Performance Scaling of Individual SPECint2006 results for Intel Xeon

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ABSTRACT

This paper describes the performance trends in Intel Dual Core Processors and Intel Xenon Quad Core processors. The microarchitecture of these processors is implemented using the basis of a new family of processors from Intel starting with the Pentium 4 processor. These processor provides a substantial performance gain for many key application areas where the end user can truly appreciate the difference. We compared the scaling of performance of different series processors, which was less time consuming and most reliable method.

KEYWORDS: Performance, Benchmarks, Moore's Law

I. INTRODUCTION:

The Intel Xeon processor, Intel Xeon Dual Core processor and Quad core processors are Intel's most advanced IA-32 microprocessor, incorporating a host of new microarchitectural features including a 400MHz system bus, hyper pipelined technology, advanced dynamic execution, rapid execution engine, advanced transfer cache, execution trace cache, and Streaming Single Instruction, Multiple Data (SIMD) Extensions 2 (SSE2).

II. PROCESSOR PERFORMANCE TRENDS

The performance of modern processors is rapidly increasing as both clock frequency and the number of transistors required for a given implementation grow. Moore's Law says that the device density of the processor double in every 18 months. Figure 1 shows the transistor count per die of processors introduced by Intel over the past 35 years [1,4,6].

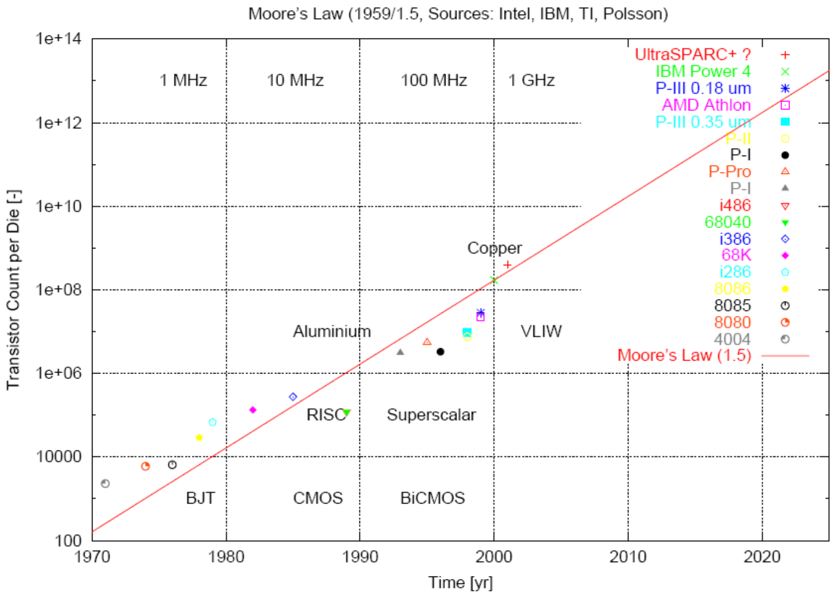

Fig 1: Moore's Law for microprocessor transistor counts assuming a starting point of 1959 and doubling time of 18 months.

III. BENCHMARKS

Benchmarks are used for the performance evolution of the processors. There are different types of benchmarks are available, among all SPEC, HINT, and TPC are most important and popular benchmarks for performance evolution. SPEC is a nonprofit corporation formed to establish, maintain, and endorse a standardized set of benchmarks. SPEC's member-ship includes computer hardware and software vendors, leading universities, and research facilities worldwide. SPEC CPU2006 is designed to provide a comparative measure of compute-intensive performance across a range of hardware. Comprised of two suites of benchmarks, SPEC CPU2006 gauges compute-intensive integer performance with CINT2006 and measures floating-point performance with CFP2006. CINT2006 and CFP2006 results are presented as ratios, which are calculated using a reference time determined by SPEC and the runtime of the benchmark higher scores indicate better performance.

The SPEC CPU2006 suite contains 18 floating-point programs (Some programs are written in C and some in FORTRAN) and 13 integer programs (8 written in C, 4 in C++ and 1 in ANSI C). Table shown below provides a list of the benchmarks in SPEC CPU2006 suite. The SPEC CPU2006 benchmarks replace the SPEC89, SPEC92, SPEC95 and SPEC CPU 2000 benchmarks [2, 3, 5, 6].

SPEC CPU2006 Integer Benchmarks

S. No	Integer Benchmark	Language	Description
1	400.perlbench	C++	PERL Programming Language
2	401.bzip2	C	Data Compression
3	403.gcc	C	C Language Optimizing Compiler
4	429.mcf	C	Combinatorial Optimization

5	445.gobmk	C	Artificial Intelligence : Game Playing
6	456.hmmer	C	Search a Gene Sequence Database
7	458.sjeng	C	Artificial Intelligence : Chess
8	462.libquantum	C	Physics / Quantum Computing
9	464.h264ref	C	Video Compression
10	471.omnetpp	C++	Discrete Event Simulation
11	473.astar	C++	Path – Finding Algorithm
12	483.xalancbmk	C++	XSLT Processor
13	998.specrand	ANSI C	

SPEC CPU2006 Floating Point Benchmarks

S. No	Floating Point Benchmark	Language	Description
1	410.bwaves	Fortran – 77	Computational Fluid Dynamics
2	416.gamess	Fortran	Quantum Chemical Computations
3	433.milc	C	Physics / Quantum Chromo Dynamics
4	434.zeusmp	Fortran – 77	Physics / Magneto Hydro Dynamics
5	435.gromacs	C/Fortran	Chemistry / Molecular Dynamics
6	436.cactusADM	C / Fortran-90	Physics / General Relativity
7	437.leslie3d	Fortran – 90	Computational Fluid Dynamics
8	444.namd	C++	Scientific, Structural Biology, Classical Molecular Dynamics Simulation.
9	447.dealII	C++	Solution of Partial Differential Equations using the Adaptive Finite Element Method.
10	450.soplex	C++	Simplex Linear Programming Solver
11	453.povray	C++	Computer Visualization / Ray Tracing
12	454.calculix	C/Fortran-90	Structural Mechanics
13	459.GemsFDTD	Fortran-90	Computational Electromagnetic
14	465.tonto	Fortran-95	Quantum Crystallography
15	470.lbm	C	Computational Fluid Dynamics
16	481.wrf	C/Fortran – 90	Weather Processing
17	482.sphinx3	C	Speech Recognition
18	999.specrand	ANSI C	Mine Canary

IV. ANALYSIS OF BENCHMARK RESULTS

We used SPEC CPU 2006 data [2] for the performance evolution Intel Xeon processors, Intel Xeon Dual core processors and Intel Xeon Quad core series processors under the same operating conditions, by using their performance numbers and frequency we calculated Task Completion time, and plotted graphs in between Task Completion Time (s) and Core Clock (ns) for Xeon Dual core series processors, Intel Xeon series Processors and Intel Xeon Quad Core series Processors. The Scalability of Intel Xeon Dual Core series Processors is shown in fig.2.

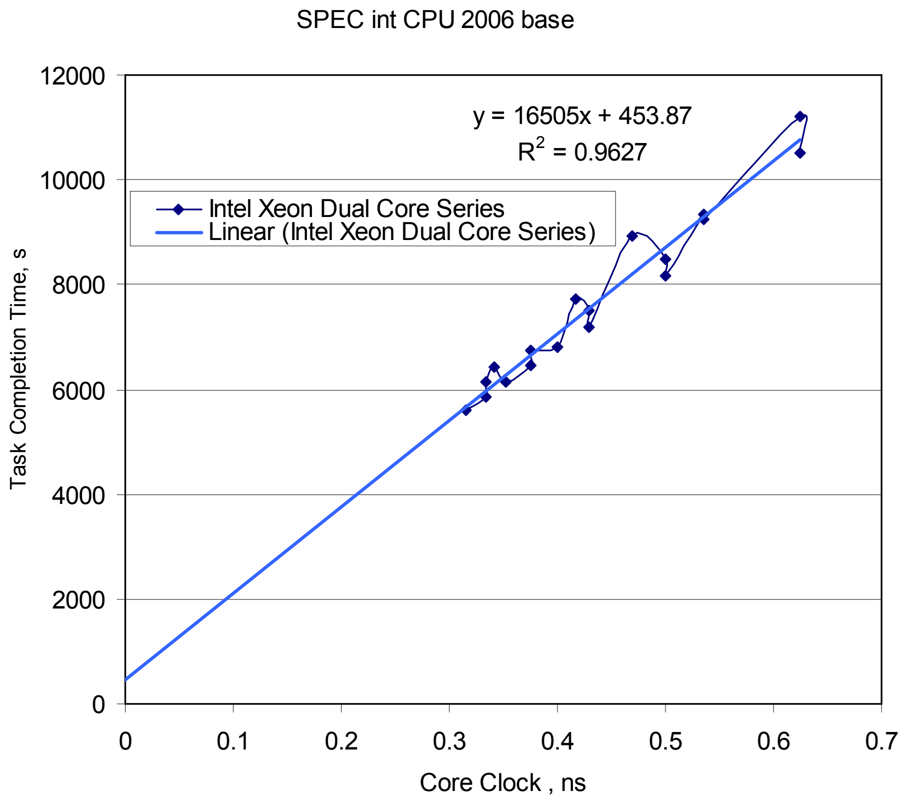

Fig 2: Scalability of Intel Xeon Dual Core Processors on SPECint2006
The Scalability of Intel Xeon series Processors and Intel Xeon Quad Core series Processors is shown in fig.3 and fig.4 respectively.

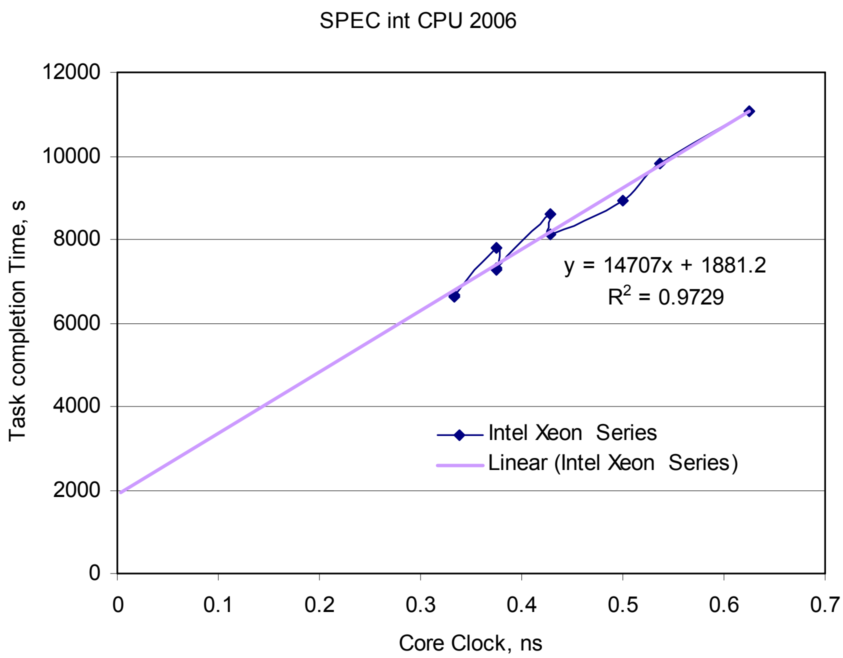

Fig 3: Scalability of Intel Xeon Processors on SPECint2006

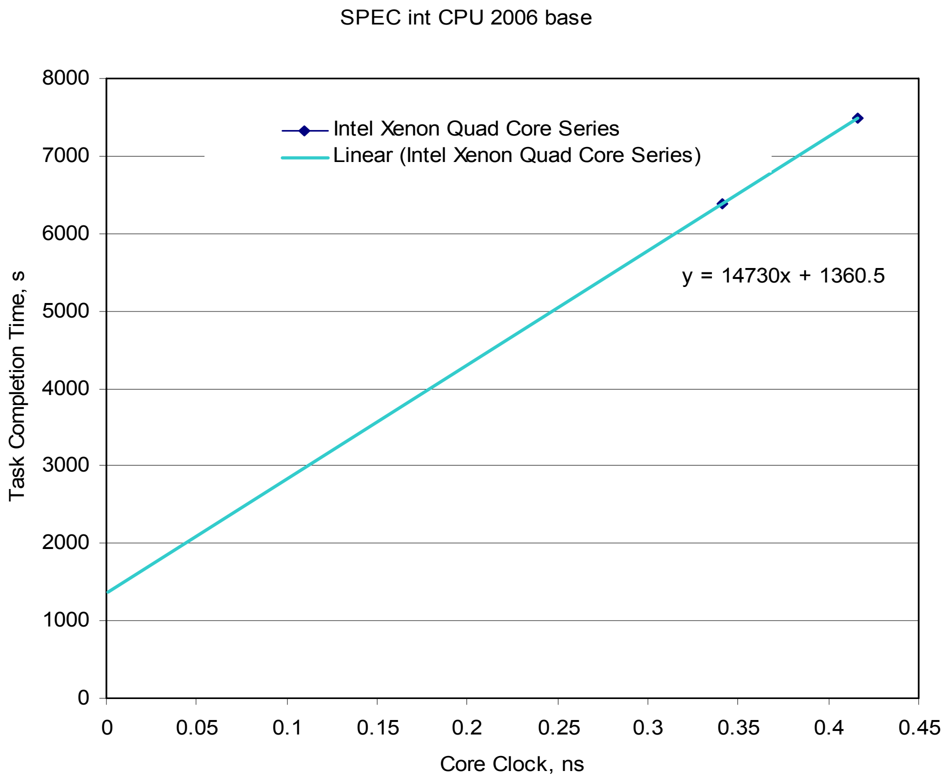

Fig 4: Scalability of Intel Xeon Quad Core Processors on SPECint2006

V. RESULT AND DISCUSSION

The increase in performance of processors in different series, Intel Xeon, Intel Xeon Dual core and Intel Xeon Quad core Processors was studied by using performance numbers published from SPEC CPU 2006 [2], we calculated the scaling of Task Completion Time (s) with respect to Core Clock (ns).

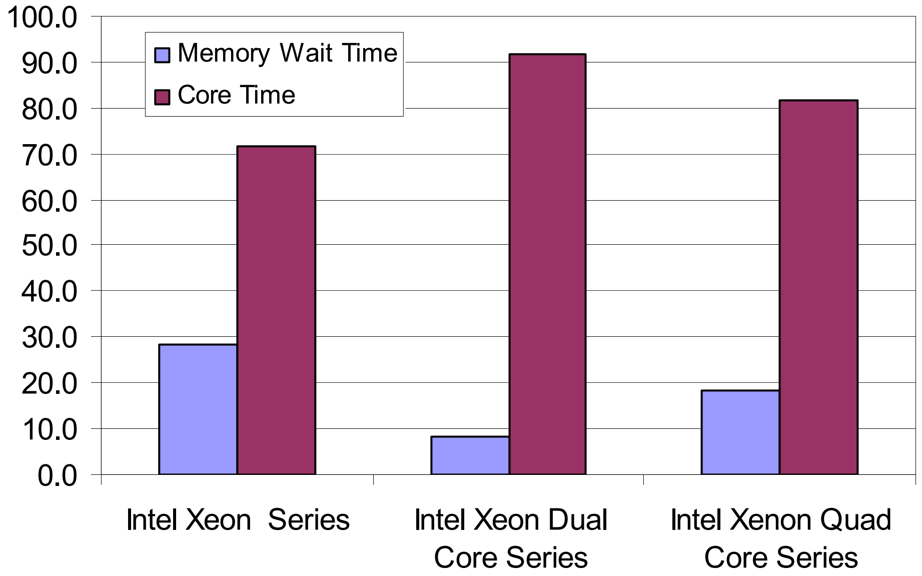

Fig 5: Variation of Memory wait time and Core time in Intel Xeon processors, Intel Xeon Dual core processors and Intel Xeon Quad core series processors

The scaling of Memory wait time and Core time in Intel Xeon processors, Intel Xeon Dual core processors and Intel Xeon Quad core series processors was calibrated, it shows that Intel Xeon Dual core processors shows maximum performance by showing its least memory wait time. This method was so reliable to compare the performance of the modern processors. Performance of the different series processors are compared by normalizing the performance of Intel Xeon Series processors.

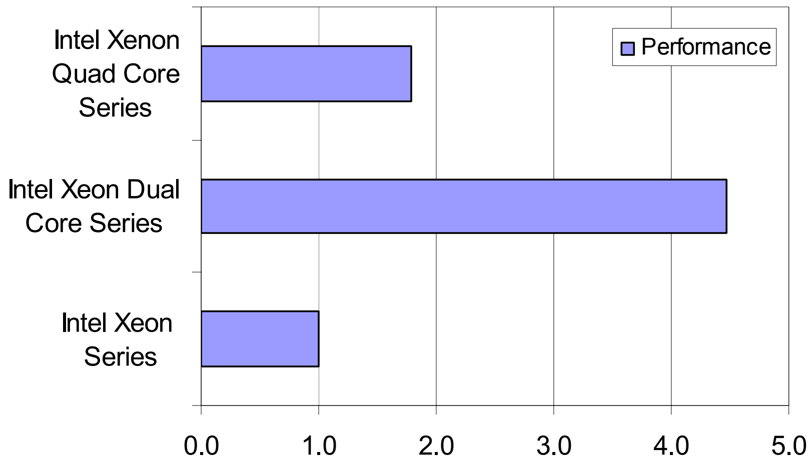

Fig 6: Comparison of performance Intel Xeon processors, Intel Xeon Dual core processors and Intel Xeon Quad core series processors

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