

White Paper

Centrino vs. Pentium M: The Battle For Wireless Notebooks

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Executive Summary

On March 12th, Intel Corporation will announce its new *Centrino* and *Pentium M* brands for mobile computing. In an estimated \$300-million worldwide marketing campaign, Intel will heavily promote the *Centrino* brand but will spend little time talking about the new *Pentium M*. This paper compares the two brands—which both use the identical microprocessors—and explains how wireless functionality is the primary difference between the two. In addition, this paper provides a perspective on how *Pentium M* notebooks can offer even longer battery-life, as well as faster, more reliable wireless connectivity capabilities than available from *Centrino* notebooks.

What's the Difference?

The *Pentium M* (M for mobile) is a new microprocessor family from Intel and their first designed from the ground up for mobile usage. The name is already causing some confusion because there are existing *Pentium III-M* and *Pentium 4M* families, leading one to believe the *Pentium M* is an older technology. *Pentium M* clock speeds are slower than those available from the *Pentium 4M* family and the new chips are also more expensive. Because of these facts, many laptops will continue to use the *Pentium 4M*, while the new chips will likely go into “thin and light” mobile computers where battery life is the most critical feature.

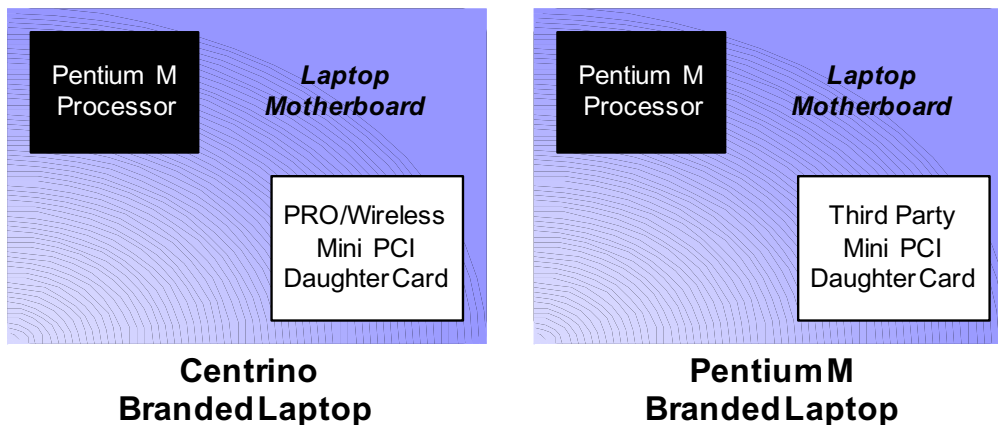
The key benefit of this new processor family is extended battery life. Through various techniques such as aggressive clock gating (which turns off parts of the processor not being used), and micro ops fusion (which combines instructions for faster execution), the new architecture is able to achieve significant power savings and extended battery life.

Centrino is a brand, rather than a product, supported by Intel marketing funds and applied by Intel and its customers to a bundle of Intel products that includes their *Pentium M* microprocessor, a related Intel chipset and Intel's 802.11 wireless networking module. The other Intel components are the Intel 855 "chipset" family and the Intel *PRO/Wireless* mini PCI card. All three components from Intel must be included in a laptop for it to be branded *Centrino*. The 855 chipset is responsible for audio, graphics, communications, and memory control. The *PRO/Wireless* card provides wireless local-area-networking (WLAN) connections compatible with the Institute of Electrical and Electronics Engineers (IEEE) 802.11b specification. In a nutshell, *Centrino* is Intel's attempt to leverage the advantages of its new *Pentium M* microprocessor to help sell other components, by implying that you must buy the entire bundle from Intel to get the advantages. In reality, many *Pentium M*-branded laptops will include superior wireless functionality, provided by third parties, while still offering the power-savings processor capabilities attributed to *Centrino*.

How can *Pentium M* machines have better WLAN capabilities?

Because Intel has suggested that the WLAN capability is "integrated into the *Centrino* platform," many believe that the wireless capability is built into the microprocessor or chipset. This misunderstanding is not surprising since many think of *Centrino* as a microprocessor, which it clearly is not. The *PRO/Wireless* capability is delivered on a "daughter card" which connects to the laptop PC motherboard. This daughter card is about one-half the size of a credit card, and is an industry standard form-factor called mini PCI. Almost all laptops today include one or more mini PCI connectors for adding modems, Ethernet, or wireless capabilities as factory-installed options.

The flexibility of designing a *Pentium M*-based laptop with mini PCI connectors also allows for laptop vendors to provide two nearly identical laptops, one branded *Centrino* with Intel's *PRO/Wireless* mini PCI module inside, and one branded *Pentium M* with a superior WLAN mini PCI module with technology from companies such as Atheros Communications.



What is better about *Pentium M* wireless capabilities?

Centrino-branded notebooks with Intel's *PRO/Wireless* module are limited to older generation 802.11b wireless connectivity. In contrast, many *Pentium M*-branded notebooks will offer the latest features in wireless networking—even longer battery life, five times the speed, less interference and better overall performance—due to “multi-mode” support for 802.11a and 802.11b (often written 802.11a/b) and even 802.11a/b/g WLAN capabilities.

When purchasing a WLAN-enabled laptop computer, backward compatibility with legacy 802.11b technology is needed due to installed based of interoperable products. With available 802.11a/b multi-mode products, most enterprises and many homes are doing new installs to take advantage of faster and more reliable 802.11a technology. 802.11a runs up to 54 Mbps, nearly five times the 11Mbps maximum speed of 802.11b¹.

802.11a also runs in the 5 GHz spectrum band, which has less interference than the 2.4 GHz band. 802.11b products, like Intel's *PRO/Wireless* module in *Centrino* laptops, share the 2.4 GHz band with cordless phones, microwave ovens, security cameras, Bluetooth devices and more. If nearby, these other devices cause radio interference, which can slow or disable the WLAN connection. Radio regulations (from the FCC in the U.S.) are significantly more restrictive for 5 GHz, prohibiting many of these interfering devices from operating in this band.

The 5 GHz band offers many more channels to avoid interference from nearby WLAN access points, the devices with which a laptop wirelessly communicates. The 2.4 GHz regulations in most countries provide for only three non-interfering channels. This means that every fourth access point will be sharing a channel, thus causing interference. This is not a problem for single-family homes with a single access point, but can introduce significant performance problems in apartments or large enterprise deployments where many access points might be in the building. The 5 GHz band has 13 non-interfering channels in the U.S. and as many as 19 in Europe. With pressure from Senators Boxer and Allen and their “Jumpstart Broadband Act”, the U.S. government recently announced support for an additional 11 non-interfering channels at 5 GHz, which are expected to be available soon.

A new 802.11 WLAN standard called 802.11g is coming soon from the IEEE. The 802.11g specification is essentially the same 54 Mbps technology as 802.11a, but runs in the 2.4 GHz spectrum. It has the potential speed advantages of 802.11a, but still has the interference problems and limited number of channels as 802.11b. This specification is still in development, although products are already shipping based on a draft version of the standard. All 802.11g networks also interoperate with 802.11b, so a lack of 802.11g support will only affect speed and not interoperability. Some *Pentium M* laptops will be shipping soon with multi-mode 802.11a/b that is also “802.11g-ready”, requiring only a software update when the specification is finalized.

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1. Note that these speeds are raw bit rates. Because of addressing, packet receipt acknowledgements and other overhead, the actual data throughput is typically only about one-half these speeds, and even that is only at close range. The speeds slow down further with increased distance from the access point or with interference from other radio devices.

Why is Wi-Fi CERTIFIED better than Centrino Compatible?

To help promote their new *Centrino* brand, Intel is also launching a “*Centrino* Compatible” program aimed at convincing users that only *Centrino* laptops will communicate with certain public “hotspot” access points. However, an independent certification for multi-vendor interoperability already exists from the Wi-Fi Alliance. The Wi-Fi Alliance is made up of over 200 companies throughout the world. The Alliance has certified over 600 different 802.11a and 802.11b products for interoperability and also promotes interoperable public hotspot access points under the “Wi-Fi ZONE” name. The organization expects to begin 802.11g certification this fall, after the standard is finalized. More information on the Wi-Fi Alliance is available at www.wifi.org. Most laptops with Atheros multi-mode technology have been Wi-Fi Certified to assure interoperability.

Why have four of the five largest PC vendors chosen Atheros?

Laptops are a significant investment and typically have a useful life of three years or more. Since the market is moving quickly to higher-performing WLANs, multi-mode support for all the flavors provides future-proofed investment protection. Multi-mode support also assures users they can connect to **any** 802.11-based network anywhere. Atheros is the only vendor of 802.11 multi-mode technology shipping in laptops today. In fact four of the five largest PC vendors are already integrating into their laptops multi-mode WLAN mini PCI modules based on technology from Atheros Communications (see http://www.atheros.com/news/PC_umbrella.html).

Atheros' products not only provide all the advantages of multi-mode WLAN, but also have won many awards and rave reviews for their superior performance. That's why Atheros has over 100 customers today for the company's WLAN technology. *Pentium M* or other laptops with Atheros wireless include the industry's most comprehensive security suite to protect data as it travels through the air. Additionally, Atheros-equipped *Pentium M* laptops can provide even better battery life than a *Centrino* equivalent machine. By sending the data at five times the speed, the wireless circuits finish their work in one-fifth the time and then go into a standby mode that dramatically reduces power consumption.

Summary

It's important to look beyond the brands at the features and capabilities of the new *Centrino* and *Pentium M* notebooks. The two key brand attributes of *Centrino*—wireless capabilities and battery life—will actually be better in *Pentium M* notebooks using Atheros wireless technology.

For more information on Atheros' security, performance, or other features, please see our web site at www.atheros.com or call us at 408-773-5200.

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