

# Intel® Pentium® 4 Processor on 90nm Technology

April 12 2004

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Intel has recently published an article called **The Microarchitecture of the Intel® Pentium® 4 Processor on 90nm Technology**. This paper describes the first Intel® Pentium® 4 processor manufactured on the 90nm process. It reviews the NetBurst® microarchitecture and discusses how this new implementation retains its key characteristics, such as the execution trace cache and a 2x frequency execution core designed for high throughput.

This Pentium 4 processor improves upon the performance of prior implementations of the NetBurst microarchitecture through larger caches, larger internal buffers, improved algorithms, and new features. This processor also implements Hyper-Threading Technology, which is the ability to simultaneously run multiple threads, allowing one physical processor to appear as two independent logical processors. This technology is another means of providing higher performance to the end user. We discuss how this processor not only maintains support for this key technology but also increases the benefit seen due to Hyper-Threading Technology.

The first Intel® Pentium® 4 processor manufactured on the 90nm manufacturing process contains 125 million transistors with a die size of 112mm<sup>2</sup>. It builds upon the NetBurst® microarchitecture that forms the foundation of prior Pentium 4 processors. Like its predecessors, this processor is designed to provide the end user with new levels of performance, enabling compute-intensive tasks to be undertaken by conventional desktop processors. One means of achieving this performance is by designing the processor to run at a high frequency.

The frequency of a processor is a key component to determining overall performance, as the frequency determines the rate at which the processor can process data. We have extended the original Pentium 4 processor pipeline to enable this processor to reach higher frequencies than is possible with the original pipeline. Additionally, as the frequency of the processor continues to increase, the amount of time spent waiting for data to be retrieved if they are not located in the processor's caches is becoming a larger and larger percentage of overall execution time. This effect reduces the performance impact of continually increasing the processor frequency. To alleviate this problem, several features are implemented to increase the number of times that data will be present in the caches. With these and other features, including a set of new instructions, the Pentium 4 processor is able to achieve new heights in performance.

Citation: Intel® Pentium® 4 Processor on 90nm Technology (2004, April 12) retrieved 17 April 2024 from <https://phys.org/news/2004-04-intel-pentium-processor-90nm-technology.html>

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