ll know enough about this revolutionary platform to plan for the future of software as a Web service *MSDN Magazine* ,2008 [High-Performance C# and .NET](#) Nicholson N Ramsey,2025-10-12 Master the art of building fast efficient and scalable NET applications that thrive under real world enterprise workloads Learn how to diagnose bottlenecks exploit concurrency and design systems that perform flawlessly at scale High Performance C and NET is a hands on deeply practical guide to writing software that runs faster scales better and consumes fewer resources It bridges the gap between theory and production teaching developers how to think like performance engineers profiling systems interpreting metrics and applying targeted optimizations with confidence The book covers every layer of the modern NET performance stack from algorithmic efficiency and garbage collection tuning to asynchronous programming multithreading and low level memory control Each chapter builds on real world examples that mirror enterprise challenges helping readers move beyond superficial tweaks to systemic sustainable performance improvements Whether you re building high throughput APIs real time analytics engines or distributed microservices this book equips you with a proven methodology for profiling diagnosing and resolving performance issues transforming code that merely works into code that excels Key Features Comprehensive performance profiling Learn to use BenchmarkDotNet dotTrace PerfView and NET diagnostic tools effectively Concurrency and async mastery Write non



blocking parallel code that scales across modern multicore architectures System level insights Understand how garbage collection JIT compilation and memory layout impact real world performance Production grade optimization Integrate load testing observability and continuous performance checks into your CI CD pipelines Future proof engineering Apply architectural and coding principles that sustain high performance across evolving NET versions Written by a seasoned NET performance engineer and software architect this book distills years of experience optimizing enterprise scale systems into a clear actionable framework for professionals who demand more from their code If you re ready to elevate your NET development skills and build software that delivers uncompromising speed reliability and scalability High Performance C and NET is your essential guide Start optimizing today

### **Building Highly Scalable Database Applications with .NET**

Wallace B. McClure, John J. Croft, 2002-06-25 This is the only book on the market to focus on addressing issues of building highly scalable database applications with NET technologies Comprehensive coverage includes building NET applications for all the major RDBMSs SQL Server Oracle DB2 and MySQL

### **Network Programming for the Microsoft .NET**

**Framework** Anthony Jones, Jim Ohlund, Lance Olson, 2004 About the Technology The NET Framework is the infrastructure for the overall NET Platform The common language runtime and class libraries including Windows Forms Microsoft ADO NET and Microsoft ASP NET combine together to provide services and solutions that can be easily integrated within and across a variety of systems The NET Framework provides a fully managed protected and feature rich application execution environment simplified development and deployment and seamless integration with a wide variety of languages The networking technology that exists in the System Net namespace of the NET Framework represents the core building blocks for Microsoft s current and future investments in the XML Web Services arena

### **A Developer's Guide to SQL Server**

**2005** Bob Beauchemin, Dan Sullivan, 2006 I come from a T SQL background so when I first laid my eyes on SQL Server 2005 I was shocked and then I was scared I didn t have a CLR or XML background and suddenly had an urgent need to learn it SQL Server 2005 is too big of a release to learn from the books online Fortunately now there is a book for developers who need to go from SQL Server 2000 to SQL Server 2005 and to do it as painlessly as possible Basically it s one stop shopping for serious developers who have to get up to speed quickly I ll keep this one on my desk not on my bookshelf Well done Bob and Dan Dr Tom Moreau SQL Server MVP and Monthly Columnist SQL Server Professional Brockman Moreau Consulting Inc A SQL book truly for developers from two authorities on the subject I ll be turning to this book first when I need to understand a component of SQL Server 2005 Matt Milner Instructor Pluralsight An excellent book for those of us who need to get up to speed on what s new in SQL Server 2005 The authors made sure this book includes the final information for the release version of the product Most other books out now are based on beta versions It covers key areas from XML and SQLCLR to Notification Services Although the wide variety of information is great my favorite part was the advice given on when to use what and how performance is affected Laura Blood Senior Software Developer Blue Note Computing Inc SQL Server 2005 is

a massive release with a large number of new features Many of these features were designed to make SQL Server a great application development platform This book provides comprehensive information about the SQL Server features of most interest to application developers The lucid text and wealth of examples will give a developer a clear understanding of how to use SQL Server 2005 to a whole new class of database applications It should be on every SQL Server developer's bookshelf

Roger Wolter Solutions Architect Microsoft Corporation While there will be a lot of good books on SQL Server 2005 development when people refer to the bible they'll be talking about this book Dr Greg Low Senior Consultant Readify Pty Ltd

SQL Server 2005 is loaded with new features and getting a good overview is essential to understand how you can benefit from SQL Server 2005's features as a developer Bob and Dan's book goes beyond enumerating the new SQL Server 2005 features and will provide you with lots of good examples They did a good job striking a balance between overview and substance Michiel Wories Senior Program Manager SQL Server Microsoft Corporation Few technologies have been as eagerly anticipated as Microsoft SQL Server 2005 Now two SQL Server insiders deliver the definitive hands-on guide accurate comprehensive and packed with examples A Developer's Guide to SQL Server 2005 starts where Microsoft's documentation white papers and Web articles leave off showing developers how to take full advantage of SQL Server 2005's key innovations It draws on exceptional cooperation from Microsoft's SQL Server developers and the authors' extensive access to SQL Server 2005 since its earliest alpha releases You'll find practical explanations of the new SQL Server 2005 data model built in .NET hosting improved programmability SQL 1999 compliance and much more Virtually every key concept is illuminated via sample code that has been fully updated for and tested with the shipping version of the product Key coverage includes Using SQL Server 2005 as a .NET runtime host extending the server while enhancing security reliability and performance Writing procedures functions triggers and types in .NET languages Exploiting enhancements to T-SQL for robust error handling efficient queries and improved syntax Effectively using the XML data type and XML queries Implementing native SQL Server 2005 Web Services Writing efficient robust clients for SQL Server 2005 using ADO.NET classic ADO and other APIs Taking full advantage of user-defined types UDTs query notifications promotable transactions and multiple active result sets MARS Using SQL Management Objects SMO SQL Service Broker and SQL Server Notification Services to build integrated applications

**A Programmer's Guide to ADO.NET in C#** Mahesh Chand, 2002-04-25 A Programmer's Guide to ADO.NET in C# begins by taking readers through an overview of C# and then delves into ADO.NET Authors Chand and Gold provide details on each of the major data providers of the .NET platform such as OLE DB SQL Server and ODBC that enable developers to read and write data to the targeted database These chapters also serve as a good reference for finding detailed methods and properties for these data provider classes

*Conference Proceedings of the 1998 International Conference on Supercomputing*, 1998 Proceedings Parallel Computing      *The C++ Report*, 1996

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## **Table of Contents Writing High Performance Net Code**

1. Understanding the eBook Writing High Performance Net Code
  - The Rise of Digital Reading Writing High Performance Net Code
  - Advantages of eBooks Over Traditional Books
2. Identifying Writing High Performance Net Code
  - Exploring Different Genres
  - Considering Fiction vs. Non-Fiction
  - Determining Your Reading Goals
3. Choosing the Right eBook Platform
  - Popular eBook Platforms
  - Features to Look for in an Writing High Performance Net Code
  - User-Friendly Interface
4. Exploring eBook Recommendations from Writing High Performance Net Code
  - Personalized Recommendations
  - Writing High Performance Net Code User Reviews and Ratings
  - Writing High Performance Net Code and Bestseller Lists
5. Accessing Writing High Performance Net Code Free and Paid eBooks
  - Writing High Performance Net Code Public Domain eBooks
  - Writing High Performance Net Code eBook Subscription Services
  - Writing High Performance Net Code Budget-Friendly Options
6. Navigating Writing High Performance Net Code eBook Formats

- ePub, PDF, MOBI, and More
- Writing High Performance Net Code Compatibility with Devices
- Writing High Performance Net Code Enhanced eBook Features
- 7. Enhancing Your Reading Experience
  - Adjustable Fonts and Text Sizes of Writing High Performance Net Code
  - Highlighting and Note-Taking Writing High Performance Net Code
  - Interactive Elements Writing High Performance Net Code
- 8. Staying Engaged with Writing High Performance Net Code
  - Joining Online Reading Communities
  - Participating in Virtual Book Clubs
  - Following Authors and Publishers Writing High Performance Net Code
- 9. Balancing eBooks and Physical Books Writing High Performance Net Code
  - Benefits of a Digital Library
  - Creating a Diverse Reading Collection Writing High Performance Net Code
- 10. Overcoming Reading Challenges
  - Dealing with Digital Eye Strain
  - Minimizing Distractions
  - Managing Screen Time
- 11. Cultivating a Reading Routine Writing High Performance Net Code
  - Setting Reading Goals Writing High Performance Net Code
  - Carving Out Dedicated Reading Time
- 12. Sourcing Reliable Information of Writing High Performance Net Code
  - Fact-Checking eBook Content of Writing High Performance Net Code
  - Distinguishing Credible Sources
- 13. Promoting Lifelong Learning
  - Utilizing eBooks for Skill Development
  - Exploring Educational eBooks
- 14. Embracing eBook Trends
  - Integration of Multimedia Elements
  - Interactive and Gamified eBooks

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