Modeling and simulation of Power Consumption on Heterogenous CPU Cores under varying workloads and operating conditions

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***Abstract*—This document serves as phase-1 report for E0-240 - Modeling and Simulation course project delivery. The main objective of this project is to apply concepts learned in E0-240 course in to Modeling and simulation of a real-world system, which in this case is Multi-core, Heterogenous CPU. This project, will focus on developing a Power Consumption Model for simulated Full-System [1] under varying workloads. This model will be developed taking in consideration various operating conditions of the CPU such as Dynamic Frequency Scaling, Heterogenous Cores [2]**

***Index Terms*—Modeling, simulation, heterogenous CPU cores, power consumption**

I. Background

II. Methodology

As mentioned in previous work [3], a similar method is followed, wherein a ODROID-XU4 [4] Big-Little development board is chosen as first target for experimentation, data gathering and validation efforts. An overview of this hardware is show in Figure. 1.

A. Data Gathering

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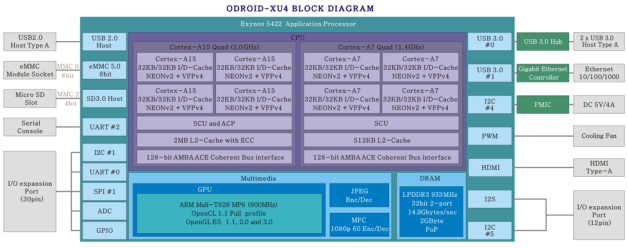

Fig. 1. ODroid XU4 board overview

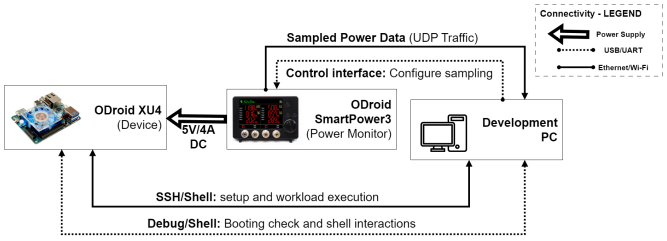

Fig. 2. Experiment setup for power data gathering from ODROID-XU4 [4] hardware

TABLE I
Power and Performance Feature gathered from mentioned experiment setup

Feature/Statistics Type	Feature details	
	Source	*Details*
CPU Clock Cycles	perf[x]	CPU cycles, us cycles, instructions, CPU frequency, CPU idle state statistics
Instruction Branches	perf[x]	Branch instruction and speculative operation statistics
Caches	perf[x]	Data/Instruction cache references, misses at L1, Last-Level-Cache levels
Board Level Power	SmartPower3 [5]	Current, Power drawn from power supply.
Misc. Performance	perf[x]	CPU Migrations, Context switches, Virtual memory

III. Phase-2 Progress

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IV. Phase-2 Observations and Results

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TABLE II
LIST OF WORKLOADS BEING USED FOR DATA GATHERING AND VALIDATION

Workload Type	**Workload details and status of integration**	
	***W*orkloads**	***Status***
Stress Test	stress command [6]	✓
Video Encoding	ffmpeg encode [6]	✓
File Compression	gzip, bzip2, xz on complex datasets [7]	✓
Benchmark Suite	SPEC2017 CPU Benchmarks [8]	Planned

V. DISCUSSION ON PHASE-2 OUTCOMES

VI. NEXT STEP

A. Modeling and Empirical Model generation

B. Power Model Integration to Gem5

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