

Username: Pralay Patoria **Book:** Pro .NET Performance. No part of any chapter or book may be reproduced or transmitted in any form by any means without the prior written permission for reprints and excerpts from the publisher of the book or chapter. Redistribution or other use that violates the fair use privilege under U.S. copyright laws (see 17 USC107) or that otherwise violates these Terms of Service is strictly prohibited. Violators will be prosecuted to the full extent of U.S. Federal and Massachusetts laws.

Contents

Foreword

About the Authors

About the Technical Reviewers

Acknowledgments

Introduction

Chapter 1: Performance Metrics

Performance Goals

Performance Metrics

Summary

Chapter 2: Performance Measurement

Approaches to Performance Measurement

Built-in Windows Tools

Performance Counters

Event Tracing for Windows (ETW)

Time Profilers

Visual Studio Sampling Profiler

Visual Studio Instrumentation Profiler

Advanced Uses of Time Profilers

Allocation Profilers

Visual Studio Allocation Profiler

CLR Profiler

Memory Profilers

ANTS Memory Profiler

SciTech .NET Memory Profiler

Other Profilers

Database and Data Access Profilers

Concurrency Profilers

I/O Profilers

Microbenchmarking

Poor Microbenchmark Example

Microbenchmarking Guidelines

Summary

Chapter 3: Type Internals

An Example

Semantic Differences between Reference Types and Value Types

Storage, Allocation, and Deallocation

Reference Type Internals

The Method Table

Invoking Methods on Reference Type Instances

Sync Blocks And The `lock` Keyword

Value Type Internals

Value Type Limitations

Virtual Methods on Value Types

Boxing

Avoiding Boxing on Value Types with the `Equals` Method

The `GetHashCode` Method

Best Practices for Using Value Types

Summary

Chapter 4: Garbage Collection

Why Garbage Collection?

Free List Management

Reference-Counting Garbage Collection

Tracing Garbage Collection

Mark Phase

Sweep and Compact Phases

Pinning

Garbage Collection Flavors

Pausing Threads for Garbage Collection

Workstation GC

Server GC

Switching Between GC Flavors

Generations

Generational Model Assumptions

.NET Implementation of Generations

Large Object Heap

References between Generations

Background GC

GC Segments and Virtual Memory

Finalization

Manual Deterministic Finalization

Automatic Non-Deterministic Finalization

Pitfalls of Non-Deterministic Finalization

The Dispose Pattern

Weak References

Interacting with the Garbage Collector

The System.GC Class

Interacting with the GC using CLR Hosting

GC Triggers

Garbage Collection Performance Best Practices

Generational Model

Pinning

Finalization

Miscellaneous Tips and Best Practices

Summary

Chapter 5: Collections and Generics

Generics

.NET Generics

Generic Constraints

Implementation of CLR Generics

Collections

Concurrent Collections

Cache Considerations

Custom Collections

Disjoint-Set (Union-Find)

Skip List

One-Shot Collections

Summary

Chapter 6: Concurrency and Parallelism

Challenges and Gains

Why Concurrency and Parallelism?

From Threads to Thread Pool to Tasks

Task Parallelism

Data Parallelism

C# 5 Async Methods

Advanced Patterns in the TPL

Synchronization

Lock-Free Code

Windows Synchronization Mechanisms

Cache Considerations

General Purpose GPU Computing

Introduction to C++ AMP

Matrix Multiplication

N-Body Simulation

Tiles and Shared Memory

Summary

Chapter 7: Networking, I/O, and Serialization

General I/O Concepts

Synchronous and Asynchronous I/O

I/O Completion Ports

NET Thread Pool

Copying Memory

Scatter–Gather I/O

File I/O

Cache Hinting

Unbuffered I/O

Networking

Network Protocols

Network Sockets

Data Serialization and Deserialization

Serializer Benchmarks

DataSet Serialization

Windows Communication Foundation

Throttling

Process Model

Caching

Asynchronous WCF Clients and Servers

Bindings

Summary

Chapter 8: Unsafe Code and Interoperability

Unsafe Code

Pinning and GC Handles

Lifetime Management

Allocating Unmanaged Memory

Memory Pooling

P/Invoke

PInvoke.net and P/Invoke Interop Assistant

Binding

Marshaler Stubs

Blittable Types

Marshaling Direction, Value and Reference Types

Code Access Security

COM Interoperability

Lifetime Management

Apartment Marshaling

TLB Import and Code Access Security

NoPIA

Exceptions

C++/CLI Language Extensions

The `marshal_as` Helper Library

IL Code vs. Native Code

Windows 8 WinRT Interop

Best Practices for Interop

Summary

Chapter 9: Algorithm Optimization

Taxonomy of Complexity

Big-Oh Notation

[Turing Machines and Complexity Classes](#)

[Memoization and Dynamic Programming](#)

[Edit Distance](#)

[All-Pairs-Shortest-Paths](#)

[Approximation](#)

[Traveling Salesman](#)

[Maximum Cut](#)

[Probabilistic Algorithms](#)

[Probabilistic Maximum Cut](#)

[Fermat Primality Test](#)

[Indexing and Compression](#)

[Variable Length Encoding](#)

[Index Compression](#)

[Summary](#)

Chapter 10: Performance Patterns

[JIT Compiler Optimizations](#)

[Standard Optimizations](#)

[Method Inlining](#)

[Range-Check Elimination](#)

[Tail Call](#)

[Startup Performance](#)

[Pre-JIT Compilation with NGen \(Native Image Generator\)](#)

[Multi-Core Background JIT Compilation](#)

[Image Packers](#)

[Managed Profile-Guided Optimization \(MPGO\)](#)

[Miscellaneous Tips for Startup Performance](#)

[Processor-Specific Optimization](#)

[Single Instruction Multiple Data \(SIMD\)](#)

[Instruction-Level Parallelism](#)

[Exceptions](#)

[Reflection](#)

[Code Generation](#)

[Generating Code from Source](#)

[Generating Code Using Dynamic Lightweight Code Generation](#)

[Summary](#)

Chapter 11: Web Application Performance

[Testing the Performance of Web Applications](#)

[Visual Studio Web Performance Test and Load Test](#)

[HTTP Monitoring Tools](#)

[Web Analyzing Tools](#)

[Improving Web Performance on the Server](#)

[Cache Commonly Used Objects](#)

[Using Asynchronous Pages, Modules, and Controllers](#)

[Tweaking the ASP.NET Environment](#)

[Turn Off ASP.NET Tracing and Debugging](#)

[Disable View State](#)

[Server-Side Output Cache](#)

[Pre-Compiling ASP.NET Applications](#)

[Fine-Tuning the ASP.NET Process Model](#)

[Configuring IIS](#)

[Output Caching](#)

[Application Pool Configuration](#)

[Optimizing the Network](#)

[Apply HTTP Caching Headers](#)

[Turn on IIS Compression](#)

[Minification and Bundling](#)

[Use Content Delivery Networks \(CDNs\)](#)

[Scaling ASP.NET Applications](#)

[Scaling Out](#)

[ASP.NET Scaling Mechanisms](#)

[Scaling Out Pitfalls](#)

[Summary](#)

[Index](#)