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COMPILER OPTIMIZATION AND EMBEDDED SYSTEMS

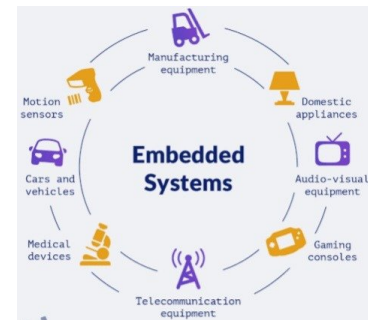DEPARTMENT OF COMPUTER APPLICATIONS

WHAT IS COMPILER OPTIMIZATION?

Compiler optimization is generally implemented using a sequence of optimizing transformations, algorithms which take a program and transform it to produce a semantically equivalent output program that uses fewer resources or executes faster.

- G. Arthi Sri III BCA

WHAT IS EMBEDDED SYSTEM?

Embedded system is a combination of hardware and software designed for a selected function. The systems are often programmable and fast functionality. It is a controller programmed by a real-time operating system (RTOS) with a dedicated function within an electrical system, often with real-time computing constraints.

-Divya Bharathi III BCA

https://www.sam-solutions.com/blog/all-you-need-to-know-about-embedded-system-programming/

Advantages And Disadvantages Of Compiler Optimization And Embedded Systems

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COMPILER OPTIMIZATION

Advantages
- The code may occupy less memory.
- Increase the speed of execution.
- Decrease the memory footprint.

Disadvantages
- It will take longer for the compiler to generate optimized code.
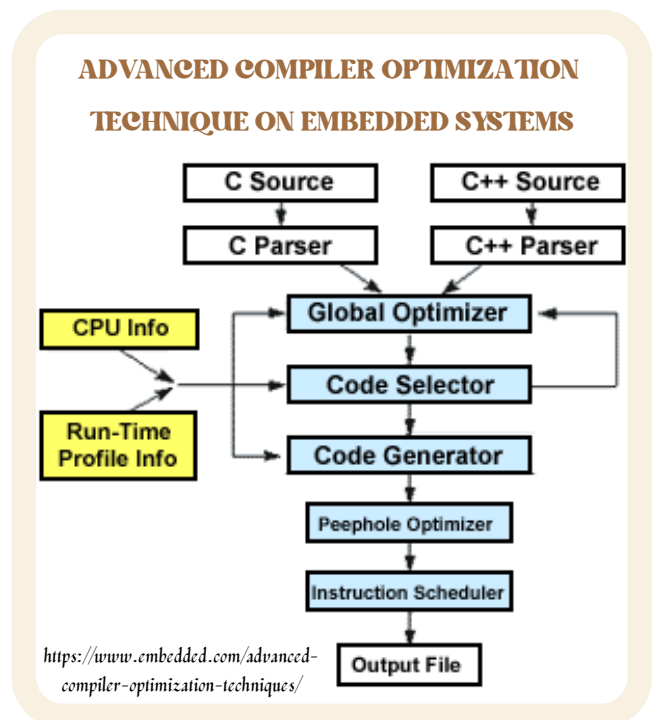- It can be more difficult to debug code that is optimized.

EMBEDDED SYSTEMS

Advantages
- Low power operation.
- Real time response.
- Versatile because of little in size.

Disadvantages
- Hard to take a back-up of implanted documents.
- Hard to keep up.
- Investigating is Harder.

-J. Jayanthi III BCA

ADVANCED COMPILER OPTIMIZATION TECHNIQUE ON EMBEDDED SYSTEMS

C Source → C Parser
C++ Source → C++ Parser
CPU Info, Run-Time Profile Info → Global Optimizer → Code Selector → Code Generator → Peephole Optimizer → Instruction Scheduler → Output File

https://www.embedded.com/advanced-compiler-optimization-techniques/

INFLUENTIAL PERSON IN COMPILER OPTIMIZATION

Pen-Chung Yew is a Distinguished Research Fellow in the Institute of Information Science, Academia Sinica. He has been a professor in the Department of Computer Science and Engineering, University of Minnesota since 1994. He served as the Head of the department and the holder of the William-Norris Land-Grant Chair Professor between 2000 and 2005. Research in this area explores the design, development, and use of computer architectures and compilers to improve computational efficiency, throughput and security. Efficiency, throughput and security of code execution at the machine level is influenced by the machine architectures, the static and dynamic compilation of high-level languages, and use of parallelism and multi-processors. Specific research in this field includes enhancement of computer micro-architectures and compilers to support system security at both the source code and the binary level, leveraging machine learning techniques to improve compilers, using dynamic binary translation and optimization techniques to support system virtualization, and program execution monitoring for optimization, testing, debugging and security. Recent accomplishments include the first learning-based approach to enhance dynamic binary translation for system virtualization, compiler techniques to enhance security and memory performance of modern multicore processors, and various techniques to localize and fix concurrency bugs in parallel programs.

Professor Pen-Chung Yew had two papers accepted for this year's International Symposium on Code Generation and Optimization.

## INFLUENTIAL PERSON IN EMBEDDED SYSTEMS

Elecia White is the founder of Logical Elegance, an embedded systems consulting company based in San Jose. Elecia has developed strong skills in signal processing, hardware integration, complex system design, and performance. Having been through FAA and FDA certification processes, she understands the importance of producing quality designs and how they lead to quality implementations.

Elecia has spent several years in management roles but enjoys hands-on engineering and the thrill of delivering excellent products. While continuing to provide leadership and mentoring, she prefers to focus on the technical aspects of a project. A graduate of Harvey Mudd College in Claremont, CA, Elecia enjoys sharing her passion for science, engineering and interesting gizmos, particularly how these things can make the world a better place.

Elecia White, Founder,
Embedded Software Engineer,
Logical Elegance

-S. Shameem III BCA

FUN FACTS

• If you lie to the compiler, it will get its revenge.
–Henry Spencer

• Embedded lines of code are growing 26% annually but developers are increasing by 8%.
–Venture Development Corporation
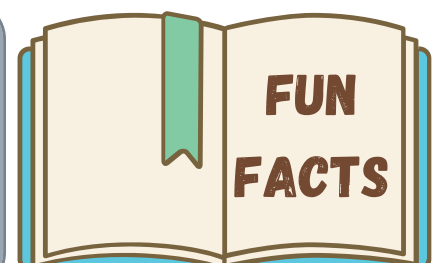
CROSSWORD
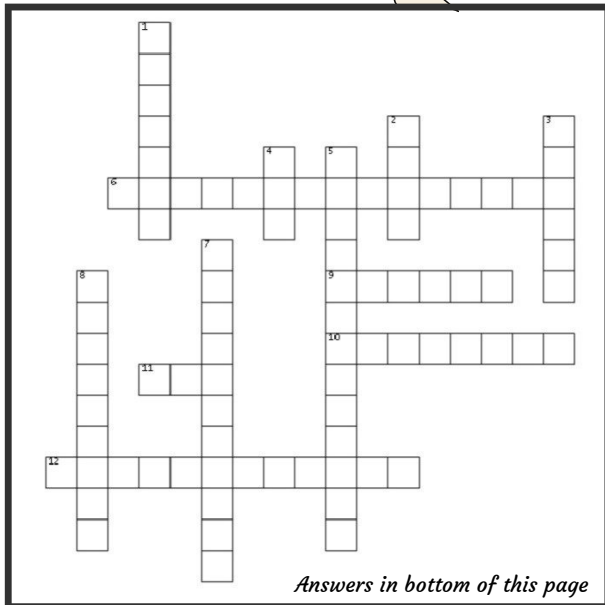
Answers in bottom of this page

ACROSS

6. In a compiler the module that checks every character of the source text is called:

9. Relocation bits used by relocating loader are specified by

10. _ _ _ _ _ _ optimization is a simple and effective technique for locally improving target code.

11. How many types of parser will be in compiler?

12. _ _ _ _ _ _ is the activity of filling up unspecified information of labels using appropriate semantic actions in during the code generation process.

DOWN

1. The three address statements can be implemented using the following methods are :Quadruple ,indirect triples,_ _ _ _ _.

2. The different storage allocation strategies are static allocation,stack allocation,_ _ _ _ _ _ _ allocation.

3. _ _ _ _ _ obtains a string of tokens from the lexical analyzer and verifies that it can be generated by the language for the source program.

4. _ _ _ _ _ _ _ is a useful data structure for implementing transformations on basic blocks.

5. In computer design _ _ _ _ _ is used to obtain a rightmost derivation in reverse.

7. Which data structure in a compiler is used for managing information about variables and their attributes?

8. The graph that shows basic blocks and their successor relationship is called as _ _ _ _ _

Top 5 Best Embedded Systems In 2021

- Qualcomm Snapdragon
- STMicroelectronics Embedded Systems
- Renesas
- INTEL
- NXP Semiconductors

PUZZLES

1. How is the protection and security for an embedded system made?
a) Security chips　　b) Memory disk security　　c) IPR　　d) OTP

2. Which type of memory is suitable for low volume production of embedded systems?
a) Non-volatile　　b) RAM　　c) Volatile　　d) ROM

3. How an embedded system communicate with the outside world?
a) Memory　　b) Output　　c) Peripherals　　d) Input

4. When two nodes send at the same time, then the occurring problem is known as
a) Collision　　b) Accident　　c) Switching　　d) Interaction

5. An optimizing compiler
a) Is optimized to occupy less space　　b) Optimized the code
c) Is optimized to take less time for execution　　d) None of these

Answers in next page
-J. Vidhya III BCA

CROSSWORDS ANSWERS

ACROSS　6. Lexical Analyzer　9. Linker　10. Peephole　11. Two　12. Backpatching

DOWN　1. Triples　2. Heap　3. Parser　4. DAG　5. Handle Pruning　7. Symbol Table　8. Flow Graph
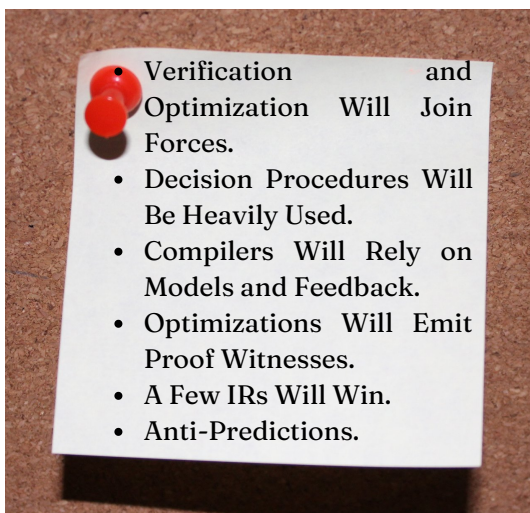
Types Of Optimizations

- Peephole optimizations
- Local optimizations
- Global optimizations
- Loop optimizations
- Prescient store optimizations
- Interprocedural, whole-program or link-time optimization
- Machine code optimization and object code optimizer

Types Of Embedded Systems

- Based On Performance & Functional Requirements
  - Real Time
  - Stand Alone
  - Networked
  - Mobile

- Based On Performance Of The Microcontroller
  - Small Scale
  - Medium Scale
  - Sophisticated

THE FUTURE OF COMPILER OPTIMIZATION

- Verification and Optimization Will Join Forces.
- Decision Procedures Will Be Heavily Used.
- Compilers Will Rely on Models and Feedback.
- Optimizations Will Emit Proof Witnesses.
- A Few IRs Will Win.
- Anti-Predictions.

REFERENCES

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2. Influencial Person In Embedded Systems : https://www.oreilly.com/pub/au/5007

3. Cross Word : https://wordmint.com/public_puzzles/700173

4. Top 5 Best Embedded Systems In 2021 : https://www.360quadrants.com/semiconductor-and-electronics/embedded-systems

Achievers

- V. Nandhini - III BCA, Third Prize, PowerPoint Presentation, Ideathon 2021 On Best Business Plan, Organized By SKPC ICT Academy Entrepreneurship.

- P. Manisha - I BCA, First Prize, PowerPoint Presentation, Idathon 2021 On Best Business Plan, Organized By SKPC ICT Academy Entrepreneurship.

- P. Deepa - II BCAThird Prize, Rangoli- Pongal Competition, Organized By Sri Kanyaka Parameswari Arts And Science College For Women.

- G. Kalyani - II BCA, First Prize, Mehandhi Competition, Organized By Sri Kanyaka Parameswari Arts And Science College For Women.

- G. Reshma - II BCA, Third Prize, Hairdo, Organized By Sri Kanyaka Parameswari Arts And Science College For Women.

PUZZLES ANSWERS

1. c)
2. a)
3. c)
4. a)
5. b)

Design : S. Shameem III BCA