AMD Athlon™ 64 3800+ Review

by **John Reynolds**

Pins and Latency

AMD launched their AMD64 platform last year, introducing 64-bit instruction and addressing first to the business server market with the Opteron processor and subsequently to the consumer desktop market with the Athlon 64 FX and Athlon 64 processors. These new CPUs quickly garnered gaming enthusiasts' attention as they demonstrated performance superior to that of the competition's processors in many important benchmarks. This appreciable performance, combined with the promise of future potential when used with 64-bit software, seemed to pave the way for this new platform. Yet AMD knew that the requirement of using registered memory for the early Athlon FX and 64 processors — essentially rebranded Opterons — wasn't a strong selling point for the consumer market. Thus the introduction of a new interface with support for conventional, unbuffered DDR memory, Socket 939.

AMD launched Socket 939 and its new Athlon 64 FX and Athlon 64 processors on June 1st. This new 939-pin lineup consists of one FX CPU, the FX-53, which, similar to its 940-pin sibling, is clocked at 2.4 GHz, sports 128 kb (64K data / 64K instruction) of L1 and 1 MB of L2 cache, and is comprised of roughly 106 million transistors. In addition to this FX-53, AMD has also introduced the Athlon 64 3500+ and 3800+ 939-pin CPUs, clocked at 2.2 GHz and 2.4 GHz respectively. Both Athlon 64s have 128 kb of L1 and 512 kb of L2 cache and approximately 68 million transistors. And like the Athlon 64 FX, the 3500+ and 3800+ are manufactured on a 130nm, SOI (Silicon on Insulator) process and boast a 128-bit, dual-channel, integrated memory interface that, combined with the new Socket 939 interface, now supports unbuffered PC3200 DDR memory, thereby removing the associated latencies of registered memory for better performance.

Last, AMD also introduced the Athlon 64 3700+ processor which uses the Socket 754 interface and is also clocked at 2.4 GHz Unlike the other new Athlon 64s, the 3700+ boasts 1 MB of L2 cache and a 64-bit memory controller. Industry analysts are predicting that the Socket 754 interface will be AMD's mainstream approach since the 3700+ is a speed hike of the Athlon 64 3400+, but time will tell.

The AMD Athlon™ 64 Processor
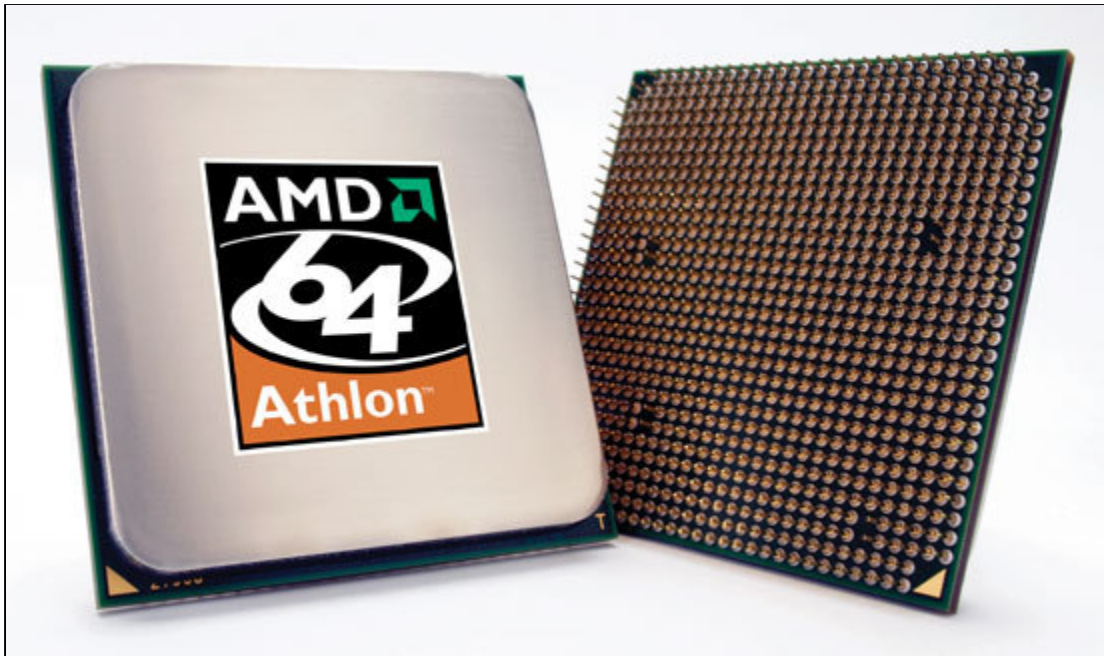

The AMD Athlon™ 64 FX Processor
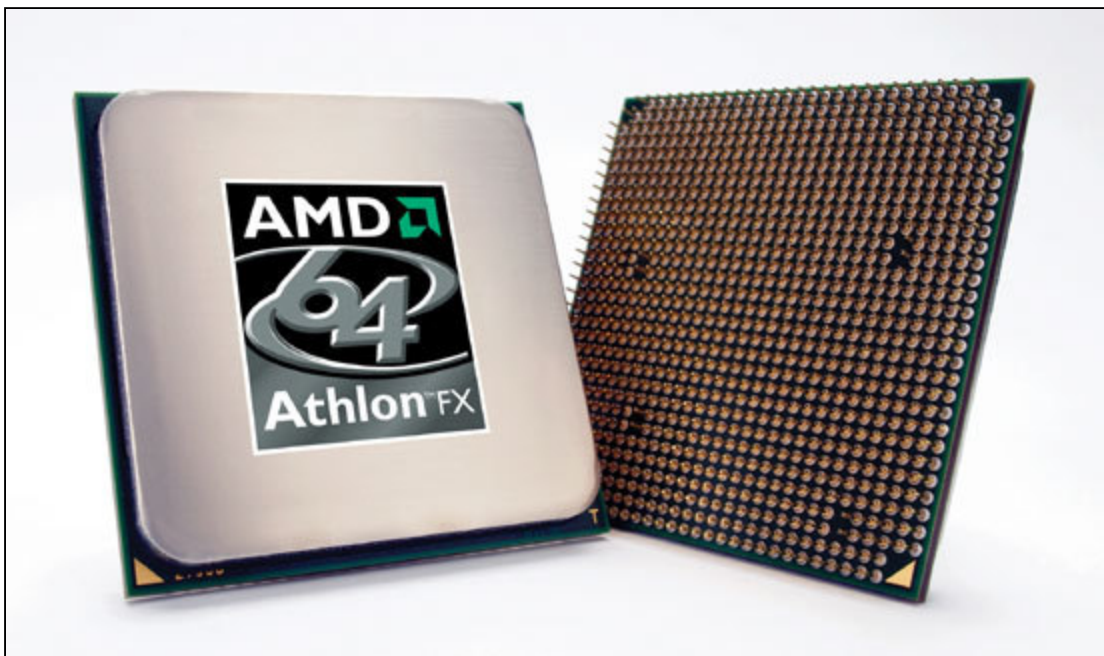
Features and Pricing

The Socket 939 platform has several notable features, first of which is an increased HyperTransport link, which now runs at 1 GHz compared to its previous speed of 800 MHz. HyperTransport is essentially a bus that links to various I/O channels, such as the PCI bus, via tunnels comprised of differential signaling. Only 16-bits wide, though double-pumped, this bus requires high speeds to achieve its performance, thus the speed bump to 1 GHz and its 8 GB of system bandwidth (combined with the additional 6.4 GB via the CPU's memory controller for a total of 14.4 GB) should give increased performance.

Next is AMD's EVP, or Enhanced Virus Protection. Also known as NX (no execute) Bit, EVP is hardware support designed to prevent the execution of viruses on AMD64-based systems. Though it won't be enabled until Windows

XP's SP2 (service pack 2) becomes available, EVP works by essentially halting the execution of code that's attempting to run in a memory area marked as a data page (a common tool of virus writers). AMD are obviously heavily promoting this feature as one that could save corporations millions in associated IT costs. This reviewer, however, isn't particularly eager to test the feature on his home computer <g>.

<div align="center">The AMD Athlon™ 64 Processor Architecture</div>
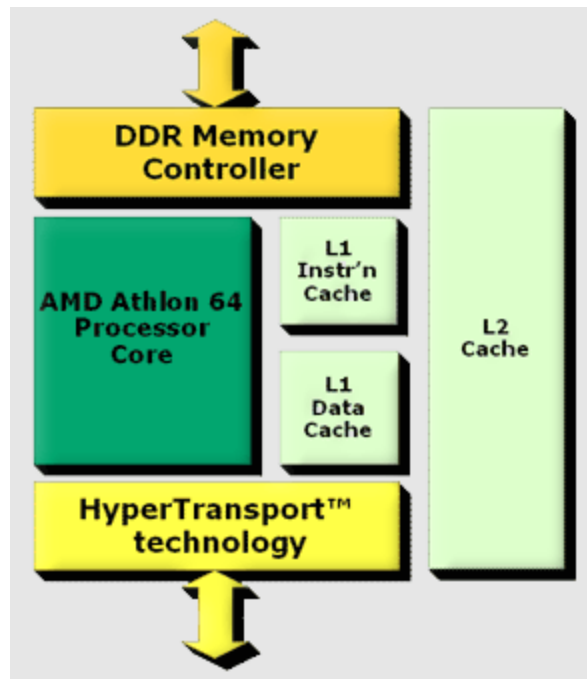
Cool'n'Quiet is a technology AMD developed for their mobile platforms. The technology reduces both heat and noise by essentially downclocking the processor when when it is idling (i.e., running under a light load). Less heat is produced due to the throttled clock speed and less noise from slower fan rotation. This feature could be particularly useful for those with small form factor setups, such as Shuttle's LANBOY cases.

Last, prices on the June 1st launch for these new Athlon 64 processors were set as follows (in 1,000-unit quantities):

- AMD Athlon 64 FX-53 processor $799 each
- AMD Athlon 64 3800+ processor $720 each
- AMD Athlon 64 3700+ processor $710 each
- AMD Athlon 64 3500+ processor $500 each

Support for unbuffered DDR memory, however, will help lower the overall cost for building a Athlon 64-based system. A quick glimpse at current online numbers as of late June shows that the above price stickers have not moved much at all.

Test System Setup

- AMD Athlon 64 3800+ processor
- ASUS A8V 939 motherboard (BIOS 1003, VIA 4-in-1 4.51)
- 1 GB (2 x 512 MB) Corsair XMS PC3200 DDR RAM
- VisionTek 9800 Pro 128 MB (Catalyst v4.6 drivers)
- Adaptec 19160 SCSI controller
- 36 GB Seagate Cheetah 15,000 RPM HD (NTFS)
- Windows XP Professional (SP1)
- DirectX 9.0b

The benchmark suite that will be used to test the Athlon 64 3800+ is listed here: http://www.simhq.com/_technology/technology_tests.html. Again, unless specified otherwise all games are configured to use their highest settings, and 32-bit color and trilinear texture filtering are always used as the baseline default during testing. Also, Windows XP is configured to have Automatic Update, System Restore, and all unnecessary startup services disabled. Fraps v2.2.1 was used to record performance scores unless otherwise noted.

Benchmarks

As noted in the test system setup section, the Athlon 64 3800+ being reviewed is installed on a ASUS A8V motherboard, which is based on VIA's K8T800 chipset and supports AGP 8x. Unfortunately, after weeks of trying to obtain a faster graphics board, the best AGP card available to us at the time of testing was the Xtasy 9800 Pro listed above. For this reason, only lower resolutions were used during testing.

First up is the **Comanche 4** benchmarking demo. Though several years old, this piece of software has consistently remained one of the most CPU-limited titles on the market, refusing to lose more than a few frames even when tested across a wide range of resolutions. Texture compression and hardware shaders were checked in the demo's options.

	640x480	800x600	1024x768
Avg. fps	69.7	69.5	69.2
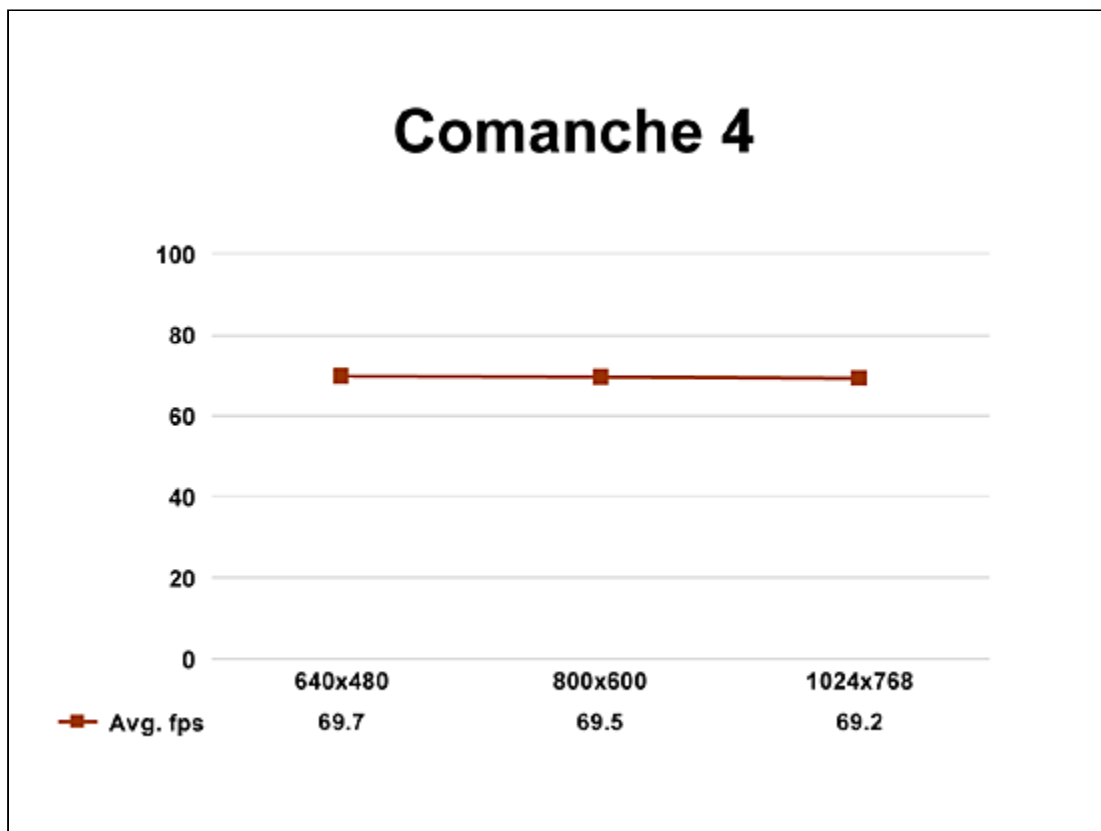
Even years after its release, it never ceases to amaze watching this demo refuse to move away from being almost 100% limited by the CPU

Lock On: Modern Air Combat was tested using the MiG-29 Intercept demo. Again, several settings such as water were dialed back since they have such dramatic impact on the game's performance. The Intercept demo was ran until the six minute mark.

Lock On: Modern Air Combat

	800x600	1024x768
Low fps	17.0	10.0
Avg. fps	42.0	29.9
High fps	175.0	162.0
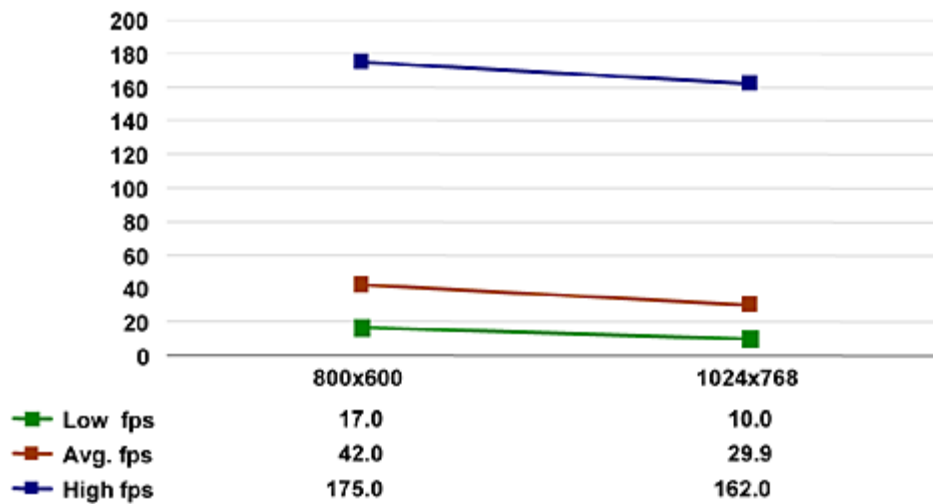
The 9800 Pro is clearly limiting Lock On's performance in this playback, with such a substantial frame rate loss between the tested resolutions. This is the rare flight simulation that scales well with faster graphics boards.
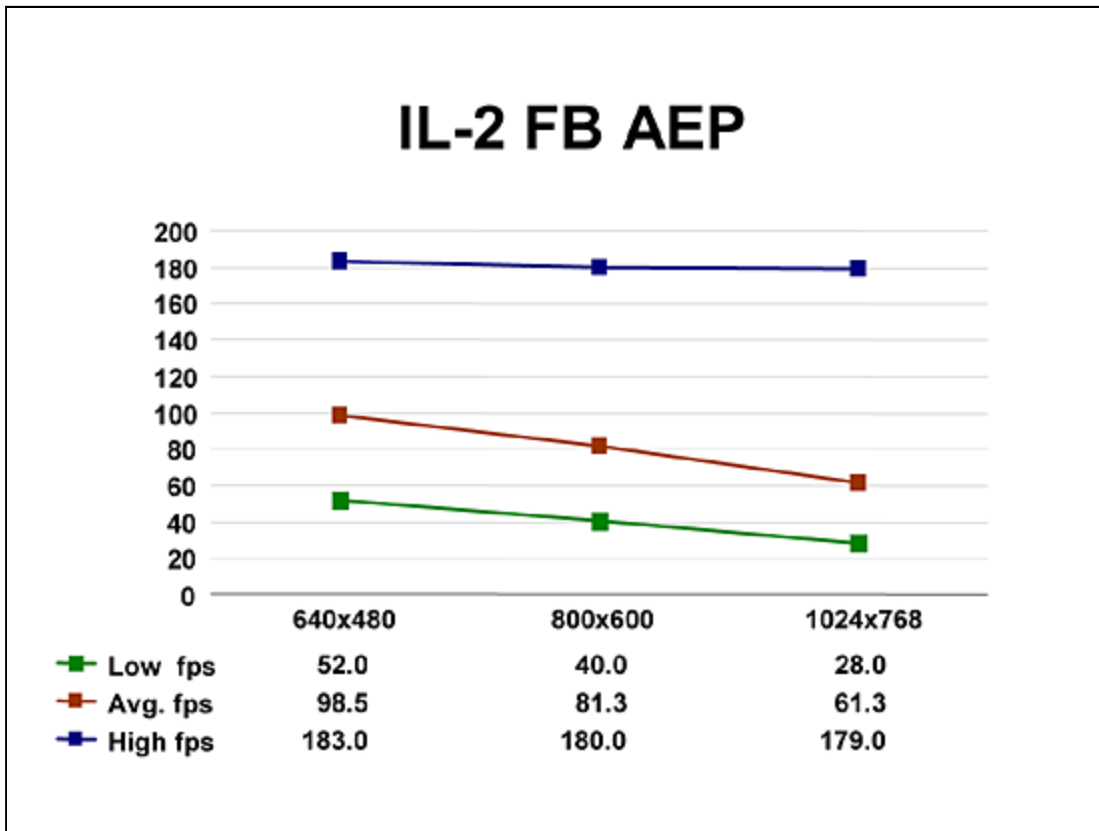
Microsoft's **Flight Simulator 2004** has proven itself to be fairly stressful on even high-end hardware when its options are dialed to the max. SimHQ's demo is a dusk flight over the city of Hong Kong, which gives a good combination of water, wooded hills, and buildings. The demo is ran with the Spot Plane view active and the camera set directly behind, and frame rate recording is halted upon landing. The option Ground Scenery Casts Shadows was disabled during testing.

Flight Simulator 2004

	800x600	1024x768
Low fps	40.0	30.0
Avg. fps	50.5	38.4
High fps	58.0	46.0
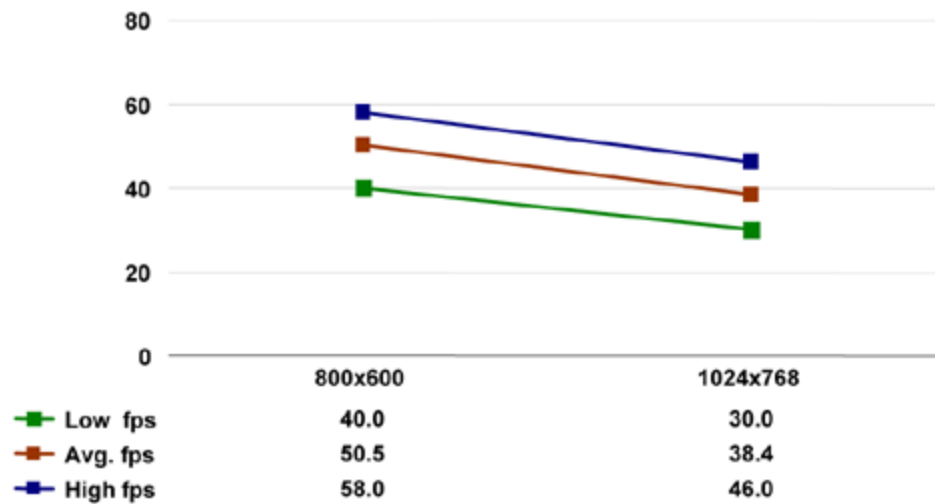
This is obviously another simulation that was limited by the test system's graphics card, losing over 20% performance between the two resolutions.

The **IL-2: Sturmovik Forgotten Battles - Aces Expansion Pack** represents SimHQ's non-modern flight simulation test. Using OpenGL rather than D3D, the landscape option was set to perfect. Testing consisted of using Fraps to record the frame rate during the first two minutes of the Bf109 Introduction training demo.

IL-2 FB AEP

	640x480	800x600	1024x768
Low fps	52.0	40.0	28.0
Avg. fps	98.5	81.3	61.3
High fps	183.0	180.0	179.0

While losing over 33% performance between 640x480 and 1024x768 resolutions, IL-2 FB AEP still churned out a high frame rate.

The venerable **Falcon 4** has received a recent overhaul with the release of SuperPAK 4.1. Testing was conducted using SimHQ's demo, a low level, air-to-ground dusk mission that consists of two Falcons using Mk20s and Mavericks. The outbound flight route takes the Falcons over the city and into a hot combat zone.

Falcon 4 SuperPAK 4.1

	800x600	1024x768
Low fps	47.0	28.0
Avg. fps	71.5	59.7
High fps	144.0	65.0
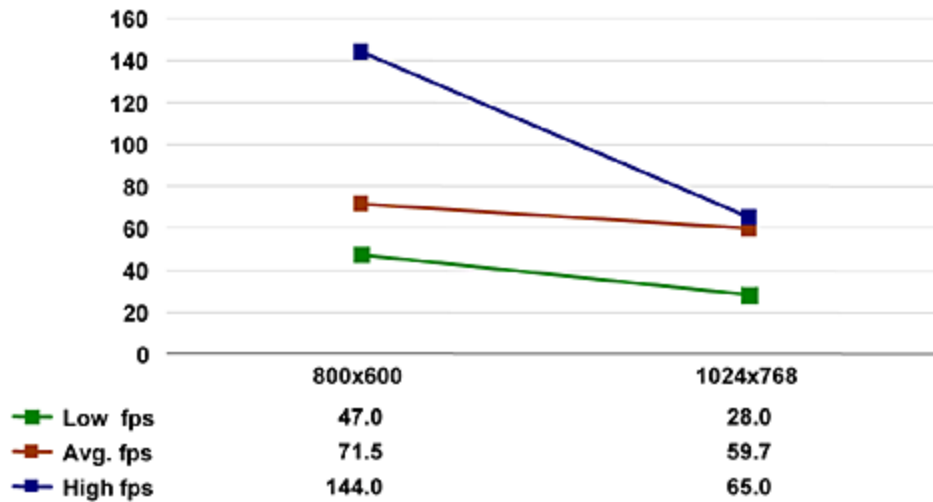
Again we see a fairly significant frame rate loss — in this case roughly 15% — between tested resolutions.

For the sake of consistency, **Far Cry** was tested with all graphical options placed at their highest settings. The Research map was used and testing consisted of playing completely through the map in God mode, using the same path for each resolution.

Far Cry

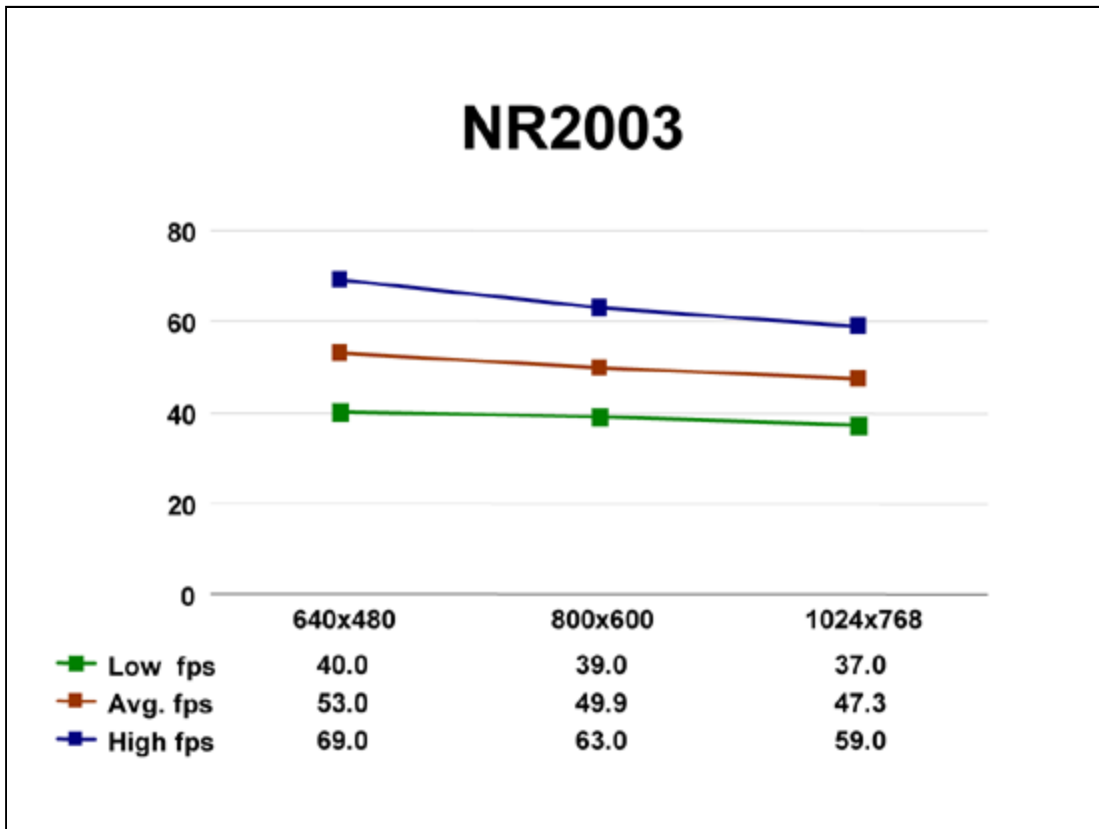|	800x600	1024x768
Low fps	33.0	23.0
Avg. fps	77.7	56.3
High fps	254.0	183.0
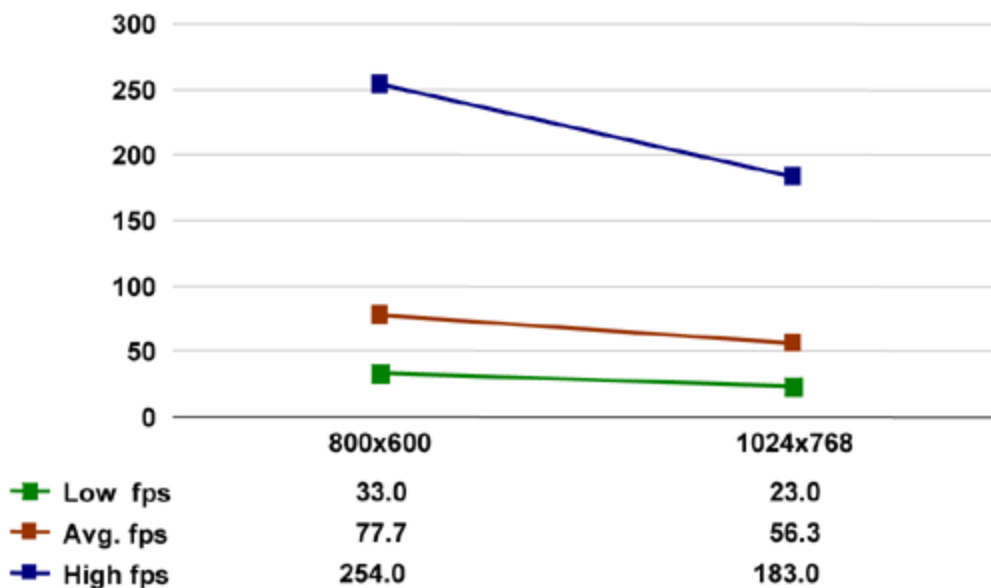
Even on the aging 9800 Pro and its 128 MB of on board memory, Far Cry still turns in very playable frame rates at 1024x768, though testing was conducted without anti-aliasing or anisotropic filtering enabled. A roughly 30% performance drop occurred between the two resolutions.

Call of Duty's Dawnville demo was used to test this OpenGL title based on id Software's Quake 3 engine. The included timedemo utility was used to record performance rather than Fraps, and the "com_maxfps" command was used to raise the default frame limit of 85.

Call of Duty

	640x480	800x600	1024x768
Avg. fps	104.0	103.0	99.9
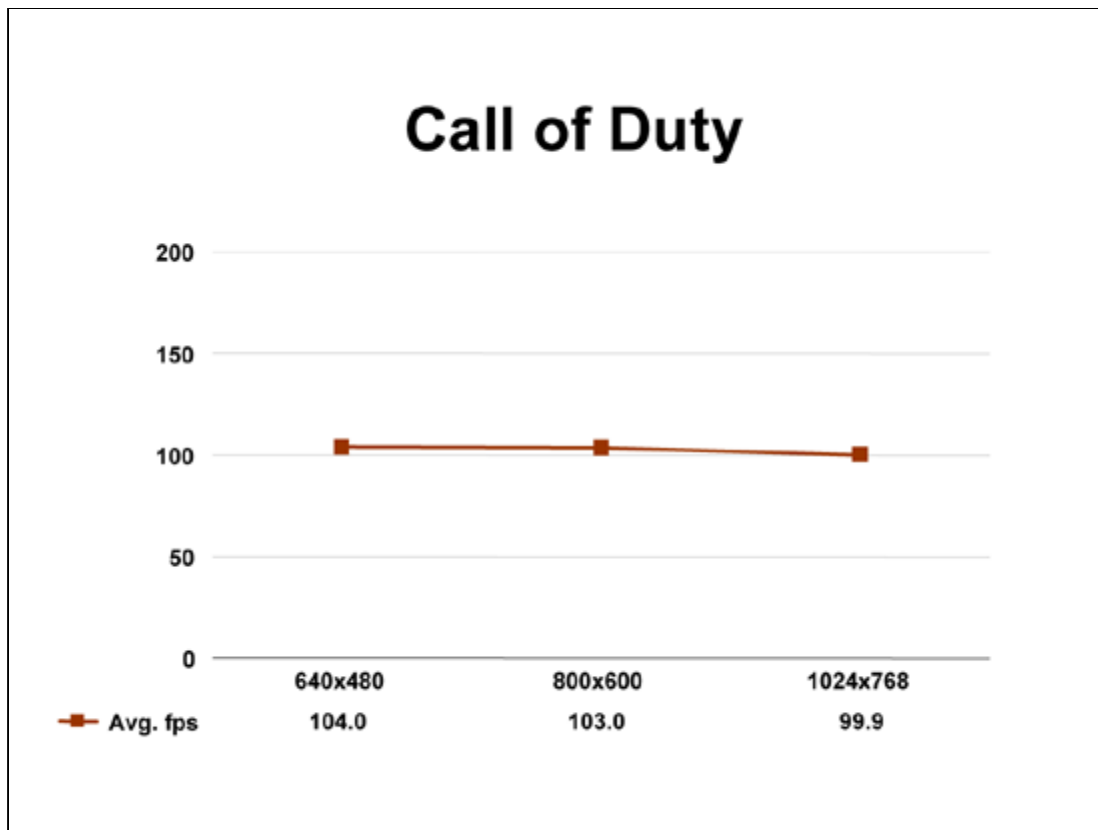
Quake 3-based games typically scale extremely well with faster processors, and while frame rates in excess of 100 are hardly worth complaining about it would appear that ATi's OpenGL driver support is preventing the game from reaching scores closer to those generated by their competitor's boards.

NASCAR Racing 2003 Season was tested using SimHQ's crowded Daytona replay. The camera was fixed to Earnhardt's cockpit for the view mode, and all graphical options were set to their highest.

NR2003

	640x480	800x600	1024x768
Low fps	40.0	39.0	37.0
Avg. fps	53.0	49.9	47.3
High fps	69.0	63.0	59.0

NR2003 appears somewhat CPU-limited, with a roughly 10% variation in frame rate within the range of tested resolutions. These scores, however, are still very high and show the horsepower of the 3800+.

Conclusion

The Athlon 64 3800+'s outstanding performance is probably derived from a few key areas. While an extension of the standard 32-bit x86 architecture, AMD64 technology supports 64-bit registers and addresses up to 16 Exabytes of memory (32-bit CPUs are limited to 4 GB) that promise additional performance gains once 64-bit software reaches the market. However, this is not why the Athlon 64s are such fast processors for today's games; the answer most likely lies in the fact that they're designed to execute more instructions per clock (IPCs) cycle than the competition, outperforming other CPUs that are running at much higher physical clock speeds. Secondly, and perhaps most importantly, the integrated memory controller simply gives the Athlon 64 platform a high system bandwidth, and game benchmarking overwhelmingly indicates that such software thrives on system bandwidth.

Of course a system is only as stable as the platform on which it is built, and the A8V provided a solid, reliable backbone for the 3800+. In fact, the test system's chassis was a Antec Sonata case, which proved to be whisper-quiet even with a 15k Cheetah SCSI hard drive installed, and the machine purred through the entire benchmark suite without a hiccup. It is unfortunate that SimHQ was unable to obtain a more powerful AGP graphics board to pair with the Athlon 64 3800+, for quite a few of the titles used were obviously not reaching the test system's performance potential. Yet in spite of this situation several of the lower resolution tests nevertheless obtained very respectable scores, a testament to AMD's processor. While still demanding a sizable financial outlay in price, the 939-pin Athlon 64s' ability to handle the latest simulations with aplomb make them well worth the price of admission for those looking to build a high-end gaming system.