Three Vectors of Performance

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INTRODUCTION

Personal computing has evolved over the past two decades from integer-intensive applications like spreadsheets, word processing, and two-dimensional graphics to rich multimedia, communications, and 3D graphics. During the same time frame, the computer industry has continued to use benchmarks heavily weighted towards integer measurements as the metric for overall PC performance.

Changes in the Intel architecture, most recently the addition of the 57 MMX™ technology instructions, are helping to drive the huge software shift towards multimedia and communications rich applications for the home and for business. Although many traditional benchmarks have been revised to better reflect today's PC workload or usage model, they tend to only measure one component of performance such as integer. When processor or system performance is represented by a single benchmark, consumers may be mislead by a performance number that does not accurately reflect how the system performs under multiple usage patterns.

A more valuable measure of performance for all users is a combination of benchmarks that best represent the most common PC usage patterns. The following information outlines three "vectors" of performance that Intel suggests give a clear, comprehensive measure of CPU performance that should assist the growing number of PC consumers. The vectors are:

- Integer Performance
- Floating-Point Performance
- Multimedia Performance

VECTOR 1: INTEGER PERFORMANCE

As integer computing trends have evolved from 16-bit to 32-bit, so has the operating environment. Over the last few years, the industry has moved from (16-bit) Microsoft Windows* 3.1, to (32-bit) Windows 95 and Windows NT. Benchmarks have also evolved from a purely 16-bit environment, such as Winstone96* and CPUmark16* to a 32-bit environment like Winstone32* and now Winstone97* and CPUmark32*. To reflect today's 32-bit operating environment, and to provide the most accurate integer performance rating, it is important to use 32-bit benchmarks.

Integer performance benchmarks best reflect the performance of a processor or system that is running word processing and spreadsheet type applications (excluding embedded 3D graphics, imaging, audio and video files).

VECTOR 2: FLOATING-POINT PERFORMANCE

Floating-point usage in applications is increasing. Today, applications are extremely complex and require a multitude of algorithms to be performed in order to execute effectively. With a floating-point unit , multimedia software (3D applications in particular) run smoother.

Table 1. Floating-Point Usage

Application	Type	F.P. Content
True Space*	Graphics	55%
Photo Morph*	Imaging	35%
3D Studio MAX	3D Graphics	30%
Quake*, Agile Warrior	Games	30%

For computer users running 3D graphics, game, and CAD applications, floating-point performance benchmarks provide a fair representation of their processor or system performance. If the floating-point performance is not part of the benchmark process, overall performance is likely to be misstated.

VECTOR 3: MULTIMEDIA PERFORMANCE

The future of computing is multimedia. The industry has embarked on a new road. More than 100 Independent Software Vendors (ISVs) are developing MMX technology software applications in addition to the MMX technology applications that were already available at the time of the Pentium® processor with MMX technology launch. Yet benchmarking data has been limited in describing the performance of the system when it comes to multimedia performance. Intel Media Bench and Norton Media Bench are two benchmarks that use media-rich applications to determine the multimedia performance of a CPU.

Multimedia performance benchmarks provide a more useful measurement of processor performance for computer users more focused on videoconferencing, PC imaging, rich audio and video for presentations and training , and internet or intranet applications.

As video playback and video conferencing become mainstream in the computing industry, benchmarks need to evolve to address these technologies.

CONCLUSION

Using an outdated single performance benchmark to represent today's applications can only result in confusing the end user. As computer usage increases and multimedia and floating-point type applications become even more mainstream, users and the market will need all three vectors of performance measurements to help them understand system and CPU performance under relevant usage conditions. Only then will they be able to make informed and weighted decisions.

For more information on how Intel's processors perform on the three vectors, visit our website at http://www.intel.com/procs/perf/