

Compilers in Embedded Systems

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Abstract: Compiler technology always aims at generating an optimized code for improving the performance for every design of the architectures of the processors and also giving away less energy in generating that optimized code. There are many problems and challenges in achieving the above, they are mainly: generating the code for few specialized architectures, memory constraints while generating the code, much energy consumption for smaller codes and many others. We mainly concentrate on suppressing the challenges to an extent by improving the performance in the possible ways. In this paper, we highlight about optimized code generation and lesser energy consumption.

Keywords: Machine level, optimization

1. Introduction

The era of compilers started with the code generation for every basic instruction. User generates the code in the high-level language, which is not understandable by the machine, so it demands machine-level language for its ease of understanding. So to achieve this, the compiler has to perform some set of steps. Those steps are mainly: code generation, intermediate representation and optimization. The end result would be machine-level language which is understood by the machine for the processing to be done. The set of steps are performed by the compiler in order to support the architecture in which it has been designed. Not every architecture and design gives us the same result. Each design and the architectures vary with their own constraints which may be either in terms of their codes or in their whole performance. So, here we identify the problem as the generating an optimized code included lesser energy consumption. In achieving this, it should be cost-effective, should be a better product than its previous versions, high performance and few other features.

In this paper, we discuss about the methods of obtaining an optimized code and also various ways of minimizing energy consumption. In the recent days, many embedded products have arrived which are designed with specialized architectures. These products demand for a better compiler which could satisfy the above mentioned features. So, we specifically highlight about compilers in embedded systems.

2. Literature survey

Nikil Dutt [1], in this paper, the implementations are done in such a way that not just the target codes are generated but also the code sizes are reduced keeping the memory constraints in

consideration. Here, the increase in the program execution is also illustrated. Limitations are incorporation of reliability metrics, dynamic adaptation of code based on environmental constraints and integration issues.

Raju. Ch [2], in this analysis, using the register allocation technique and compiler knowledge function, implementing the compiler for real applications for dealing with high-level language accessibility. Future work deals with the improvement of bridging the compiled code and the assembly code which is handwritten.

P. E nyindh[3], in this paper, it tells about techniques for optimization for modern systems against the elimination of the typical compilers. To achieve that, new and sophisticated compiler analysis is done. But program execution time is not increased even after generating efficient codes.

Mandar Gogate [4], systematically re-targetable, multi-processor compilers are designed which are some of the major approaches to solve the compiler design issues in embedded systems. But only the two of the techniques are discussed, other issues are not resolved.

Armita. P [5], this paper deals with automation in selection of the complex instruction set and mapping the basic blocks to them. In future work, this can be improvised with regard to dataflow instructions with multiple outputs.

Tajana [6], here Source code optimization deals with Algorithmic optimization, Data optimization and profiling for energy and performance. Testing, development and Algorithmic optimization consumes a lot of time, human intervention subjects to errors.

Chakrapani. L. N [7], here characterizing the limits based upon compiler optimization approach in embedded systems. But innovation in micro-architectural features is required for better compiler design.

Mikko Roth [8], energy estimates are considered to check on the energy consumption and compiler optimization. But high investment is required to setup the platform. Further extension is needed for the compiler framework towards multi-criteria optimizations.

David A. Ortiz [9], here analysis of variance, techniques and design of experiments are used to design and analyse the energy consumption and performance of source-code optimization. But the methodology is not universally acceptable.

Shuhaizar Daud [10], discusses about reduced power consumption, architecture specifications to optimization results

in reduced energy consumption. But the designs will be exposed to the architectural constraints and the underlying principles.

3. Discussions

Since code optimization and energy optimization are the two major features that are focused in the compiler environment. There are many techniques and ways in achieving the above, in which few are discussed in the above mentioned works. There are also many challenges and problems while optimizing a generated code. Few of them are: code generation for the specialized architecture, memory constraint is another important concept that could exploit the timing and structure of the embedded systems, amount of energy consumed should be reduced, performance constraints and many others. In this paper, we mainly concentrate on compilers in embedded systems. The role of a compiler in other systems is not very complicated when compared with embedded systems. We highlight embedded systems here, for the traditionally used languages like C, C++ the software is different for those platforms. When it comes to embedded systems, it is completely different as it bears a new set of goals, constraints, architectures and system organizations. This requires a proper thinking of approaching towards the compiler technology for the embedded systems. The above works discuss about the possible approaches for the challenges in the embedded systems.

4. Conclusion

Compiler technology is very much advancing in terms of generating the code for the designated architectures and the systems. For the complicated embedded processors, the compilers have to come up with an advancing way of code and

energy optimization, which is done by using CPU and application specific information. We have discussed about many techniques for finding better solutions for the optimization. Performance is another metric that comes in light when dealing with compilers especially in case of embedded systems. In this paper, we deal with getting an optimized code and also the energy consumption for this. Both are considered in achieving an ideal compiler for the embedded systems.

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