Chip Space and Transistor Count Estimator

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General

The transistor count and chip space estimation tool is based on Microsoft Excel. It is used to estimate the required die area and the number of transistors of a simulated processor. To reach this goal, it is necessary to estimate the number of bits and the number of ports of memory based structures. Therefore this tool provides the estimation of bits and ports, too.

A processor simulator has a configuration file, usually. The parameters of this configuration file are the input for the estimation. Because there is additional data necessary to estimate the chip space and the number of transistors additional assumption have to be made.

The spreadsheets of the Excel Workbook (the estimator) are structured as follows.

The first spreadsheet contains the parameters of the configuration file of the processor simulator and is named “Configuration File Parameters”.

The second spreadsheet contains the assumptions, which have to be made for the estimations. This spreadsheet is named “Basic Assumptions”.

For the memory-based parts of the simulated processor an estimation of the number of bits and ports is necessary. These estimations are modelled in the next to spreadsheets named “Port Calculation” and “Bit Calculation”.

With the information in the first four spreadsheets the transistor estimation and the area estimation can be done. Therefore the fifth and sixth spreadsheets are used and they are named “Transistor Calculation” and “Area Calculation”.

The results of the estimations are summarized in the seventh spreadsheet “Result Presentation”.

To keep the formulas of the calculations readable the used fields in the spreadsheets are named. In the eighth spreadsheets the naming conventions for this fields are stored and it is named “Field Name Conventions”.

The workbook is enhanced with some Macros, which implements helpful functions for working with the spreadsheets.

Spreadsheets

In this section the spreadsheets are described more detailed than in the general section of this document.

Configuration File Parameters

This spreadsheet contains the parameters of the simulator for which the processor should be estimated. The source of these parameters is a configuration file of the simulator. At the moment there is no way to read and write configuration files automatically, but this could be a useful extension.

Basic Assumptions

The spreadsheet “Basic Assumptions” contains additional data for the estimation. In a configuration of a simulator the values are only specified which are necessary for the evaluation of the IPC value.
The basic assumptions complete the parameters, which are implicit in the simulator, like the width of addresses in bit or the size of the registers files.
Other parameters are not in the simulator but are needed to estimate the transistor count or the die size. These parameters are for example the number of transistors of a bit cell or of a read or write port.
For empirical estimation models measured sizes of functional units is necessary. These results of measurement are elements of the “Basic Assumptions” sheet, too.

Port Calculation

The “Port Calculation” spreadsheet contains the formulas to calculate the number of ports of the memory - based units. The formulas depends strongly on the implementation of the simulator and the baseline architecture of the estimated processor. Changes in the architecture of more accurate modelling components in the simulator may have effects on the memory – based components and the number of their read and write ports. Therefore the user of the estimator has to check the formulas, if they fit to his modelled processor and to adapt them eventually.

Bit Calculation

This spreadsheet contains the formulas, which calculate the number of the bits of each memory - based component in the estimated processor. The number of bits determine how many bit cells have to be implemented if such a component would be build.
Like the port calculation the bit calculation is strongly influenced by the baseline architecture. Therefore the user has to check, if the formulas fit to his simulator and to adapt them eventually.

Transistor Calculation

In the analytical models the number of bits and ports are the input parameters for the transistor calculation, in the case of empirical estimation, measured values. These values are stored in the spreadsheets “Port Calculation”, “Bit Calculation” and“Basic Assumptions”. Some of the formulas are rough. If there are better formulas available, they can easily be changed.

Area Calculation

Analogical to the “Transistor Calculation“ the spreadsheet “Area Calculation” is organized. The formulas base on the “Port Calculation”, “Bit Calculation” and “Basic Assumptions”. If the user has better formulas to estimate components, he can integrate these formulas into the estimator easily.

Result Presentation

To summarize the results of the calculation in one spreadsheet, the sheet “Result Presentation” is used.

Fieldname Conventions

To keep the formulas easy to read, the fields in the spreadsheets are named systematically. In the formulas these fieldnames (like “BitPerTlb”) are used instead of direct cell references (like “A3”). To keep the acronyms, which are used to generate the fieldnames, consistent, this table stores the words and the used acronyms for them.

Macros

There is a macro to copy the formulas of a range to the cells at the right side of this range. This macro is called “*copyFormulasOfRangeToTheRight*” and can be called using “Strg + t”.
The KSMS tool contains a macro to copy the results into a separate spreadsheet called “*saveResultsInNewTable*” and one to generate bar charts, called “*startChartGeneration*”.
The macros can be extended and new macros can be added to enhance the estimation tools.

Further Enhancements

The estimation tools can be extended with better formulas and additional macros and it can be adapted to other simulators or base line architectures. These enhancements and suggestions can be sent to steinhaus@rapidsolution.de together with a description. The documentation and the download area at www.ira.uka… will be extended, if the enhancements fit to our tool.