Intel® Advanced Platform Technologies

Enabling new generations of robust communications and embedded applications

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Intel® platform technologies enable new generations of robust communications and embedded applications

Today, meeting broad customer requirements is rarely accomplished by improving a single system element, such as clock speed or form factor. To the contrary, customers want power efficiency, system manageability, improved I/O bandwidth, more virtual memory addressing, flexibility, and scalability—often on a single platform.

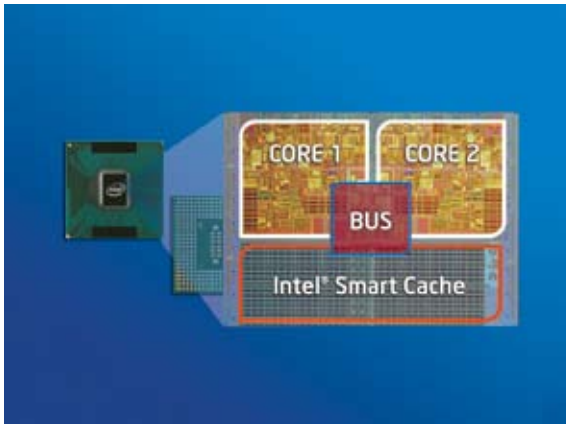
That's why Intel is delivering platform technologies that help you deliver the most advanced, cost-effective solutions to your customers.

The Intel platform approach supports multiple development objectives by combining multi-core architecture with complementary, system-enhancing technologies, delivering scalable, power-efficient processing for a wide range of embedded and communications applications. Using integrated hardware acceleration of critical platform services, Intel frees processing cycles for new application features, improving availability and manageability, and lowering overall operational costs.

With these innovative, integrated platform technologies and standards-based system elements, you can focus resources on designing and delivering a greater range of next-generation features and solutions to your customers, while reducing development time and investment. Complemented by a broad array of hardware and software providers, including members of the Intel® Communications Alliance, Intel enables highly-optimized solutions at all levels of integration.

Look to Intel for a New Level of Platform Technology

- **Multi-core Processing:** Greater performance and performance-per-watt, featuring the Intel® Core™ Duo processor and Dual-Core Intel® Xeon® Processor LV 2.0 GHz
- **Intel® Virtualization Technology:** Increased system stability, serviceability and performance
- **Intel® Active Management Technology:** Reduced system management costs
- **Intel® Extended Memory 64 Technology:** Improved performance for data-intensive applications



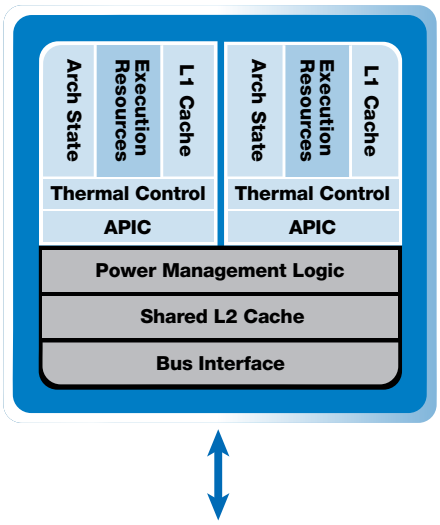


Figure 1. Configuration of the Intel® Core™ Duo processor shows two complete execution cores and shared L2 cache. The processor features intelligent power management to deliver significantly greater performance-per-watt over previous Intel® single-core processors.

Intel® Multi-Core Processors

Clock-speed no longer tells the whole story

Intel® dual-core processors combine the benefits of two high-performance execution cores on one silicon die (see figure 1), offering improved performance without increased power dissipation. This multi-core architecture can deliver significantly greater performance and performance-per-watt than single-core processors, even at lower clock speeds (please see benchmark data on page 3). These performance-per-watt gains offer particular benefits for applications requiring performance in a constrained form factor, addressing the complex development requirements of communications blades, industrial control applications, point-of-service terminals and ruggedized laptops.

In contrast to traditional single-core, multi-tasking environments, multi-core designs allow specific applications to be assigned to different cores, enhancing performance and security. In embedded application environments, it is possible to run real-time tasks on a dedicated execution core, unencumbered by tasks that would otherwise compete for CPU resources. For example, TenAsys Corporation found that by running two operating systems on two separate cores, they were able to eliminate competition for CPU resources. This helped minimize jitter so that closed-control loop applications, like those found in automated machinery, could run with maximum precision (please see case study at www.intel.com/design/embedded/casestudies/311275.pdf).

Even in a single application environment, multi-core technology can enhance performance by enabling the developer to decompose the application into parallel instruction and/or data streams. In this case, the performance gain is a function of the amount of the application that can run in parallel.

While incorporating advanced processor technology, Intel dual-core processors protect development investments by remaining software-compatible with previous 32-bit Intel® Architecture processors. For more information on Intel dual- and multi-core processors for embedded and communications applications please visit intel.com/go/advancedtech.

Benchmark Tests Demonstrate Improvements in Performance and Performance-per-Watt

Dual-core, low-voltage platforms versus single-core, low-voltage platforms

The Dual-Core Intel Xeon processor LV 2.0 GHz can provide a greater than 2X performance gain as compared to previous single-core Intel Xeon processor-based platforms (see Figure 2). Given its lower thermal dissipation, the Dual-Core Intel Xeon processor LV 2.0 GHz can deliver a 4X improvement in performance/watt as compared to previous single-core Intel Xeon processors (see Figure 3).

Figure 2: Relative Performance (Specint_rate_base2000)[1,2]

Source: Intel Corporation

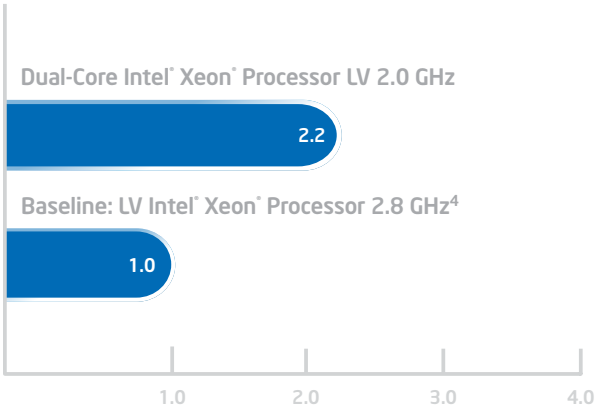
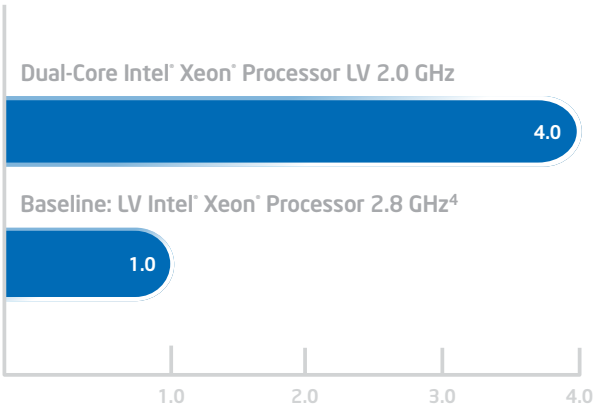


Figure 3: Relative Performance/Watt (Specint_rate_base2000/TDP)[1,2,3]

Source: Intel Corporation



[1] Platform Configurations:

- Two Dual-Core Intel Xeon Processors LV 2.0 GHz, Intel E7520 Memory Controller Hub, DDR2-400 MHz, 8 DIMMS, each with 512 MB memory. (Dual-Core Intel® Xeon® Processor LV with Intel® E7520 Chipset Development Kit)
- Two Low Voltage Intel Xeon Processors with 800 MHz System Bus, Intel E7520 Memory Controller Hub, DDR2-400 MHz, 8 DIMMS, each with 256 MB memory. (Intel® Xeon® Processor with 800 MHz system bus, Intel® E7520 Chipset, and Intel® 6300ESB ICH Development Kit)

Performance tests and ratings are measured using specific computer systems and/or components and reflect the approximate performance of Intel product as measured by those tests. Any difference in system hardware or software design configuration may affect actual performance. Buyers should consult other sources of information to evaluate the performance of systems or components they are considering purchasing. For more information on performance tests and on the performance of Intel products, visit http://www.intel.com/performance/resources/limits.htm

[2] SPEC CPU2000 benchmark tests reflect the performance of the microprocessor, memory architecture, and compiler of a computer system on compute-intensive, 32-bit applications. SPEC benchmark test results for Intel microprocessors are determined using particular, well-configured systems. These results may or may not reflect the relative performance of Intel microprocessors in systems with different hardware or software designs or configurations (including compilers). Buyers should consult other sources of information, including system benchmarks, to evaluate the performance of systems they are considering for purchase. For more information about SPEC CPU2000, visit http://www.intel.com/performance/resources/limits.htm

[3] Peformance/watt reflects the Spec CPU2000 benchmark test results (as described above), divided by Thermal Design Power (TDP) for the respective processors. For the Dual-Core Intel Xeon Processor LV 2.0 GHz, TDP is specified at 31W. For the Low Voltage Intel Xeon Processor with 800 MHz System Bus, TDP is specified at 55W.

[4] Intel branded product name for "LV Intel Xeon Processor 2.8 GHz" is Low Voltage Intel Xeon Processor with 800 MHz System Bus.

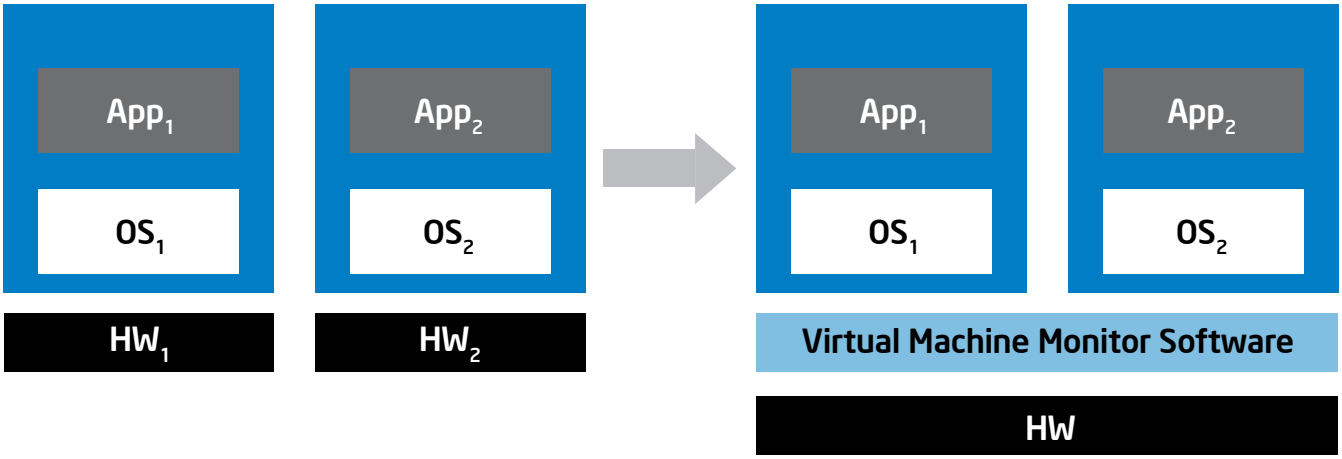


Figure 4. Intel® Virtualization Technology enables a single hardware platform to support multiple software environments, as though they were deployed on separate systems.

Intel® Virtualization Technology

Support for system stability, serviceability, performance and testing

By implementing key features in its silicon platforms, Intel is bringing the benefits of virtualization to the communications and embedded applications marketplace. Intel® Virtualization Technology enables a single hardware platform to support multiple software environments as though they were deployed on separate systems.

The ability to isolate operating system and application stacks provides a range of potential benefits for application developers. For added protection against corruption, virtualization provides greater isolation and security between different applications and operating systems. In addition, virtualization can increase system uptime and decrease maintenance costs by enabling software failover without the cost of redundant hardware and by allowing version migration without bringing down the application. Virtualization allows legacy applications to co-exist with new applications on the same hardware platform, thereby protecting previous development investments.

An example of a virtualization deployment is shown in Figure 4. On the left, two sets of applications and operating systems are running on two different machines. On the right, virtualization is used to run all the software on a single machine.

Intel® Active Management Technology

Reducing system management costs

Today's IT platform managers must track assets, minimize downtime and protect systems against attack, in addition to managing total cost of ownership. Intel® Active Management Technology (Intel® AMT) can help them do the job more efficiently and more cost-effectively.

Intel AMT enables a collection of persistent, tamper-resistant information—including asset ID, software version, hardware configuration, license and warranty status—to be accessed remotely, regardless of the health of the CPU or operating system, even when the system is turned off. Utilizing this platform technology, applications and operating system software or firmware can be accessed and reconfigured remotely, allowing system managers to implement features and solve numerous system issues without on-site visits. Benefits can include faster fixes, increased availability, round-the-clock support, and a reduction in the cost of service-level agreements. For equipment manufacturers, Intel AMT enables remote support of factory floor systems.

Cost-impact studies conducted by Intel have shown that Intel AMT can reduce on-site service visits by 42%, thus eliminating 21% of the total IT support costs. Intel has developed an estimator to help predict the return on investment (ROI) from Intel AMT. To reference this white paper, please visit intel.com/it/digital-enterprise/active-management-technology.pdf.

Intel AMT will become standard on Intel® architecture-based systems in 2006, making these benefits available from "Shop Floor to Top Floor". Companies can institute universal system-management software and policies throughout their IT networks, reducing expenses by centralizing support functions. These benefits can apply to a variety of network-connected devices such as industrial controllers, communications appliances and point-of-service terminals.

Intel® Extended Memory 64 Technology

Performance improvement for data-intensive applications

Intel® Extended Memory 64 Technology[1] (Intel® EM64T) is an enhancement to Intel® IA-32 architecture which supports 64-bit instructions and provides access to larger address spaces. With Intel EM64T, software developers can address up to 1 TB of physical memory, paving the way for greater performance by eliminating paging penalties associated with smaller memory spaces.

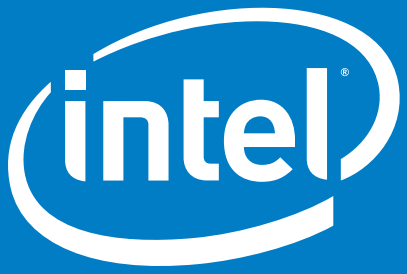
Intel EM64T enables addressing of memory larger than the 4 GB typically supported by a 32-bit architecture. It is particularly valuable for applications requiring large address space, for example:

- Medical imaging and print imaging: Managing larger files in less time
- Home location register (HLR) servers and storage appliances: Supporting large databases and files that often exceed the 4 GB memory capacity supported by 32-bit addressing
- Virus detection applications: Comparing virus detection patterns 64 bits at a time, offering twice the throughput of 32-bit architectures

For applications requiring complex calculations and a high level of precision, developers may consider writing 64-bit code. Because the system can manipulate data and execute instructions in 64-bit chunks, these applications can yield vastly improved performance over their 32-bit counterparts. Intel's approach to extended memory technology allows the processor to run either 32-bit or newly written 64-bit code.

Reliable Solutions, Now and for the Future.

Intel integrated platform technologies address multiple development objectives, allowing developers of communications and embedded applications to create more innovative and effective solutions for end-customers. Look to Intel and its ecosystem of hardware and software providers (www.intel.com/go/ica) to offer solutions at all levels of integration, helping you meet stringent platform requirements and competitive development schedules.



[1] Intel® EM64T requires a computer system with a processor, chipset, BIOS, operating system, device drivers and applications enabled for Intel EM64T. Processor will not operate (including 32-bit operation) without an Intel EM64T-enabled BIOS. Performance will vary depending on your hardware and software configurations. See www.intel.com/info/em64t for more information including details on which processors support Intel EM64T or consult with your system vendor for more information.

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