International Journal of Scientific Research & Engineering Trends
Volume 5, Issue 1, Jan-Feb-2019, ISSN (Online): 2395-566X

GREENDROID: Energy Efficient Mobile Application Processor Using Android System

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Abstract – **Mobile application processors will soon replace desktop processors as the focus of innovations in microprocessor technology. Already, these processors have largely reached their most power-hungry cousins, supporting out-of-order execution and multi-core processing. In the near future, the problem of the exponential worsening of dark silicon will be the main force dictating the evolution of these designs. In a recent paper, we have argued that the natural evolution of mobile application processors is to use this dark silicon to create hundreds of automatically generated energy saving cores, called conservation cores(c-cores), that can reduce energy consumption in an order of magnitude. This article describes Greendroid, a research prototype that demonstrates the use of such cores to save energy through the access points in the Android mobile phone software stack.**

Keywords – **c-cores: conservation cores, ios: iphone operating system, GPS: global positioning system, VLSI:very large scale integration system.**

I. INTRODUCTION

Recent VLSI technology trends have led to a disruptive new regime for dig-ital chip designers,**where Moore's law con**tinues but CMOS scaling provides increasingly diminished fruits. As in prior years, the computational capabilities of chips are still increasing by 2.8 times per process generation. However, a utilization wall limits us to only 1.4 times of this benefit causing large under clocked swaths of silicon area hence the term dark silicon. With the advancement in electronic design industry normal mobile phones with only calling capabilities have gone obsolete now.

Mobiles phones are now replaced by smart phones which run on an open source operating system like android or iOS. Smart phones have integrated capabilities of a personal digital assistant, music player, digital camera and a GPS based navigation device. A Greendroid processor will have many smart conservation core also pronounced as c-cores. Each core targets a specific portion of the Android operating system. Android operating system is well suited for use with c-cores.

These c-cores are reconfigurable. Green droid is a mobile application processor which will reduce power consumption in smart phones. Green Droid will provide many specialized processors targeting key portions of android based smart phone. Green droid will reduce power consumption for these codes by making use of special computing cores known as conservation cores.

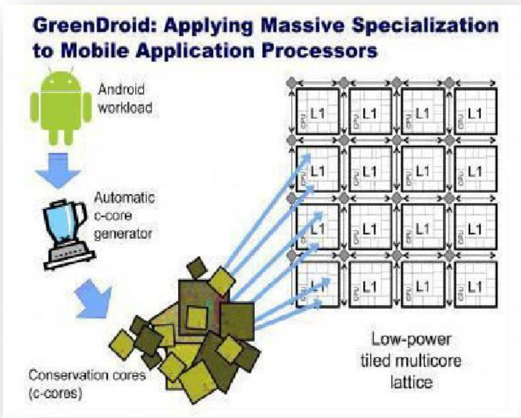

Fig. 1 Greendriod.

It does this through the use of a number of automatically generated sophisticated power optimized cores also called as conservation cores. This mobile application processor is based on 45nm multi core technology and can accomplish general purpose mobile applications with 11 times less energy than the best available power efficient design in the market, at similar or better performance levels.

II. UTILIZATION WALL CONCEPT

With each successive process generation, the percentage of a chip that can actively switch drops exponentially due to power constraints.

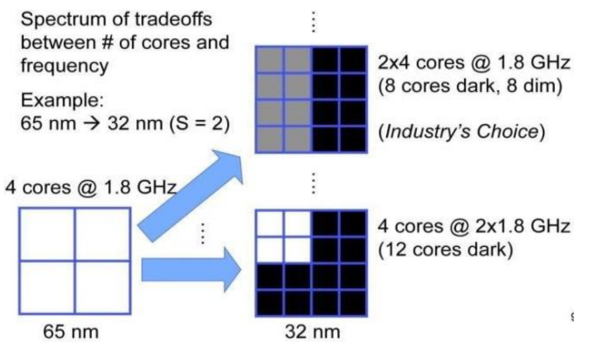

Fig. 2 Utilization Wall Dark Implications for Multi-core.

The usual design of the chip in a cell phone to lose considerable energy due to the availability of unused transistors is called dark Silicon. Dark silicon, when we have three billion transistors on the chips, but we can use only 1.8 percent of them at a time so as to squeak under the draconian energy budget threshold of our chip. The problem of dark Silicon directly responsible for desktop processors industry to stop the clock frequency scaling and instead build multi-core processors. Green droid turns out to be a boon to this dark problem of Silicon. It follows the ideology of filling the chip with highly specialized cores, the share of the chip, which burns at one time may be the most energy efficient for that specific task.

III. DRAWBACKS OF ANDROID

- Power consumption is more, since it is mainly meant for internet surfing, co-operate applications.
- Frequently using applications always remains on, unless we clear the task manager and it consumes power
- 1111Normally uses 200 m ampere-hour, where battery provides 1500 m ampere-hour.

IV.GREENDROID ARCHITECTURE

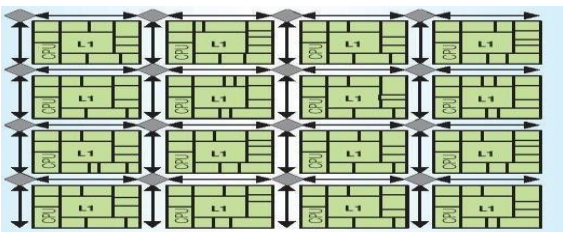

Fig. 3 Green droid Tiled Architecture.

- lattice of 16 cores Tiled
- Each tile contains
- 6-10 Android c-cores (~ 125 totals).
- On-chip network router.
- 32 KB D-cache (shared with CPU) .
- MIPS processor.

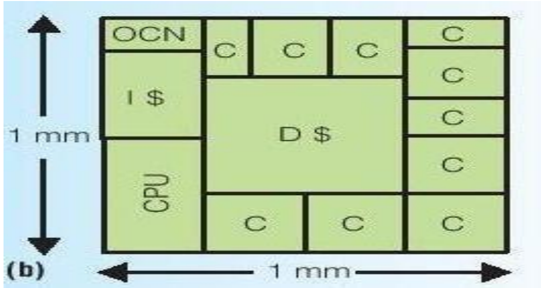

Fig. 4 Green droid Tiled Floor plan.

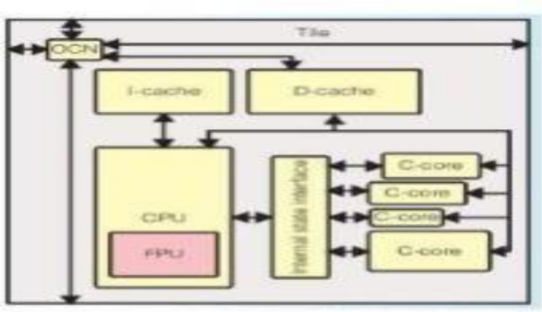

Fig. 5 Green droid Tiled Skeletonal plan.

V. APPLYING C-CORES TO ANDROID

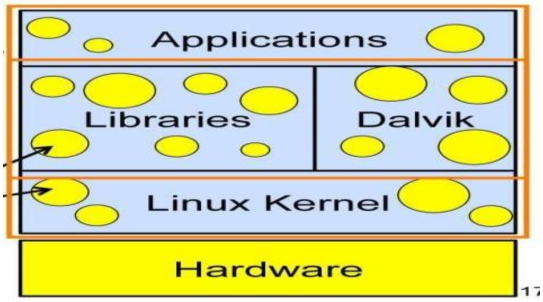

Fig.6 the c-cores to android converting layer

Growing transistor counts, limited power budgets, and the breakdown of voltage scaling are currently conspiring to create a Utilization Wall that limits the fraction of a chip that can run at full speed at one time. In this regime, specialized, energy-efficient processors can increase parallelism by reducing the per-computation power requirements and allowing more computations to execute under the same power budget Conservation corps, or C-CORES, are specialized processors that focus on reducing energy and energy- delay instead of increasing performance. This focus on energy makes c-cores an excellent match for many applications that would be poor candidates for hardware acceleration (e.g., irregular integer codes). We present a tool chain for automatically synthesizing c-cores from application source code and demonstrate that they can significantly reduce energy and energy- delay for a wide range of applications. The c-cores support patching, a form of targeted reconfigurability, that allows them to adapt to new versions of the software they target. Our results show that conservation cores can reduce energy consumption by up to 16 times for functions and by up to 2.1 times for whole applications, while patching can extend the useful lifetime of individual c-cores to match that of conventional processors.

VI. ADVANTAGES

- Green droid looking for energy efficient designs & architectures.
- Green droid will demonstrate the benefits of c-cores for mobile application processors.
- Green droid is a mobile application processor that implements Android mobile environment hotspots using hundreds of specialized cores called conservation corps.
- Deliver faster responsiveness and higher performance when the user is running multiple programmes at the same time.

VII. CONCLUSION

Utilization wall describes how Exponentially worsen the dark silicon problem, which has been overcome by implementing GREENDROID technology by Application of c- cores to android, where C-core reduce energy consumption for key regions, by selective de pipelining. Conservation corps will enable the conversion of dark silicon into energy savings and allow increased parallel execution under strict power budgets. The usage of the C-Cores can be reduced by limiting the Number of C-Core used per application and also it is make use of the selective depipelining technique to reduce the overhead of executing highly irregular code by minimizing registers and clock transitions. As per future idea the Number of C-Cores can be reduced and hence Performance also increases. I Cache and D Cache can be Integrated so that the work flow becomes even more fast.

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