COMPARISON OF SINGLE-CORE AND DUAL-CORE PROCESSOR PERFORMANCE ON MPSoC

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ABSTRACT

This paper presents overall performance of Dual core processor with the low-power cache memory. We are present an important area in VLSI design architecture which is a parallel processing in MPSoC. Multiple processes works on the SIMD technique in MPSoC. The Dual core processor uses new techniques to reduce power consumption and increase the speed comparatively single core processor. Since memories are gain access to sequentially, it implements a single address bus for read and writes operation with stored data.

In the Simulation on Xilinx, I will compare the different types of parameter such as power consumption, area, execution time and overall performance of Single core processor and dual core processor. Single core processor is in individual memory of 128 byte and Dual core processor is in shared memory of 128 byte.

Index Terms- MPSoC, ALU, Xilinx, Single and Double Core Processor.

1. INTRODUCTION

In today’s applications, several generations of Multi core processor; Cell phones use several programmable processors to handle the signal processing and protocol tasks required by telephony. These architectures must be designed to operate at the very low-power levels provided by batteries.

Communications and networking use specialized systems-on-chips, such as network processors, to handle the huge data rates presented by modern transmission equipment.

Unlimited amounts of computational power but must also happen in real-time, low-pwr, and low-cost requirements.

Multiprocessor systems-on-chips (MPSoCs) are the latest incarnation of the very large scale integration (VLSI) technology. A single integrated circuit/chip can hold over 100 million transistors, logic gates Even one of the simplest microprocessor contains one ALU for purposes such as maintaining timers. We can say that ALU is a core component of all central processing unit within in a computer and is an integral. Very low-power operation, and so on. These opportunities and challenges make MPSoC design an important field of research.

In this project, we presented an important area in computer architecture which is a parallel processing in MPSoC. Which Machines employing parallel processing are called parallel machines? This type of process works on the SIMD technique in MPSoC. In a parallel machine, a number of execution units (ALU’s) are connected in parallel, so that each unit is able to handle an instruction.

For example, if two such units are present in the processor, two instructions can be handled concurrently resulting in faster implementation. I will discuss on single core processor and dual core processor. On the other hand, by the help of Simulation on Xilinx, I will compare the different types of parameter such as power consumption, area, execution time and overall performance, of Single core processor and dual core processor.

In this paper I will discuss on single core processor and dual core processor. Suggests the behavioral design method for VHDL implementation of a 32-bit ALU using Xilinx Tool. The Multi-processor operation with Shared Memory combination can effectively improve the performance of this processor.

2. SINGLE CORE PROCESSOR

The single core processor, it processor work with mainly two parts 1) ALU and 2) RAM. Single core processor is in individual of 128 byte.

A calculation is identified, examined and implemented using the Xilinx software. 128 byte data storage RAM for the processor.
bytes with input lines read, write, clock, opcode, reset and address line and output line.

4. SYNTHESIS REPORT

i) Advanced HDL Synthesis Report

Table no-1 Advanced HDL Synthesis Report

<table>
<thead>
<tr>
<th>Macro Statistics</th>
<th>Single Core Processor</th>
<th>Dual Core Processor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name of statistics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 bit Adders/Subtracts</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>32-bit up counter</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Flip-Flops</td>
<td>1032</td>
<td>2064</td>
</tr>
<tr>
<td>8-bit 128-to-1 multiplexer</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>8-bit XOR</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Maximum Fan-Out</td>
<td>50</td>
<td>100</td>
</tr>
<tr>
<td>Generic Clock Buffer</td>
<td>51</td>
<td>51</td>
</tr>
</tbody>
</table>

ii) Device utilization summary

Area of processor ids decided by the help of this table.

Table no – 2 : Device utilization summary

<table>
<thead>
<tr>
<th>Macro Device</th>
<th>Single Core Processor</th>
<th>Dual Core Processor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name of device</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of Slice</td>
<td>155</td>
<td>158</td>
</tr>
<tr>
<td>Number of Slice Flip Fops</td>
<td>169</td>
<td>230</td>
</tr>
<tr>
<td>Number of 4 input LUTs</td>
<td>268</td>
<td>374</td>
</tr>
<tr>
<td>Number of IOs</td>
<td>52</td>
<td>54</td>
</tr>
<tr>
<td>Number of bonded IOBs</td>
<td>52</td>
<td>54</td>
</tr>
<tr>
<td>Number of GCLKs</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>
iii) Delay Analysis

Table no – 3: Device Delay summary

<table>
<thead>
<tr>
<th>Name of statistics</th>
<th>Single Core Processor</th>
<th>Dual Core Processor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum input arrival time before clock</td>
<td>14.47 ns</td>
<td>12.34 ns</td>
</tr>
<tr>
<td>Maximum output required time after clock</td>
<td>6.21 ns</td>
<td>4.23 ns</td>
</tr>
<tr>
<td>Maximum combinational path delay:</td>
<td>17.666ns</td>
<td>14.56 ns</td>
</tr>
<tr>
<td>Minimum period:</td>
<td>7.052ns</td>
<td>5.103ns</td>
</tr>
</tbody>
</table>

5. RESULT

The table shows the comparison between Single Core Processor and Dual Core Processor. The result clearly shows that the power consumption of Dual Core processor is lower than the one Single core Processor. Power is calculated using SPARTAN-3 XPE-11.1, power estimating tool from Xilinx.

A) Execution Time

The performance results of Single Core Processor and Dual-Core Processor generated from Xilinx tool. The total execution time for the processors were as follows: Total Execution time of Single Core Processor is 7.052 seconds Total Execution time of Core Processor is 5.103 seconds

\[ n = \text{Ex Single Core Processor} - \text{Ex Dual Core Processor} / \text{Ey(Dual Core Processor)} \times 100 \]

B) Power Analysis

The power analysis is done with Xilinx power estimator (XPE) that express in a excel sheet The static power of proposed design is same as Single core processor but dynamic power is reduced and total power consumption decreases.

Above diagram is show power analysis both Single core processor and Dual core processor. Both towers are different. Because Single Core Processor is use less no of LUTs). Comparatively Dual core processor. But the dynamic power is reduces. of Dual core processor

C) Area

Area of Processor is depend on the how many LUTs use in the system. LUT stands for a Look Up Table. The many number of Flip Flop is inbuilt it, that's a execute the different type of operation, same as in a single core processor and Dual core processor built a different no. of LUTs.
Figure 6: Graph shows comparison of circuit area of Single core processor and Dual core processor.

From the above graphs we can clearly make out that overall power consumption of Dual core processor is reduced than the previous one. The dynamic power consumed by Dual core processor is 24.62% lesser than the Single core processor.

D) Overall performance Analysis

The overall performance of single core processor is 0.944 and in dual core processor is 0.151. Thus, in case of overall performance there is 4.292% of dynamic power reduction in Dual core processor.

6. CONCLUSION

The table shows the comparison between Single core processor and Dual core processor.

Though there is a increase in circuitry in case of Dual core processor due to added LUT, but the time of execution decreases, still the overall product of delay (ns) and power (W) is reduced, which shows the improvement in result. There is a power reduction of 24.62% in the circuit of Dual core processor.

In case of overall performance there is 4.292%, increase compare with Single core processor.

The Dual-Core Processor is over 3.814% faster than Single Core Processor.

Table 4: Comparison of overall power consumption of Dual core processor

<table>
<thead>
<tr>
<th>Name of Device</th>
<th>Execution Time (ns)</th>
<th>Power (W)</th>
<th>Area (LUT)</th>
<th>Overall performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Core Processor</td>
<td>7.052</td>
<td>0.134</td>
<td>268</td>
<td>0.944</td>
</tr>
<tr>
<td>Dual Core</td>
<td>5.103</td>
<td>0.101</td>
<td>374</td>
<td>0.515</td>
</tr>
</tbody>
</table>

REFERENCES


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