SoftExplorer

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Abstract

SoftExplorer is a power/energy estimation tool that allows the designer to estimate the consumption of his application. The estimation can be done, from both C and ASM codes, on different processors.

1. Introduction

The growth part of nomad applications requires the designer to take into account the consumption constraints during the design step. Furthermore, the need to reduce the time to market leads an increase of software components. Thus, the designers need to have tools to allow them to estimate the power/energy consumption of their applications during the first step of the design flow. Indeed, the optimizations realized early in the design step have more impact than these realized at later in the flow even if all the optimizations are important.

So, SoftExplorer had been developed to fit to this problem by providing to designer a fast and accurate estimation tool. This tool is stemming from research works, called FLPA methodology (more detail about the FLPA methodology can be found in [1]), realized by J. Laurent et al from the LESTER laboratory of the University of South Brittany. The next section presents the SoftExplorer's estimation flow allowing the power/energy estimation of an application.

2. SoftExplorer's Estimation Flow

Figure 2 presents the estimation flow for both the C and ASM estimation. When estimation is performed from the C code, a parser is first used to transform the input code in an architecture independent pseudo code. This parser is built around the gcc.4 front end. In the working directory, SoftExplorer generates a file called test.parser, which represents this pseudo code. This file is the same whatever the targeted processor. Another file is generated, that includes all the data structures and global variables used in the code and proposes a mapping in memory for them. The user can then change this initial mapping for the mapping he prefers.

The next step is to apply a prediction model on the pseudo code. The prediction model allows taking into account the optimizations that could be carried out by the compiler; more information about these models can be found in [2]. These prediction models are the following:
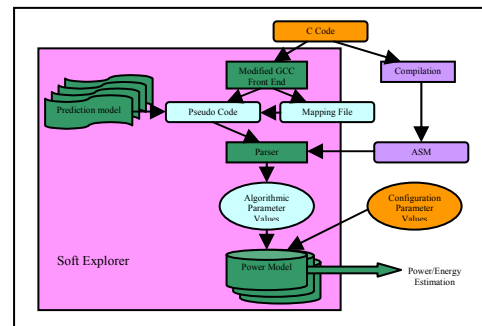

Figure 1: SoftExplorer's estimation flow

The first graphical interface (figure 2) allows the user to choose estimation method (C or ASM), the target and the application that he wants to estimate. Today, four processors are available: a low power DSP (TI TMS320VC5510), three powerful DSPs (TI TMS320C6201 and C6701) and a general purpose (ARM7TDMI).

The estimation time with SoftExplorer, for a complex application like MPEG2 encoder algorithm, requires about one second of CPU time.
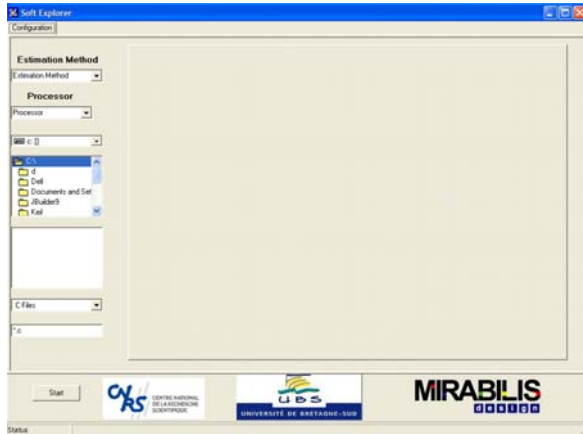
Figure 2: SoftExplorer's configuration graphical interface

As the data placement in memory has a great impact on the power/energy consumption of an application, SoftExplorer generates automatically a mapping file (figure 3) to take into this placement (only for data structures and global variables) during the estimation step. The user can modify this placement to force SoftExplorer to respect his data constraints.
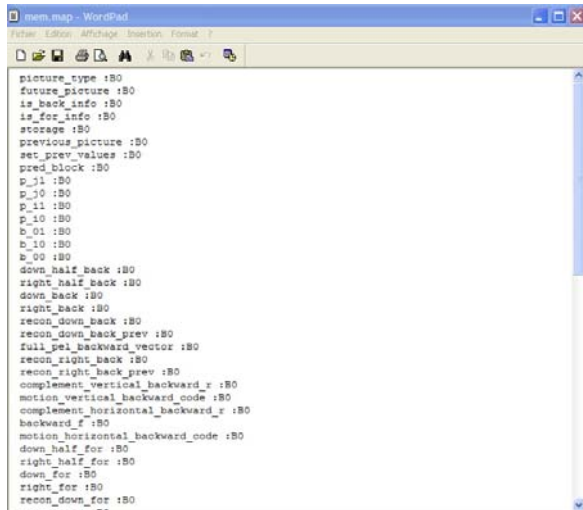

Figure 3: SoftExplorer's mapping file

This file, also, allows SoftExplorer to compute the memory conflicts rate. This metric is very useful to enable the designer to optimize his data placement in order to decrease the consumption of his application.

The Function Results page presents the power and energy consumptions of every function in the code (figure 4). The Power is read on the vertical axis of the graphic, the energy is the area of every yellow rectangle, that is to say, the power by the function's execution time. Each function is identified with its name and can be easily traced back in the input C code.
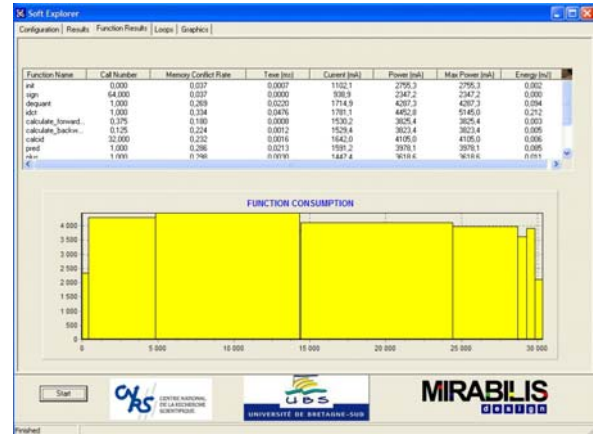

Figure 4: SoftExplorer's function result page

The use of SoftExplorer is presented in more details on the SoftExplorer's website (https://www.softexplorer.fr)

3. Conclusion

In conclusion, SoftExplorer is a fast and accurate power/energy estimation tool dedicated to software applications. The different results, given by Soft Explorer, allow the software designer to verify if his application meets the consumption constraints, allow choosing the best target and/or algorithm, in consumption point of view, to execute an application. And finally, SoftExplorer is, also, a good way to optimize the power/energy consumption when the designer has defined his target and his algorithm to realize his applications.

4. References

[1] N. Julien, J. Laurent, E. Senn, and E. Martin, "*Power consumption modeling of the TI C6201 and characterization of its architectural complexity," IEEE Micro, Special Issue on Power- and Complexity-Aware Design,* Sept./Oct. 2003.

[2] E. Senn, J. Laurent, N. Julien, and E. Martin, "*SoftExplorer: Estimating and optimizing the power and energy consumption of a C program for DSP applications," the EURASIP Journal on Applied Signal Processing, Special Issue on DSP-Enabled Radio,* vol. 2005, no. 16, September 2005.

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