DESIGN AND IMPLEMENTATION
OF A RISC-V ISA-BASED IN-ORDER DUAL ISSUE SUPERSCALAR PROCESSOR

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Design and Implementation of a RISC-V ISA based In-order Dual Issue Superscalar Processor

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C-DAC (Centre for Development of Advanced Computing)

C-DAC IS A premier R&D organization in IT&E (Information Technologies and Electronics) in the country working on strengthening national technological capabilities in the context of global developments in the field and responding to change in the market need in selected foundation areas. In that process, C-DAC represents a unique facet working in close junction with MeitY to realize nation’s policy and pragmatic interventions and initiatives in Information Technology.
Processor Design Expertise

- ER902- 32- bit 5-stage pipeline RISC processor
- VAJRA64- 11-stage pipelined In-order Dual Issue Superscalar Processor
- ASHWA64 -Superscalar, variable-length, out-of-order pipeline
VAJRA64

- A 11-stage pipelined In-order Dual Issue Superscalar Processor based on RISC-V ISA based processor. VAJRA64 is designed for mid range embedded applications that require memory management unit for high level operating systems
Features

- Quad Fetch, In-order, Dual Issue, Superscalar Core
- Support for 97 Instructions
- 64 Bit Load Store Architecture
- Pipelined Harvard Architecture
- Byte, Half-Word, Word and Double-Word Memory Access
- Interrupt support
- Multi-level MMU
- Processor Modes-User, Supervisor and Machine

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Features contd..

- RISC-V (RV64IMA) Instruction Set Architecture
  - User level ISA Version 2.0
  - Privileged Architecture Version 1.7

- 11 Stage Integer Pipeline
  - Fetch :: 4 Stage
  - Decode :: 2 Stage
  - Execute :: 5 Stage
The four separate Execution pipes:
- Asymmetric Integer lanes
  - Full ALU
  - Simple ALU
- Multiply Lane
- Divide Lane
VAJRA64 Architecture

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Synthesis results

- Xilinx Kintex7 “xc7k325t-2-ffg900” FPGA.

<table>
<thead>
<tr>
<th>Resource</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slice Registers</td>
<td>48131</td>
</tr>
<tr>
<td>Slice LUTs</td>
<td>62517</td>
</tr>
<tr>
<td>LUT-FF pair</td>
<td>83043</td>
</tr>
</tbody>
</table>
Linux boot

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Targeted applications

- Consumer devices
- Home networking appliances
- Embedded computing
- Printers
- Strategic
THANK YOU

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