Engineering A Compiler

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A New Approach to Compilers Including the Algebraic Method Cambridge University Press

Today's compiler writer must choose a path through a design space that is filled with diverse alternatives. "Engineering a Compiler" explores this design space by presenting some of the ways these problems have been solved, and the constraints that made each of those solutions attractive.

VAX-11 Code Generation and Optimization John Wiley & Sons

Coding and testing are often considered separate areas of expertise. In this comprehensive guide, author and Java expert Scott Oaks takes the approach that anyone who works with Java should be equally adept at understanding how code behaves in the JVM, as well as the tunings likely to help its performance. You'll gain in-depth knowledge of Java application performance, using the Java Virtual Machine (JVM) and the Java platform, including the language and API. Developers and performance engineers alike will learn a variety of features, tools, and processes for improving the way Java 7 and 8 applications perform. Apply four principles for obtaining the best results from performance testing Use JDK tools to collect data on how a Java application is performing Understand the advantages and disadvantages of using a JIT compiler Tune JVM garbage collectors to affect programs as little as possible Use

techniques to manage heap memory and JVM native memory Maximize Java threading and synchronization performance features Tackle performance issues in Java EE and Java SE APIs Improve Java-driven database application performance

Creating Domain-Specific Languages Using Metamodels Morgan Kaufmann Publishers

Software practitioners are rapidly discovering the immense value of Domain-Specific Languages (DSLs) in solving problems within clearly definable problem domains. Developers are applying DSLs to improve productivity and quality in a wide range of areas, such as finance, combat simulation, macro scripting, image generation, and more. But until now, there have been few practical resources that explain how DSLs work and how to construct them for optimal use. Software Language Engineering fills that need. Written by expert DSL consultant Anneke Kleppe, this is the first comprehensive guide to successful DSL design. Kleppe systematically introduces and explains every ingredient of an effective language specification, including its description of concepts, how those concepts are denoted, and what those concepts mean in relation to the problem domain. Kleppe carefully illuminates good design strategy, showing how to maximize the flexibility of the languages you create. She also demonstrates powerful techniques for creating new DSLs that cooperate well with general-purpose languages and leverage their power.

Completely tool-independent, this book can serve as the primary resource for readers using Microsoft DSL tools, the Eclipse Modeling Framework, openArchitectureWare, or any other DSL toolset. It contains multiple examples, an illustrative running case study, and insights and background information drawn from Kleppe's leading-edge work as a DSL researcher. Specific topics covered include Discovering the types of problems that DSLs can solve, and when to use them Comparing DSLs with general-purpose languages, frameworks, APIs, and other approaches Understanding the roles and tools available to language users and engineers Creating each component of a DSL specification Modeling both concrete and abstract syntax Understanding and describing language semantics Defining textual and visual languages based on object-oriented metamodeling and graph transformations Using metamodels and associated tools to generate grammars Integrating object-oriented modeling with graph theory Building code generators for new languages Supporting multilanguage models and programs This book provides software engineers with all the guidance they need to create DSLs that solve real problems more rapidly, and with higher-quality code.

Building an Optimizing Compiler CRC Press

The proliferation of processors, environments, and constraints on systems has cast compiler technology into a wider

variety of settings, changing the compiler and compiler writer's role. No longer is execution speed the sole criterion for judging compiled code. Today, code might be judged on how small it is, how much power it consumes, how well it compresses, or how many page faults it generates. In this evolving environment, the task of building a successful compiler relies upon the compiler writer's ability to balance and blend algorithms, engineering insights, and careful planning. Today's compiler writer must choose a path through a design space that is filled with diverse alternatives, each with distinct costs, advantages, and complexities. Engineering a Compiler explores this design space by presenting some of the ways these problems have been solved, and the constraints that made each of those solutions attractive. By understanding the parameters of the problem and their impact on compiler design, the authors hope to convey both the depth of the problems and the breadth of possible solutions. Their goal is to cover a broad enough selection of material to show readers that real tradeoffs exist, and that the impact of those choices can be both subtle and far-reaching. Authors Keith Cooper and Linda Torczon convey both the art and the science of compiler construction and show best practice algorithms for the major passes of a compiler. Their text re-balances the curriculum for an introductory course in compiler construction to reflect the issues that arise in current practice. Focuses on the back end of the compiler—reflecting the focus of research

and development over the last decade. Uses the well-developed theory from scanning and parsing to introduce concepts that play a critical role in optimization and code generation. Introduces the student to optimization through data-flow analysis, SSA form, and a selection of scalar optimizations. Builds on this background to teach modern methods in code generation: instruction selection, instruction scheduling, and register allocation. Presents examples in several different programming languages in order to best illustrate the concept. Provides end-of-chapter exercises.

Compiler Construction "O'Reilly Media, Inc." "Modern Compiler Design" makes the topic of compiler design more accessible by focusing on principles and techniques of wide application. By carefully distinguishing between the essential (material that has a high chance of being useful) and the incidental (material that will be of benefit only in exceptional cases) much useful information was packed in this comprehensive volume. The student who has finished this book can expect to understand the workings of and add to a language processor for each of the modern paradigms, and be able to read the literature on how to proceed. The first provides a firm basis, the second potential for growth.

Software Language Engineering Springer Science & Business Media

Today’s embedded devices and sensor networks are becoming more and more sophisticated, requiring more efficient and highly flexible compilers. Engineers are discovering that many of the compilers in use today are ill-suited to meet the demands

of more advanced computer architectures. Updated to include the latest techniques, The Compiler Design Handbook, Second Edition offers a unique opportunity for designers and researchers to update their knowledge, refine their skills, and prepare for emerging innovations. The completely revised handbook includes 14 new chapters addressing topics such as worst case execution time estimation, garbage collection, and energy aware compilation. The editors take special care to consider the growing proliferation of embedded devices, as well as the need for efficient techniques to debug faulty code. New contributors provide additional insight to chapters on register allocation, software pipelining, instruction scheduling, and type systems. Written by top researchers and designers from around the world, The Compiler Design Handbook, Second Edition gives designers the opportunity to incorporate and develop innovative techniques for optimization and code generation.

Fast, Safe Systems Development Mit Press

This book provides a practically-oriented introduction to high-level programming language implementation. It demystifies what goes on within a compiler and stimulates the reader's interest in compiler design, an essential aspect of computer science. Programming language analysis and translation techniques are used in many software application areas. A Practical Approach to Compiler Construction covers the fundamental principles of the subject in an accessible way. It presents the necessary background theory and shows how it can be applied to implement complete compilers. A step-by-step approach, based on a

standard compiler structure is adopted, presenting up-to-date techniques and examples. Strategies and designs are described in detail to guide the reader in implementing a translator for a programming language. A simple high-level language, loosely based on C, is used to illustrate aspects of the compilation process. Code examples in C are included, together with discussion and illustration of how this code can be extended to cover the compilation of more complex languages. Examples are also given of the use of the flex and bison compiler construction tools. Lexical and syntax analysis is covered in detail together with a comprehensive coverage of semantic analysis, intermediate representations, optimisation and code generation. Introductory material on parallelisation is also included. Designed for personal study as well as for use in introductory undergraduate and postgraduate courses in compiler design, the author assumes that readers have a reasonable competence in programming in any high-level language.

Modern Compiler Design Apress

Broad in scope, involving theory, the application of that theory, and programming technology, compiler construction is a moving target, with constant advances in compiler technology taking place. Today, a renewed focus on do-it-yourself programming makes a quality textbook on compilers, that both students and instructors will enjoy using, of even more vital importance. This book covers every topic essential to learning compilers from the ground up and is accompanied by a powerful and flexible software package for evaluating projects, as well as several tutorials, well-defined projects, and test cases.

Elements of Compiler Design Springer Science & Business Media

Compilers and operating systems constitute the basic interfaces between a programmer and the machine for which he is developing software. In this book we are concerned

with the construction of the former. Our intent is to provide the reader with a firm theoretical basis for compiler construction and sound engineering principles for selecting alternate methods, imple menting them, and integrating them into a reliable, economically viable product. The emphasis is upon a clean decomposition employing modules that can be re-used for many compilers, separation of concerns to facilitate team programming, and flexibility to accommodate hardware and system constraints. A reader should be able to understand the questions he must ask when designing a compiler for language X on machine Y, what tradeoffs are possible, and what performance might be obtained. He should not feel that any part of the design rests on whim; each decision must be based upon specific, identifiable characteristics of the source and target languages or upon design goals of the compiler. The vast majority of computer professionals will never write a compiler. Nevertheless, study of compiler technology provides important benefits for almost everyone in the field . • It focuses attention on the basic relationships between languages and machines. Understanding of these relationships eases the inevitable tran sitions to new hardware and programming languages and improves a person's ability to make appropriate tradeoft's in design and implementa tion .

Programming Rust Springer

The widespread use of object-oriented languages and Internet security concerns are

just the beginning. Add embedded systems, multiple memory banks, highly pipelined units operating in parallel, and a host of other advances and it becomes clear that current and future computer architectures pose immense challenges to compiler designers-challenges th

Engineering a Compiler Genever Benning Implement reverse engineering techniques to analyze software, exploit software targets, and defend against security threats like malware and viruses. Key Features Analyze and improvise software and hardware with real-world examples Learn advanced debugging and patching techniques with tools such as IDA Pro, x86dbg, and Radare2. Explore modern security techniques to identify, exploit, and avoid cyber threats Book Description If you want to analyze software in order to exploit its weaknesses and strengthen its defenses, then you should explore reverse engineering. Reverse Engineering is a hackerfriendly tool used to expose security flaws and questionable privacy practices.In this book, you will learn how to analyse software even without having access to its source code or design documents. You will start off by learning the low-level language used to communicate with the computer and then move on to covering reverse engineering techniques. Next, you will explore analysis techniques using real-world tools such as IDA Pro and x86dbg. As you progress through the chapters, you will walk through use cases encountered in reverse engineering, such as encryption and compression, used to obfuscate code, and how to to identify and overcome anti-debugging and anti-analysis tricks. Lastly, you will learn how to analyse other types of files that contain code. By the end of this book, you will have the confidence to perform reverse engineering. What you will learn Learn core reverse engineering Identify and extract malware components Explore the tools used for reverse engineering Run programs

under non-native operating systems Understand binary obfuscation techniques Identify and analyze anti-debugging and anti-analysis tricks Who this book is for If you are a security engineer or analyst or a system programmer and want to use reverse engineering to improve your software and hardware, this is the book for you. You will also find this book useful if you are a developer who wants to explore and learn reverse engineering. Having some programming/shell scripting knowledge is an added advantage.

Springer Science & Business Media

Compiler technology is fundamental to computer science since it provides the means to implement many other tools. It is interesting that, in fact, many tools have a compiler framework - they accept input in a particular format, perform some processing and present output in another format. Such tools support the abstraction process and are crucial to productive systems development. The focus of Compiler Technology: Tools, Translators and Language Implementation is to enable quick development of analysis tools. Both lexical scanner and parser generator tools are provided as supplements to this book, since a hands-on approach to experimentation with a toy implementation aids in understanding abstract topics such as parse-trees and parse conflicts. Furthermore, it is through hands-on exercises that one discovers the particular intricacies of language implementation. Compiler Technology: Tools, Translators and Language Implementation is suitable as a textbook for an undergraduate or graduate level course on compiler technology, and as a reference for researchers and practitioners interested in compilers and language implementation.

Advanced C and C++ Compiling Springer

Science & Business Media

This book is a revision of my Ph. D. thesis dissertation submitted to Carnegie Mellon University in 1987. It documents the research and results of the compiler technology developed for the Warp machine. Warp is a systolic array built out of custom, high-performance processors, each of which can execute up to 10 million floating-point operations per second (10 MFLOPS). Under the direction of H. T. Kung, the Warp machine matured from an academic, experimental prototype to a commercial product of General Electric. The Warp machine demonstrated that the scalable architecture of high-peiformance, programmable systolic arrays represents a practical, cost-effective solu tion to the present and future computation-intensive applications. The success of Warp led to the follow-on iWarp project, a joint project with Intel, to develop a single-chip 20 MFLOPS processor. The availability of the highly integrated iWarp processor will have a significant impact on parallel computing. One of the major challenges in the development of Warp was to build an optimizing compiler for the machine. First, the processors in the xx A Systolic Array Optimizing Compiler array cooperate at a fine granularity of parallelism, interaction between processors must be considered in the generation of code for individual processors. Second, the individual processors themselves derive their performance from a VLIW (Very Long

Instruction Word) instruction set and a high degree of internal pipelining and parallelism. The compiler contains optimizations pertaining to the array level of parallelism, as well as optimizations for the individual VLIW processors.

Principles of Compilers Elsevier

This title gives students an integrated and rigorous picture of applied computer science, as it comes to play in the construction of a simple yet powerful computer system.

Compiler Construction Morgan Kaufmann

Engineering a CompilerElsevier

Software Engineering at Google Justin Kelly

This book provides readers with a single-source reference to static-single assignment (SSA)-based compiler design. It is the first (and up to now only) book that covers in a deep and comprehensive way how an optimizing compiler can be designed using the SSA form. After introducing vanilla SSA and its main properties, the authors describe several compiler analyses and optimizations under this form. They illustrate how compiler design can be made simpler and more efficient, thanks to the SSA form. This book also serves as a valuable text/reference for lecturers, making the teaching of compilers simpler and more effective. Coverage also includes advanced topics, such as code generation, aliasing, predication and more, making this book a valuable reference for advanced students and practicing engineers.

Third International Workshop, CC `90.

Schwerin, FRG, October 22-24, 1990. Proceedings CRC Press

Immersing students in Java and the Java Virtual Machine (JVM), Introduction to Compiler Construction in a Java World enables a deep understanding of the Java programming language and its implementation. The text focuses on design, organization, and testing, helping students learn good software engineering skills and become better programmers. The book covers all of the standard compiler topics, including lexical analysis, parsing, abstract syntax trees, semantic analysis, code generation, and register allocation. The authors also demonstrate how JVM code can be translated to a register machine, specifically the MIPS architecture. In addition, they discuss recent strategies, such as just-in-time compiling and hotspot compiling, and present an overview of leading commercial compilers. Each chapter includes a mix of written exercises and programming projects. By working with and extending a real, functional compiler, students develop a hands-on appreciation of how compilers work, how to write compilers, and how the Java language behaves. They also get invaluable practice working with a non-trivial Java program of more than 30,000 lines of code. Fully documented Java code for the compiler is accessible at http://www.cs.umb.edu/j--/

Getting the Most Out of Your Code O'Reilly Media

This new, expanded textbook describes all phases of a modern compiler: lexical analysis, parsing, abstract syntax, semantic actions, intermediate representations, instruction selection via tree matching, dataflow analysis, graph-coloring register allocation, and runtime systems. It includes

good coverage of current techniques in code generation and register allocation, as well as functional and object-oriented languages, that are missing from most books. In addition, more advanced chapters are now included so that it can be used as the basis for two-semester or graduate course. The most accepted and successful techniques are described in a concise way, rather than as an exhaustive catalog of every possible variant. Detailed descriptions of the interfaces between modules of a compiler are illustrated with actual C header files. The first part of the book, Fundamentals of Compilation, is suitable for a one-semester first course in compiler design. The second part, Advanced Topics, which includes the advanced chapters, covers the compilation of object-oriented and functional languages, garbage collection, loop optimizations, SSA form, loop scheduling, and optimization for cache-memory hierarchies.

Compiler Compilers Prentice Hall

Today, software engineers need to know not only how to program effectively but also how to develop proper engineering practices to make their codebase sustainable and healthy. This book emphasizes this difference between programming and software engineering. How can software engineers manage a living codebase that evolves and responds to changing requirements and demands over the length of its life? Based on their experience at Google, software engineers Titus Winters and Hyrum Wright, along with technical writer Tom Manshreck, present a candid and insightful look at how some of the world's leading practitioners construct and maintain software. This book covers Google's unique engineering culture, processes, and tools and how these aspects contribute to the effectiveness of an engineering organization. You'll explore three

fundamental principles that software organizations should keep in mind when designing, architecting, writing, and maintaining code: How time affects the sustainability of software and how to make your code resilient over time How scale affects the viability of software practices within an engineering organization What trade-offs a typical engineer needs to make when evaluating design and development decisions

Crafting A Compiler CRC Press

A compiler translates a program written in a high level language into a program written in a lower level language. For students of computer science, building a compiler from scratch is a rite of passage: a challenging and fun project that offers insight into many different aspects of computer science, some deeply theoretical, and others highly practical. This book offers a one semester introduction into compiler construction, enabling the reader to build a simple compiler that accepts a C-like language and translates it into working X86 or ARM assembly language. It is most suitable for undergraduate students who have some experience programming in C, and have taken courses in data structures and computer architecture.