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BENCHMARK OF INTEL AND AMD PROCESSORS WITH BABAR SOFTWARE

Alberto Crescente¹, Peter Solagna¹, Roberto Stroili¹

¹⁾*INFN-Sezione di Padova, Via F. Marzolo, 8, I-35131 Padova, Italy*

Abstract

This note compares the processing performance of several processors measured with some typical BaBar applications. It also reports the results of benchmark measurements obtained with the Spec2006 suite⁽¹⁾.

1 OPERATING SYSTEM

All the computers used in these tests were configured with ScientificLinux 3.0.7 and kernels 2.4.21-40.EL and 2.4.21-47.EL compiled at 32 bit. The tests were performed at different times.

2 COMPUTER CONFIGURATIONS

All the computers used in these tests are dual-processors, configured with 1 GB per core (here the processors with HyperThreading had this feature turned on and each thread is considered as a core), the only exception was on the Intel E5345 quad core machine which had 6 GB of RAM, in total, for the 8 cores.

Processors tested:

- Intel PIII 1.26 GHz
- Intel Xeon 2.4 GHz (HyperThreading) L3 512 kB, bus 533 MHz
- Intel Xeon 2.8 GHz (HyperThreading) L3 1 MB, bus 533 MHz
- AMD Opteron 265 (dual-core) 1.8 GHz
- AMD Opteron 275 (dual-core) 2.2 GHz
- AMD Opteron 2218 (dual-core) 2.6 GHz
- Intel 5160 (dual-core) 3.0 GHz
- Intel E5345 (quad-core) 2.26 GHz
- Intel X5355 (quad-core) 2.66 GHz

The computer with the PIII @ 1.26 GHz is an IBM x330 with 2 EIDE disk in mirror with a MegaRaid controller, The computers with Intel Xeon processors are SuperMicro with 2 SATA disks in mirror with a 3ware 8002 controller. The AMD 265 and 275 processors where tested on the same motherboard (at different times): the motherboard is a SuperMicro H8DAR-I, the computer was equipped with 2 SATA disks in mirror with a 3ware 8002 controller. The Intel 5160 processor was on an unknown motherboard, had 1 SCSI disk connected to an Adaptec 3940A SCSI controller. The Intel E5345 processor was tested on an Intel motherboard with 1 SATA disk. We tested two computers with the AMD 2218 processor, both from HP, one was an HP Proliant365 server the other was an HP B1465c blade server with 2 SAS disks (@10000 RPM) in mirror. Also the Intel X5355 processor was tested on an HP blade (B1460c) with 2 SAS disks (@10000 RPM) in mirror.

3 PROCESSING TEST DESCRIPTION

These tests were done using the BaBar Prompt Reconstruction code (releases 18.7.0 and 22.1.1) compiled at 32 bit. The reconstruction program runs in parallel on various computers processing different events belonging to the same run (a run is a collection of data taken within less than one hour, under similar conditions). The benchmark consists in comparing the number of events processed by each machine in the same run. The ratios between the

various machines from different runs are then averaged. One instance of the reconstruction program per core is run during these tests, two on processors with HyperThreading (enabled). From an accurate monitoring of the computers it turns out that the reconstruction program is CPU bound, the network traffic to exchange the data being less than 1 Mbps per instance at maximum.

3.1 Results

The tests have been taken at different times as the different processors were not available simultaneously. To compare the results, the processing rates of the various processors are normalized to the processing rate of the PIII machine. We verified that these results are quite stable for data belonging to different samples and for processing done at different times.

In figure 1 the processing ratios of the various computers tested, normalized to the reference PIII @ 1.26 GHz server, are shown, while in table 1 the numerical values are reported.

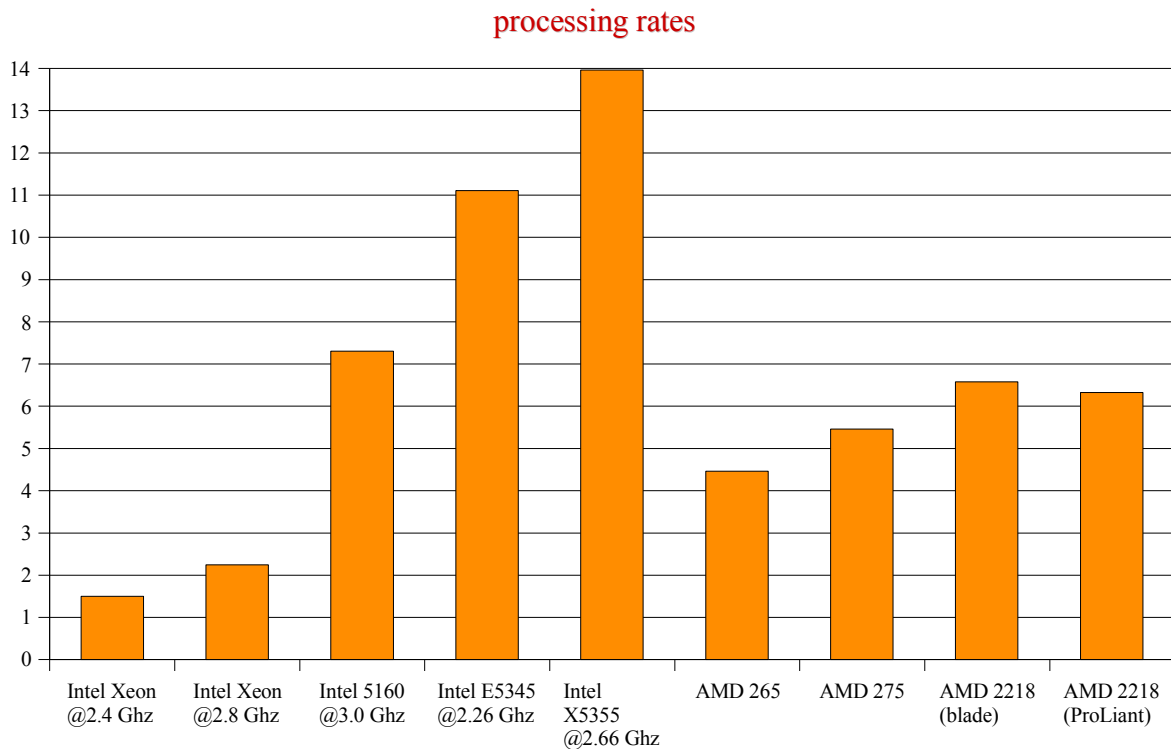


Fig. 1: Processing rates of the computers under test normalized to the Intel PIII @ 1.26 GHz processor computer

During the tests, the server with the E5345 processor (with only 6 GB of RAM) was constantly monitored to be sure that the memory on this server was not a bottleneck.

| processor | ratio |
|-----------------------|-------|
| Intel Xeon @2.4 Ghz | 1.5 |
| Intel Xeon @2.8 Ghz | 2.24 |
| Intel 5160 @3.0 Ghz | 7.31 |
| Intel E5345 @2.26 Ghz | 11.11 |
| Intel X5355 @2.66 Ghz | 13.96 |
| AMD 265 | 4.46 |
| AMD 275 | 5.46 |
| AMD 2218 (blade) | 6.58 |
| AMD 2218 (ProLiant) | 6.32 |

Tab. 1: Processing rates normalized to the reference PIII @ 1.26 GHz server

4 SKIMMING BENCHMARK

Another benchmark, on fewer processors, was done using the BaBar skimming process; this process is more I/O and memory bound so the results may be different from the previous tests and they do not reflect the pure the processing power. In this benchmark we used the following processors:

- Intel Xeon 2.8 GHz (HyperThreading) L3 1 MB, bus 533 MHz
- AMD opteron 265 (dual-core) 1.8 Ghz
- Intel 5160 (dual-core) 3.0 GHz

The computers were the same as in the previous benchmark.

As the skimming does not process in parallel data belonging to the same set, we used ten servers with the Intel Xeon 2.8 GHz in order to understand the effect of comparing data not belonging to the same set. We measured the time required to process a given amount of data and we report the values normalized to the Xeon 2.8 GHz servers as shown in figure 2.

The values are the average of the time measured on several processing, the dark band on the plot shows the error. The results are also reported in table 2.



Fig. 2: time required to process a given amount of data normalized to the average time measured on the Intel Xeon @ 2.8 GHz

The values are the average of the time measured on several processing, the dark band on the plot shows the error. The results are also reported in table 2.

| processor | ratio | error |
|--------------------------|-------|-------|
| AMD Opteron 265 | 0.785 | 0.019 |
| Intel Xeon 5160 | 0.446 | 0.008 |
| Intel Xeon @ 2.8 GHz (1) | 0.997 | 0.011 |
| Intel Xeon @ 2.8 GHz (2) | 0.998 | 0.006 |
| Intel Xeon @ 2.8 GHz (3) | 0.998 | 0.010 |
| Intel Xeon @ 2.8 GHz (4) | 0.981 | 0.009 |
| Intel Xeon @ 2.8 GHz (5) | 0.999 | 0.006 |
| Intel Xeon @ 2.8 GHz (6) | 1.037 | 0.008 |
| Intel Xeon @ 2.8 GHz (7) | 0.984 | 0.005 |
| Intel Xeon @ 2.8 GHz (8) | 1.007 | 0.010 |
| Intel Xeon @ 2.8 GHz (9) | 0.999 | 0.006 |

Tab. 2: processing time ratios for skimming

We can compare the relative performance of these processors for both kind of tests; this is shown in table 3.

| | skimming | processing |
|--------------------------------|----------|------------|
| Xeon 5160/Xeon @ 2.8 GHz | 2.24 | 3.26 |
| Xeon 5160/AMD Opteron 265 | 1.76 | 1.64 |
| AMD Opteron 265/Xeon @ 2.8 GHz | 1.27 | 1.99 |

Tab. 3: relative performances for the processors used in the skimming benchmark

5 SPEC 2006 BENCHMARKS

We used also the SPEC 2006 benchmarking suite to evaluate the processors performance, we were able to run this benchmark suite only with gcc release 4.1 and higher, so most of the tests were made using gcc 4.2. The operating system we used was in general Scientific Linux 3.0.3 32 bits, we run the benchmarks also on 64 bit version of the operating system and on Scientific Linux 5.0. The results are shown in table 4.

| processor | release | bits | gcc release | gcc options | SpecInt 2006 | SpecFloat 2006 |
|----------------------|---------|------|-------------|-------------|--------------|----------------|
| Intel PIII @ 1 GHz | SL3.0.3 | 32 | 4.1 | -O2 | 2.42 | 1.71 |
| Intel PIII @ 1 GHz | SL3.0.3 | 32 | 4.2 | -O3 | 2.52 | 1.73 |
| Opteron 2218 (blade) | SL3.0.3 | 32 | 4.2 | -O2 | 8.92 | 7.47 |
| Opteron 2220 | SL3.0.5 | 32 | 4.2 | -O2 | 9.47 | 7.93 |
| Intel X5355 | SL3.0.3 | 32 | 4.2 | -O2 | 12.70 | 8.79 |
| Opteron 2218 | SL3.0.3 | 64 | 4.2 | -O2 | 9.46 | 8.10 |
| Intel 5150 | SL5.0 | 64 | 4.2 | -O2 | 12.90 | 10.40 |

Tab. 4: Spec 2006 benchmark results for some processors

6 BENCHMARK COMPARISONS

If we compare the Spec 2006 value of the Intel X5355 and AMD Opteron 2218, normalized to the value of the PIII @ 1.26 GHz (obtained from the value of the PIII @ 1 GHz by scaling with the frequency), to the values obtained in the processing benchmark (the values of table 1 divided by the number of cores), we obtain the values shown in table 5. From the table it seems that the SpecFloat2006 values are closer to the processing values than the SpecInt2006 ones. Clearly more benchmarks are needed to draw clear conclusions. Also the Spec rates need to be evaluated.

| | SpecInt2006 | SpecFloat2006 | Processing |
|--------------|-------------|---------------|------------|
| Opteron 2218 | 2.92 | 3.47 | 3.29 |
| Intel X5355 | 4.17 | 4.08 | 3.49 |

Tab. 5: processing power scaled to the PIII @ 1.26 GHz for the Spec2006 benchmarks and for the processing benchmark

7 ACKNOWLEDGEMENTS

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8 REFERENCES

- (1) <http://www.spec.org/>