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I 7 Processor

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Abstract:

The Intel Core i7 processor, belongs to the new processor generation using Nehalem micro architecture & it is the latest in cutting edge processor with faster intelligent, multi core technology for the desktop PC. We can make faster applications and unleash incredible digital media creation. The core i7 processor is a combination of Intel Turbo Boost technology and Intel Hyper-Threading technology, which maximizes performance to match your workload.

The Intelreg Coretrade i7 processor code named Nehalem has a novel feature called Turbo Boost which dynamically varies the frequencies of the processor's cores. The frequency of a core is determined by core temperature, the number of active cores, the estimated power and the estimated current consumption. We perform an extensive analysis of the Turbo Boost technology to characterize its behavior in varying workload conditions. Furthermore, we analyze the capability of Turbo Boost to mitigate Amdahl's law by accelerating sequential phases of parallel applications. Finally, we estimate the impact of the Turbo Boost technology on the overall energy consumption. We found that Turbo Boost can provide (on average) up to a 6% reduction in execution time but can result in an increase in energy consumption up to 16%. Our results also indicate that Turbo Boost sets the processor to operate at maximum frequency when the mapping of threads to hardware contexts is sub-optimal.

Introduction:

The Intel's new technology is multi-core processor has a unique feature called Turbo Boost Technology. The i7 processor increases the frequency of the cores based on the core temperature, the number of active cores, the estimated current consumption, and the estimated power consumption. Generally, the Core i7 processor can operate at frequencies between 1.5 GHz and 3.2 GHz (non-Turbo Boost frequency/base frequency) in frequency steps of 133.33 MHz. The Turbo Boost technology enabled, the processor can increase the frequency of cores two further levels to 3.3 GHz and then 3.4 GHz. Turbo Boost is made possible by a processor feature named power gating. Traditionally, an idle processor core consumes zero active power while still dissipating static power due to leakage current. Power gating aims to cut the leakage current as well, thereby further is reducing the power consumption of the idle core. The extra power headroom available can be diverted to the active cores to increase their voltage and frequency without violating the power, voltage, and thermal envelope. Turbo Boost Technology essentially makes the Nehalem a dynamically asymmetric multi-core processor (AMP); cores use the same instruction set but their frequency can vary independently and dynamically at runtime.

Amdhal's Law: In the world of parallel computing or in general of high performances one of the metric more useful for evaluating the gain reachable in an implementation on many processors of a program in comparison with its serial uni-processor version is the speedup S defined as the ratio between the time *Tser* occurred for the execution of the serial program and the time *Tpar* occurred for its parallel version:

S = Tser / Tpar

Here, Let's consider these two times as computed by a *scalability analysis* of a particular logic implementation of the problem which they refer to, and not by their measurement on a particular hardware system. From the expression one obtain the Amdahl's Law by mean of the concept of parallelizable fraction *f* of a particular parallel implementation, that is the percentage of statements that are executable at the same time on many processors:

S = p / f H1 − pL + p

Where, p is the number of used processors and 0 < f 1. The optimal case, that is when f = 1, provides for S a value equal to p. The S is an increasing function respect to the variable p, and for p tending to infinity we obtain the limit 1/(1 – f) that expresses the Amdahl's law, from which one observe that the speedup admits a superior limitation determined by the used code, even if the number of processors *p* is very high.

The goals of Turbo Boost technology are :

1) To understand how Turbo Boost behaves depending on the properties of the application such as its degree of CPU or memory intensity,

2) To find how system load, specifically the number of threads running concurrently, affects when and how often Turbo Boost gets engaged.

3) To determine how scheduling decisions that distribute load in a processor affect the potential performance improvements offered by Turbo Boost.

Multicore Processor:

A multi-core processor is a single computing component with two or more independent actual processors (called "cores"), which are the units that read and execute program instructions. The instructions are ordinary CPU instructions such as add, move data, and branch, but the multiple cores can run multiple instructions at the same time, increasing overall speed for programs amenable to parallel computing. Manufacturers typically integrate the cores onto a single integrated circuits (known as a chip multiprocessor or CMP), or onto multiple dies in a single chip package. The improvement in performance gained by the use of a multi-core processor depends very much on the software algorithms used and their implementation. In particular, possible gains are limited by the fraction of the software that can be parallelized to run on multiple cores simultaneously; this effect is described by Amdhal's Law.

II. METHODOLOGY

We run four sets of experiments for this study: the Isolation Tests, the Paired Benchmark Tests, the Saturation Tests, and the Multi-Threaded Tests.

A. Isolation Tests

B. Paired Benchmark Tests

C. Saturation Tests

D. Multi-Threaded Tests

III. EXPERIMENTAL SETUP AND RESULTS

The experiments are executed on an Intel Core i7 with 3GB DDR3 RAM, running the Linux 2.6.27 kernel. The Core i7 is a quad core processor with 2 simultaneous multi-threading contexts per core. This provides for 8 logical cores. The algorithm can be summarized with these steps:

1) The base operating ratio is obtained by reading the PLATFORM_INFO Model Specific Register (MSR). This is multiplied by the bus clock frequency (133.33 MHz) to obtain the base operating frequency.

2) The Fixed Architectural Performance Monitor counters are enabled. Fixed Counter 1 counts the number of core cycles while the core is not in a halted state. Fixed Counter 2 counts the number of reference cycles when the core is not in a halted state.

3) The two counters are read at regular intervals and the number of unhalted core cycles and unhalted reference

cycles that have expired since the last iteration are obtained. The core frequency is calculated as,

Fcurrent = Base Operating Frequency * (Unhalted Core cycles /Unhalted Reference Cycles).

IV. CONCLUSION

Turbo Boost Technology opportunistically boosts the frequencies of the cores on the multi-core Core i7 processor. Turbo Boost enhanced performance. Turbo Boost also resulted in a significant increase in energy consumption because the processor requires a higher Disks, memory and other platform components can also be big contributors to platform power by placing the CPU and other platform components (DIMMs, Potential to accelerate sequential sections in multithreaded code which improves performance of many parallel applications --- an important attribute now and in the future.

voltage to operate at Turbo Boost frequencies. However, current processors also support low power sleep states where they consume very little power. Potential to accelerate sequential sections in multithreaded code which improves performance of many parallel applications --- an important attribute now and in the future.

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