Itanium and Simultaneous Multithreading

An article written by Jinan Kordab – Programmer – softuniversum.com

Simultaneous Multithreading

Often abbreviated as SMT, is a technique for improving the overall efficiency of CPUs. SMT permits multiple independent threads(instructions) of execution to better utilize the resources provided by modern processor architectures.

Simultaneous multithreading allows multiple threads to execute different instructions in the same clock cycle, using the execution units that the first thread left spare.

SMT is about efficiency and increased throughput of computations per amount of hardware used. It uses many **transistors**.

While multithreading CPUs have been around since the 1950s, Simultaneous Multithreading was first researched by IBM in 1968.

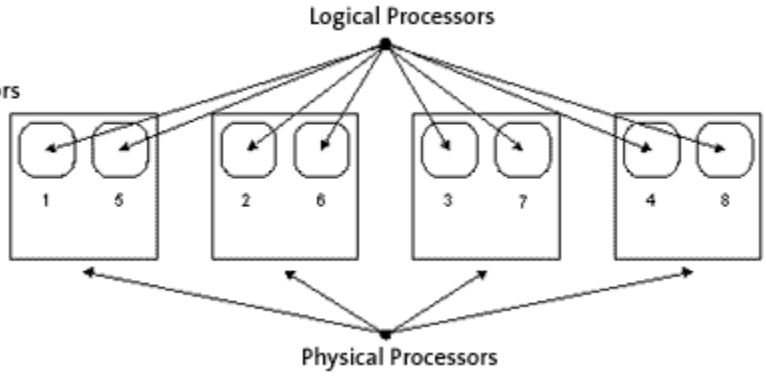
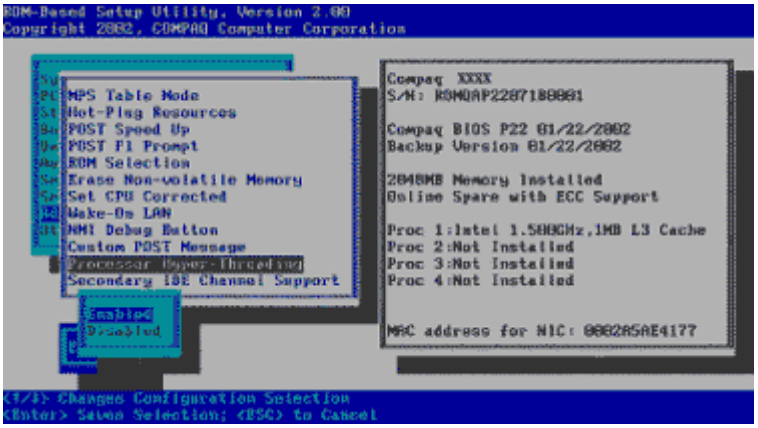


Figure 1: Numbers indicate the order in which logical processors are recognized by the BIOS when written ccording to Intel specifications. This example shows a 4P system enabled with Hyper-Treading Technology.

The first major commercial CPU developed with SMT was the DEC 21464

The Intel Pentium 4 was the first modern desktop processor to implement simultaneous multithreading.



Picture showing how to enable BIOS in a SMT supported PC to enable simultaneous multithreading.

Itanium

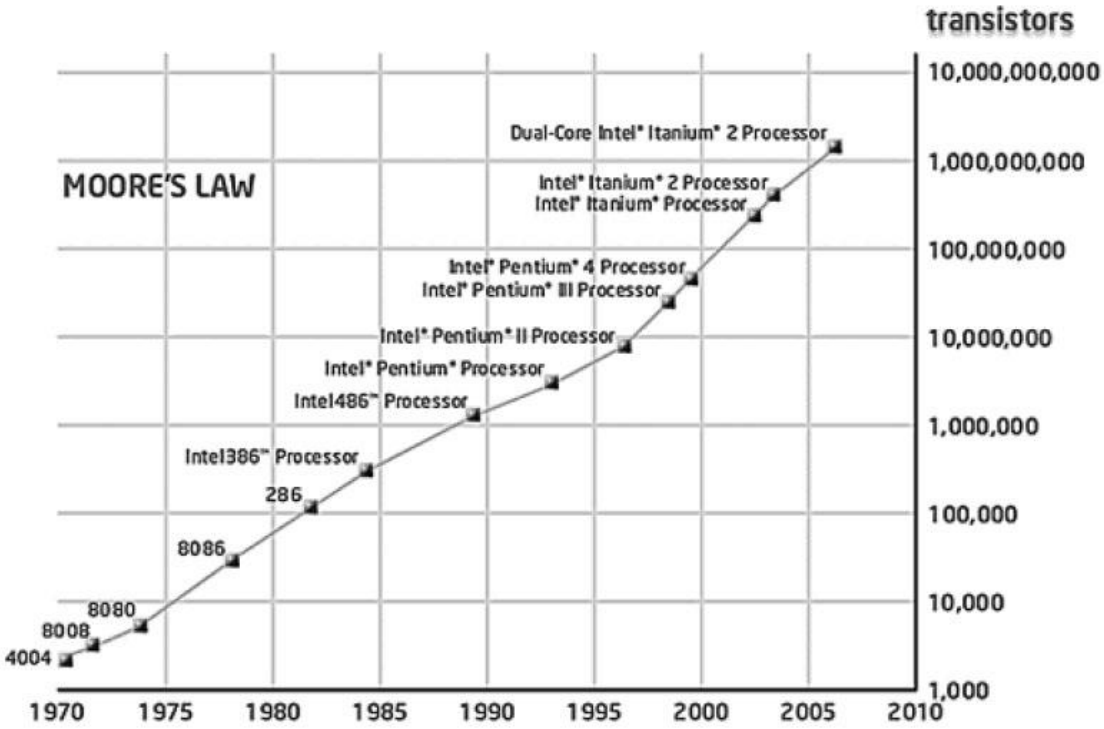
Is a microprocessor developed jointly by Hewlett-Packard and Intel. It was the original implementation of the IA-64. It has been supplanted by the Itanium 2. The first iteration of the Itanium processor, code-named Merced, was released in 2001. Acceptance in the marketplace fell far short of expectations for a number of reasons:

- delivery was two years later than originally expected
- performance issues.
- a lack of optimized software.
- yield problem and high manufacturing cost

Why to develop Itanium Technology?

It is assumed that the development of clock speed has reached its limit, so Intel rather focused on Multithreading which is used extensively in Itanium, putting Moore's Law : “the number of transistors that could be integrated into a single silicon chip would approximately double every 18 to 24 months.”

That prediction became widely known as Moore’s Law.



Source: archive.isgtw.org

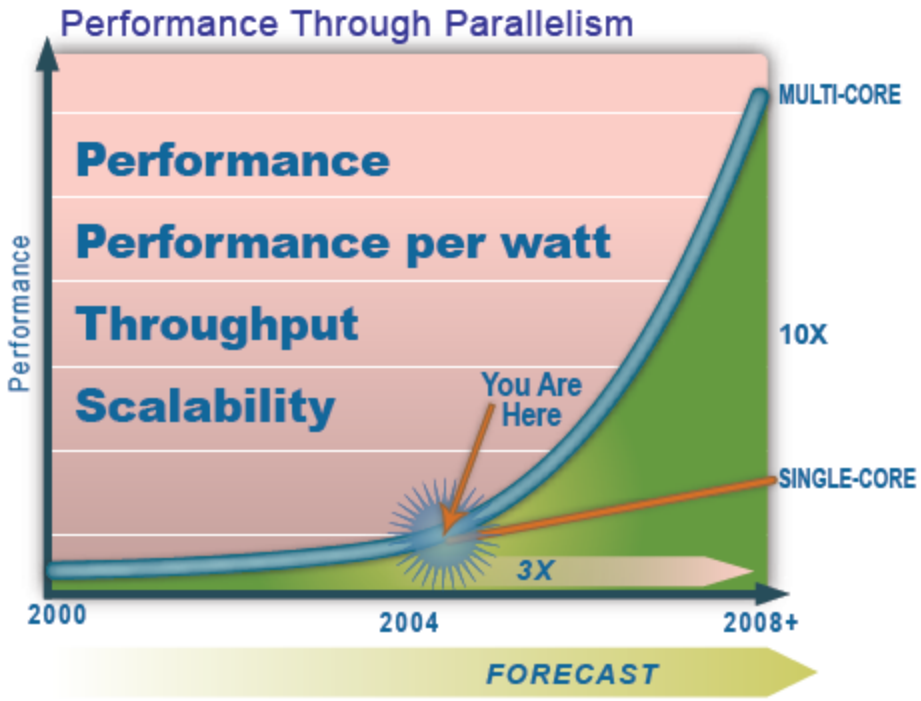
And Intel engineering advances have continued to transform that law into reality for more than 40 years .During that time, increases in transistor density have driven roughly proportional increases in processor performance and **price/performance**, and powered the rise of computing as a fundamental business enabler.

Microprocessor	*Year of Introduction*	*Transistors*
4004	1971	2,300
8008	1972	2,500
8080	1974	4,500
8086	1978	29,000
Intel286	1982	134,000
Intel386™ processor	1985	275,000
Intel486™ processor	1989	1,200,000
Intel® Pentium® processor	1993	3,100,000
Intel® Pentium® II processor	1997	7,500,000
Intel® Pentium® III processor	1999	9,500,000
Intel® Pentium® 4 processor	2000	42,000,000
Intel® Itanium® processor	2001	25,000,000
Intel® Itanium® 2 processor	2003	220,000,000
Intel® Itanium® 2 processor (9 MB cache)	2004	592,000,000
Dual-Core Intel® Itanium® 2 processor	2006	1,700, 000,000

Picture showing Intel increasing its transistors density to improve the processors throughput.

The Itanium Advantage

In 1994, when Intel and HP began working together on a new processor to address escalating computing requirements, it was already apparent that the days of frequency ramping would not last too much longer. The new architecture was therefore designed specifically to deliver new levels of **parallelism** that would enable rapid and sustainable performance ramping without relying on ever-**higher clock frequencies**.

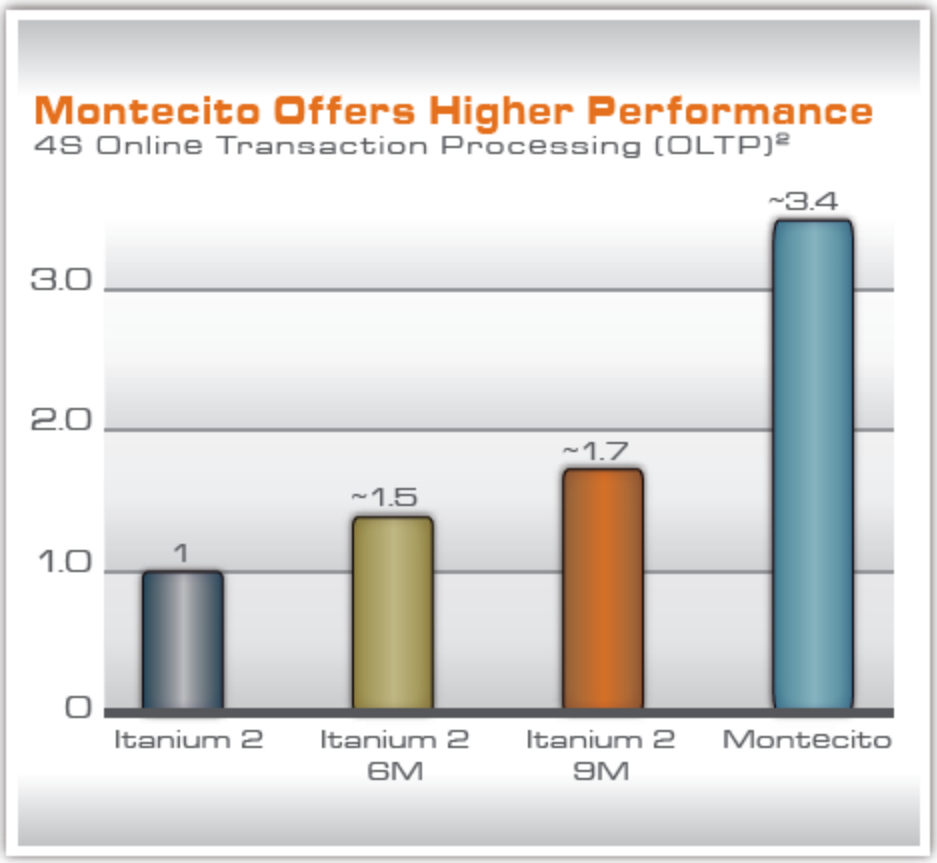


Software Support for the Itanium Architecture

Any computing architecture is only as valuable as the software that supports it. **Itanium** architecture is particularly suited to large, business-critical, data-intensive applications, and those are the areas where complete and optimized software solutions are most widely available.

Itanium is currently supported by approximately 10 operating systems, including Windows and various versions of Linux and UNIX, and there are more than 10,000 applications now available that run natively on the platform.

Leading software vendors with comprehensive solutions optimized for Itanium-based servers include BEA, Microsoft, Novell, Oracle, Red Hat, SAP, SAS, Sybase and many others. Itanium-based software solutions are also especially well represented across vertical industries that rely most heavily on **data- and transaction-intensive applications**, including energy, financial services, government, entertainment, healthcare, manufacturing, telecommunications and retail.



Real Life Examples

Servers based on **Intel® Itanium®** Processors and **Intel®Xeon®** Processors power the backend of CCB'(China Construction Bank) 's information system.

China Construction Bank, Shanxi Division, takes banking into the next era using Intel® processor-based hardware running local version of Linux* operating system.

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Also, Intel upgraded its database-intensive customer relationship management (CRM) system to new software running on a faster, less expensive, Itanium®-based platform. "Our previous system was aging, obsolete, and slow. Because the Itanium-based platform has a faster processing speed and a much larger memory cache, we found that we were able to improve overall performance, even with our database-intensive applications."

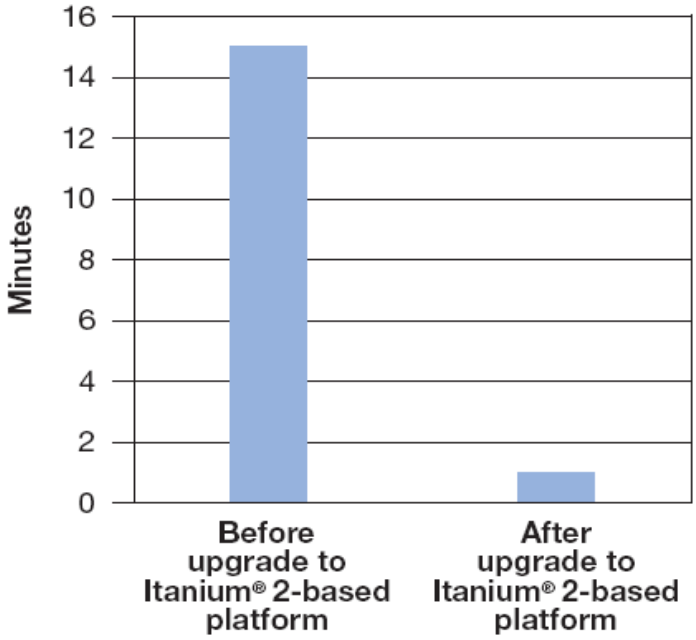

Image *Source:* IT-Intel

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