Socket 754 Shootout

By Johan De Gelas – May 2004

NVIDIA nForce 3 250Gb Versus VIA K8T800

Many of our readers are eagerly awaiting the new Socket 939 motherboards, due to begin appearing in a few days. When MSI offered us a chance to review the K8N Neo, we could still not resist, as Socket 754 may well become the choice of many budget-minded readers. A second reason might be the fact that Socket 754 Athlon 64s ship with 1 MB of L2-cache and will be rated slightly lower (and thus cheaper) than their Socket 939 brothers with 512 KB L2-cache. This makes Socket 754 interesting if your favorite application is a cache friendly one.

Featuring the new nForce250 chipset, the K8N Neo offers a lot of interesting goodies such as on-chip Gigabit LAN, 8-channel (7.1 Audio), 4 native nVidia SATA RAID connectors, MSI Core Cell for easy overclocking, a dedicated Communications slot for WLAN/Bluetooth and 2 1394A FireWire ports courtesy of the VIA VT630 chip. We compare the K8N Neo with MSI's K8T800. We believe that the fact that the latter is not based on the K8T800 Pro but the K8T800 does not matter much. The K8T800 is - despite its sensational marketing name - nothing more than a K8T800 with a PCI/AGP lock and a 1 GHz Hypertransport connection between the Northbridge and the CPU. Considering that a 800 MHz Hypertransport link was not a bottleneck at all, there is almost no gain from the faster Hypertransport link. Such a fast connection is far more interesting between two or four CPUs in an MP system.

Background

It is quite common for people to choose a motherboard because it is ranked the highest in benchmark charts, has the largest checklist of features, or the best price/performance ratio. However, this is not always a good strategy in selecting a motherboard.

In the case of the Athlon 64, it is almost useless to compare the performance of motherboards with the traditional benchmarks: the memory controller is integrated in the CPU and the performance differences are within the error margins of the benchmarks. Office and workstation applications - excluding 3D animation - depend mostly on the CPU and how fast that CPU can access the RAM memory. First Person Shooter Gaming performance depends mostly on the GPU, but most games do not come close to the limits of AGP 4x, let alone AGP 8x. So you won't see any tangible differences between the different chipsets in these benchmarks.

This doesn't mean that there are no performance differences at all, but they only surface in special circumstances. For example, when you want to use your motherboard in a FTP/HTTP server to give better service to your customers or colleagues, or to allow your friends to leech faster at LANParties, the onboard NIC may make a big difference Other examples are 3D animation and future games that feature so many polygons that the efficiency of the AGP port is tested. That is why the focus in this review is on the following:

- UDP (LAN Gaming) and TCP (HTTP/FTP server) performance of the Gigabit NIC
- Harddisk I/O RAID performance
- AGP performance

Next, we take a quick look at the features of the two competing chipsets.

Chipset Comparison

The nForce 3 250 comes in 2 versions: the nForce 3 250Gb and the 250. The only difference is the inclusion of Gigabit Ethernet and a personal firewall in the 250Gb.

Chipset feature	nForce 3 250Gb	nForce 3 150	VIA K8T800	VIA K8T800 Pro
Max. Hypertransport Connection Speed chipset to CPU	**up to 1000 MHz DDR- 16 bit***	600 MHz DDR - 16 bit	800 MHz DDR - 16 bit	1000 MHz DDR - 16 bit
Max. Hypertransport Connection from CPU Speed to chipset	**up to 1000 MHz DDR - 16 bit***	600MHz DDR - 16 bit	800 MHz DDR - 16 bit	1000 MHz DDR - 16 bit
PCI/AGP lock	**Yes**	Yes in theory	No	Yes
SATA	**4 Native**	No Native	2 Native	2 Native
RAID	**0,1,0+1**	-	0,1,0+1	0,1,0+1
USB Controllers/USB ports/Firewire	**4/8/0**	3/6/0	4/8/0	4/8/0
AGP	**8x**	8x	8x	8x
North/Southbridge connection	**Single Chip**	Single chip	533 MB/s	1066 MB/s
Audio	**AC '97 2.1 6.1 channel audio**	AC '97 2.1 6.1 channel audio	VIA Vinyl™ 6-channel Audio (AC'97 integrated)	VIA Vinyl™ 6-channel Audio (AC'97 integrated)

**Runs at 800 MHz Default, capable of running at 1000 MHz*

A quick look at the table above reveals that the nForce 250 is richer in features than its competitor. The VT8237 southbridge of the K8T800 supports two channels of Serial ATA natively, and offers an interface for two more channels with the help of an external physical layer interface chip ("SATALite"). So in theory, VIA's Southbridge should be able to support 4 SATA disks too, but we remain very skeptical as MSI didn't use it, and it is highly doubtful that such an arrangement would perform well, especially compared to the nForce 3 which natively supports 4 SATA disks. NVIDIA also scores with the native Gigabit Ethernet Interface, while the VIA solution requires an extra chip to do this. Lastly, NVIDIA's chip is a single chip solution, as opposed to VIA's Southbridge - V-Link - AGP chip solution, which should help motherboard manufacturers to improve the layout of nForce 3 motherboards.

But the nForce 3 chipset has disadvantages too. Many hardware enthusiasts described their nForce 2 motherboard as "a very nice soundcard with a motherboard attached to it." It is rather ironic that the current nForce 3 features worse sound than the K8T800. NVIDIA came up with the lame excuse that their customer surveys showed that most buyers "did not use Sound Storm, and that Sound Storm was not decisive to buy nForce."

Well, I am pretty sure that most enthusiasts will disagree heavily, and that the rest of the world simply has no idea at all what a chipset is anyway. With the same reasoning you can say that there is no interest in decent sound at all as most people are using cheap speakers anyway. It is a sad fact - we will show more evidence in this review - that the motherboard market is completely obsessed with the price argument. Aggressive pricing and short products cycles are reason why the quality of motherboard components is, in many cases, mediocre. More on this later.

What about the faster Hypertransport link? Well, it is clear that 3.2 GB/s (800 MHz x 2 x 2 bytes) full duplex is much more than the AGP port and all Southbridge devices will need. The extra bandwidth that comes available when speeding this point-to-point (P2P) connection up to 1 GHz is not going to help. The only advantage may be that the latency between the Southbridge and CPU is reduced a bit, which might help somewhat more with PCI Express, as PCI Express devices also use P2P connections to the Southbridge. AMD however confirmed that the faster HT link between CPUs in Quad/Dual Opteron systems will produce tangible performance increases.

So, let us take a quick look at two featured motherboards.

MSI's K8T Neo and K8N Neo (Platinum)

The differences in layout between the K8T Neo and K8N Neo are striking.

MSI K8T Neo

MSI K8N Neo Platinum

NVIDIA's single chip solution paid off: MSI was able to create a K8N layout that is much easier to handle than the K8T board. It is no longer hard to unlock the retention mechanism, as the CPU is not close to the power supply. The memory sockets are also positioned away from the video card. The only mistake in this layout is the two SATA connectors between the AGP slot and the CPU.

When it comes to accessories, MSI was pretty generous. MSI includes a red rounded IDE PATA cable, a rounded floppy cable, two orange SATA cables, a Dual SATA power to molex power converter and two extra brackets for 2 additional USB Ports, 4-LED diagnostics, and Firewire. The back I/O Panel is also very well equipped: aside from 5 audio mini-jacks, Optical and coaxial SPDIF connectors you also find 4 USB ports, one Firewire port, and a Gigabit Ethernet port. No complaints there. The mediocre "golden" heatsink on the nForce 3 chip should be replaced by a decent heatsink, however.

That ugly thing got so hot we couldn't even touch it for a few seconds, even when the system was not really loaded. We definitely prefer passive cooling solutions, but MSI should have used a bigger heatsink here.

When it comes to overclocking, the K8N Neo shines thanks to the PCI/AGP lock, the fact that you can alter the HT speeds, and every voltage setting you can imagine. We achieved a stable overclock of 20%, while the K8T Neo was hardly able to do more than 12%. The K8T Neo also proved to be more picky when it comes to DIMMs, as our Corsair XMS4000 would only work after a BIOS update, and even then only at CAS 2.5 (3-3-7). The board also didn't like the fact that we used a third DIMM. We can not conclude that this is unrelated to Corsair's DIMMs as we didn't have any other DIMMs to test, however.

Benchmarked Configurations

The 56.72 drivers were used for our GeForce FX 5900 Ultra (256 MB) video card and NVIDIA's nForce 4.08 and 4.24 driver was used for the K8N Neo, but we saw no difference at all in the benchmarks. For the MSI K8T Neo, we used the VIA Hyperion 4-in-1 4.51 drivers. All motherboards were flashed with the latest BIOSes. All systems used 400 MHz DDR SDRAM (CAS 2.5, 3-3-7).

MSI K8T Neo, VIA K8T800 (bios version 1.6)

- 2x512 MB Corsair PC3200 XMS (DDR-SDRAM) running at 400 MHz CAS 2 (2.5-3-3-7)
- Realtek 8110S-32 NIC
- VIA Hyperion 4.51

MSI K8N Neo, NVIDIA nForce 3 250 (bios version 1.18)

- 2x512 MB Corsair PC3200 XMS (DDR-SDRAM) running at 400 MHz CAS 2 (2.5-3-3-7)
- Onboard nForce 250GB Gigabit NIC
- nForce 4.08 driver

Shared Components

- Leadtek Geforce FX5900 Ultra 256 MB
- Quadro 980 XGL for AGP tests
- AC '97 Sound (integrated on all boards)
- Maxtor 80 GB DiamondMax 740X (7200 rpm, ATA-100/133) for PATA tests
- Wester Digital Raptor WD360GD - 36 GB (10000 rpm, SATA-150) in RAID 0 (striping) for all "Raptor RAID tests"

Software

- NVIDIA 56.72 Forceware- Drivers (Video Card)
- Windows XP Service Pack 1A
- DirectX 9b

We'd like to thank the following helpful people for their support and important contributions to this review:

- **Ilona van Poppel and Angelique Berden (MSI)**
- Damon Muzny (AMD)
- Kristof Semhke, Matty Bakkeren and Markus Weingarter (Intel)
- Robert Pearce (Corsair)

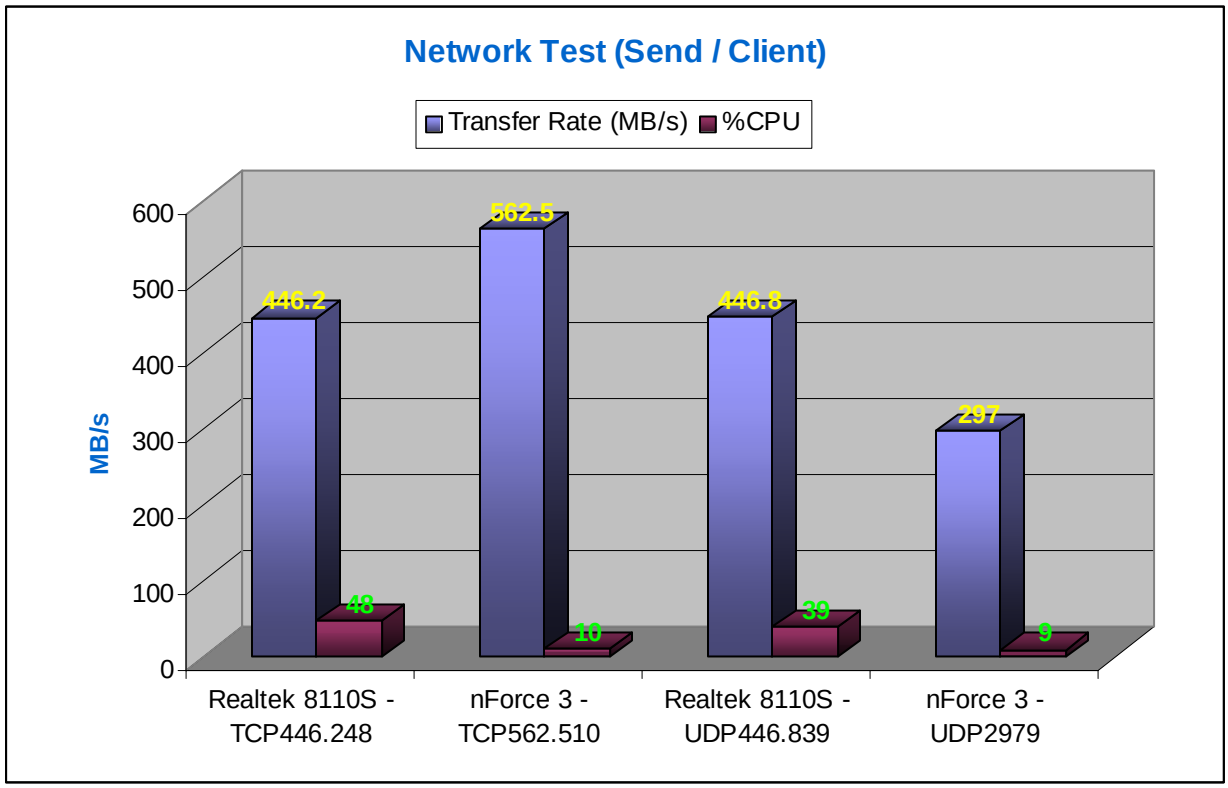
Next: the benchmarks....

Gigabit Power

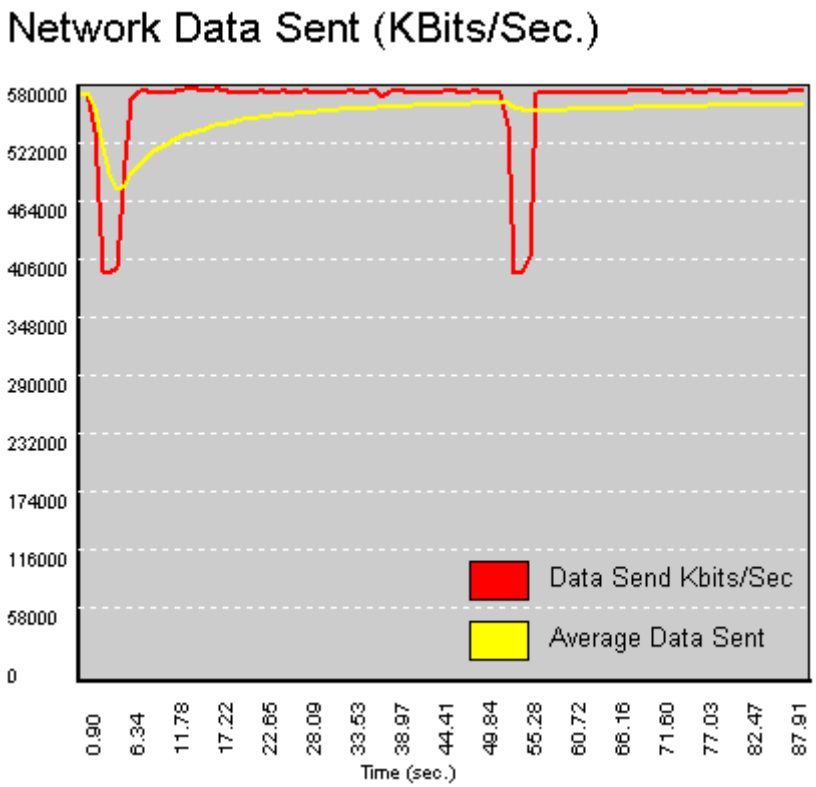
With 802.11g wireless connections reaching only 50% of their promised transfer speed (54 Mbit/s), and gigabit switches costing less than $200, there is simply no alternative to gigabit ethernet when you have some filesharing or FTP serving to do. We tested with the PassMark Advanced Network Test (which is part of PerformanceTest) to test the data transfer rate between our two reviewed motherboards and the Broadcom NetExtreme Gigabit port of the Quad Opteron. Both machines acts as server and as client.

The server waits for a connection, the client connects to the server machine and sends data to it for the duration of the test, which we set at 90 seconds for repeatable results. We used both transport protocols: UDP and TCP. To get an idea of what is excellent TCP/UDP performance, we first tested with the (CSA) Intel RC82540EM NIC on the Dual Xeon Intel SE7505VB2 board. This Intel NIC was able to **send and receive 840 Mbit/s and 780 MBit/s** in TCP and UDP respectively. We will see that this is more or less the upper limit of this test.

We start with both motherboards sending data (being the client) to our massive Quad Opteron server.

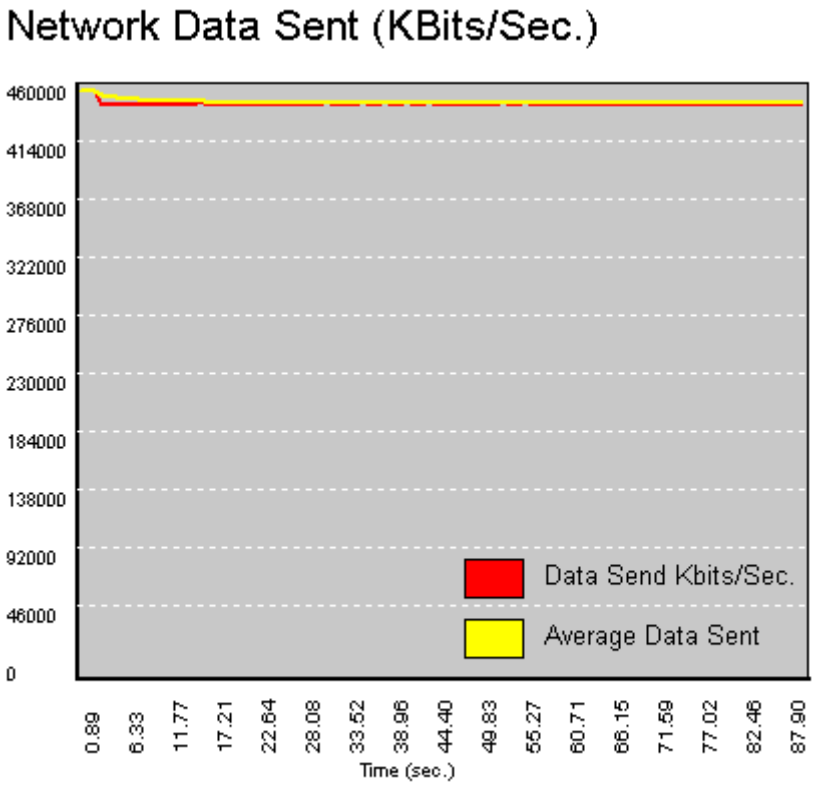


Below you find the nForce 3 Graph (TCP)



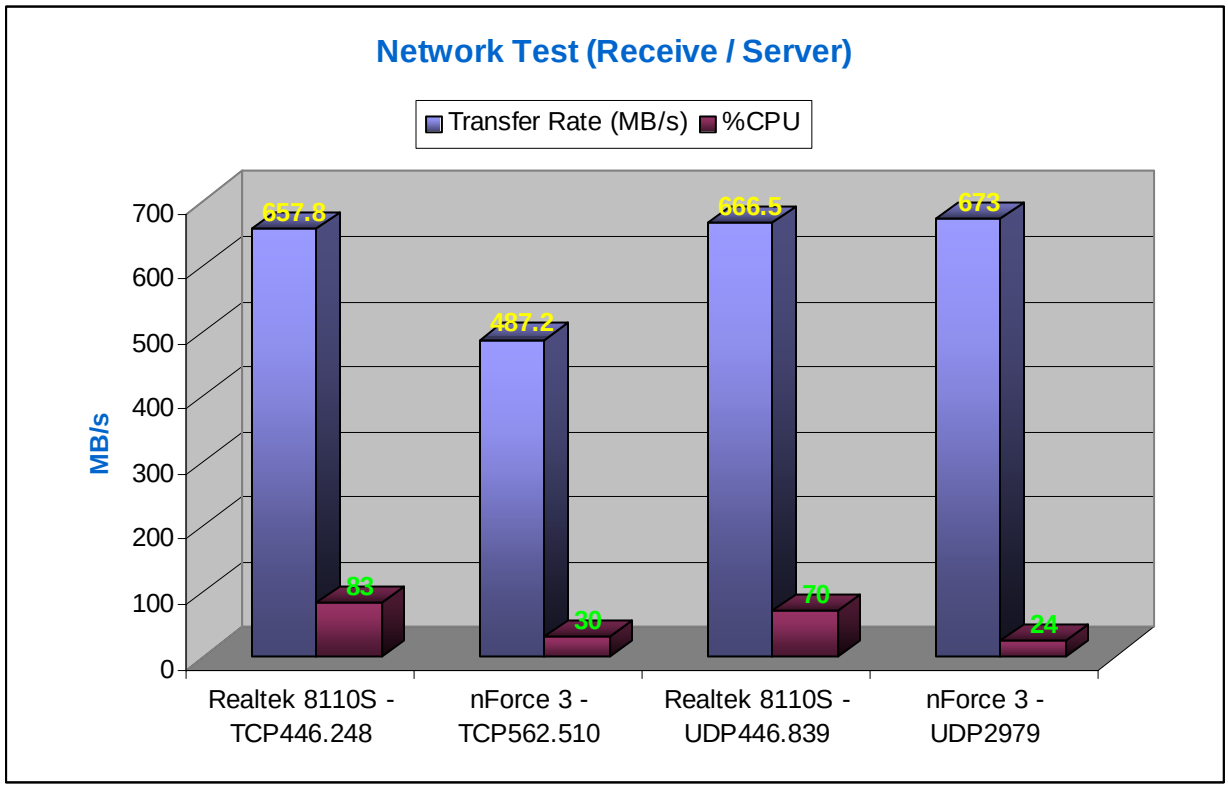
The average nForce 3 Gigabit Transfer rate would have been better (up to 580 Mbit/s) if it didn't experience two serious dips. At this point, I have no idea where these dips come from. Suggestions welcome…

Next, the VIA K8T800 + RealTek 8110-32s (TCP) graph.



Both the nForce 3 and Realtek 8110s are no where close to what the Intel NIC was capable of. For some weird reason, the nForce 3 performs quite well with TCP, but struggles with UDP transfers. All tests were repeated 3 times and the difference between tests was below 1%. The Realtek driver is a real CPU power glutton: eating up 48% of a powerful Athlon 64 3400+ (2.2 GHz) while delivering less than 500 Mbit/s. Just imagine what would happen in a system with a slower CPU or an application which also presented its own processing demands independent of simple network transfers.

In the next test, the tested motherboards assume the role of server (receive data) and the Quad Opteron sends the data.



So you don't know why you would need a 4 GHz or 4000+ CPU? To make sure a Realtek Gigabit NIC can deliver 800 Mbit/s, of course! Hogging up to 83% of our Athlon 3400+, the Realtek card can bring any modern CPU to its knees at 1 Gbit/s, but luckily the chip is only capable of transferring 650 Mbit/s. While the transferrates of the nForce 3 are not higher, the chip consumes about 1/3 of the CPU power that the Realtek needs.

We quickly confirmed these results with a real world test. Copying a 5 GB HDTV video file from our systems to the quad opteron (Windows Filesharing, SMB Protocol), gave similar CPU loads (70-90%) at 44 MB/s, while the nForce 3 achieved 59 MB/s at much lower CPU load numbers (30-50%).

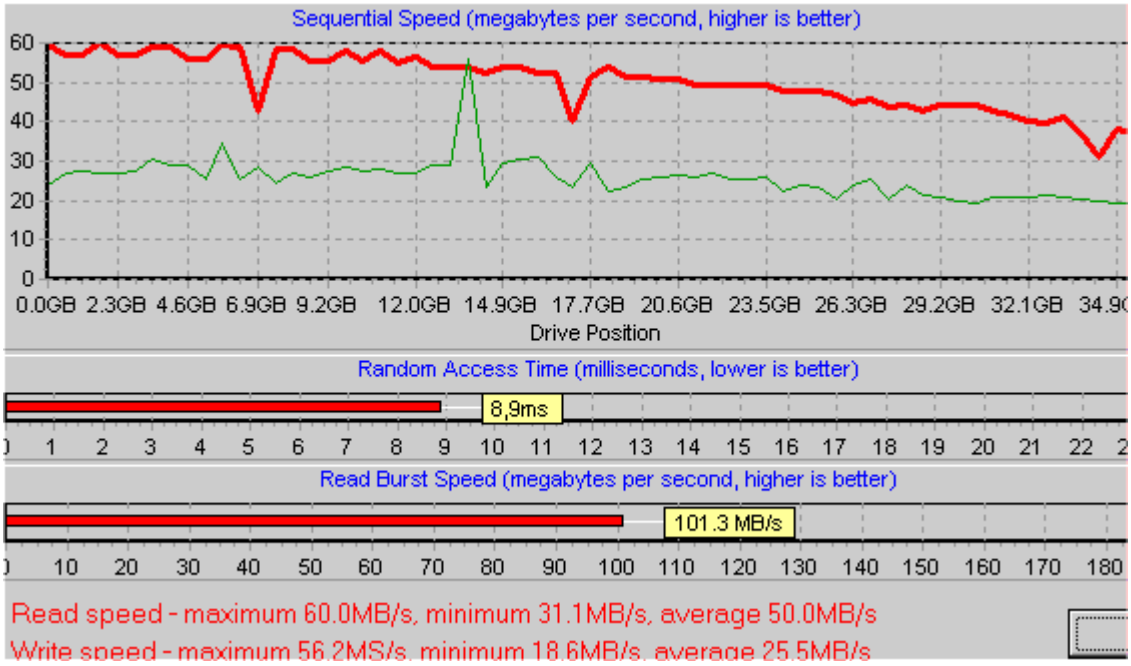
Realtek's 8110s-32: CPU vampire!

This might be more important than you think: we see a trend that many motherboard manufacturers tend to replace Intel NICs with Realtek ones to save a few pennies more. Yet another sign that this market is suffering from too much price pressure. A few dollars more can offer you a much better computing experience, a few dollars less give you a unresponsive machine on some occasions.

RAID-0 Performance

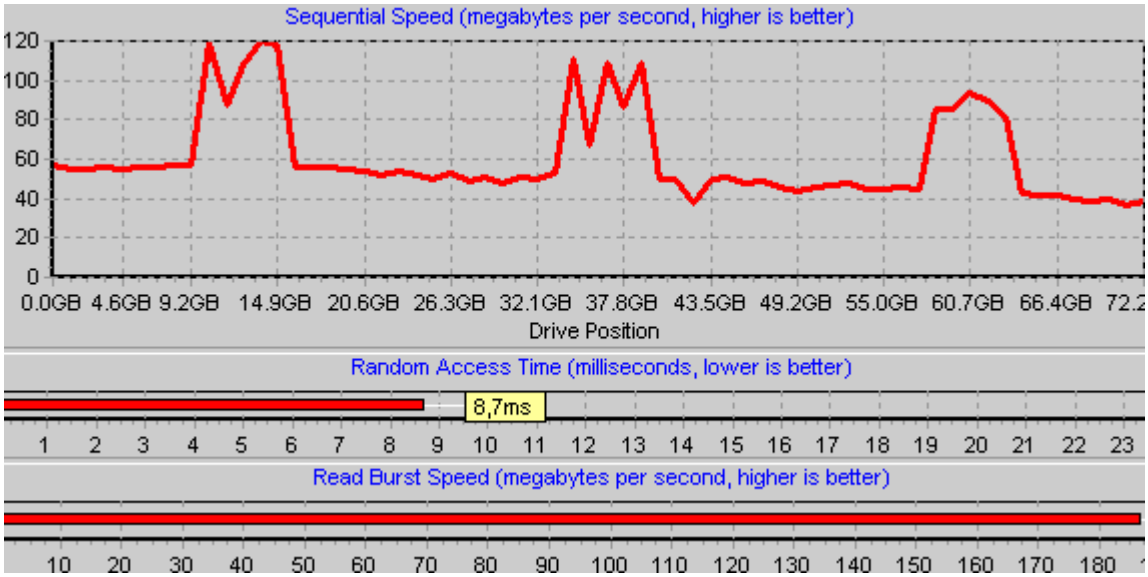
Single drive numbers were so similar on both setups that I did not even bother to discuss them. Basically VIA is about 3% faster (transfer rate) while NVIDIA's IDE implementation has around 5% lower CPU overhead. The RAID 0 results were much more interesting, however.

To get an idea how efficient a RAID controller is, we decided to test with one Raptor disk attached to the SATA connector of the VIA K8T 800 Southbridge. Below you find the HDTach Graph.



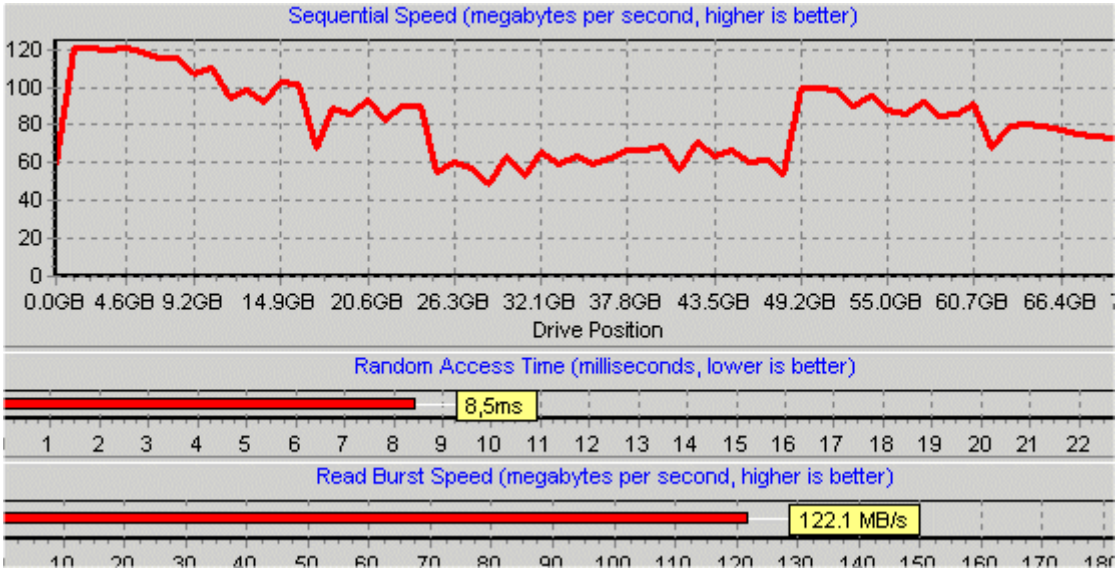
A single Raptor is able to sustain about 55 MB/s if you read relatively large files in a sequential manner. This means the head hardly moves, with head movements limited to a very low track to track seektime: the head never moves more than one track. The movement starts at the edge (outer circle or track) of the disc, where - thanks to "zone recording"- the head encounters the most sectors per rotation, so we achieve the highest transfer speed. When the head moves more and more towards the inner track of the disc, the amount of sectors per rotation lowers (smaller inner tracks), and thus the transfer speed is likewise reduced. A smart RAID-0 controller should be able to deliver at least 60 MB/s, or twice the minimum transfer speed of each disc, and on average we should come close to 100 MB/s.

Next, the Nvidia nForce 3 driving two 10,000 RPM WD Raptor 360, using RAID-0:



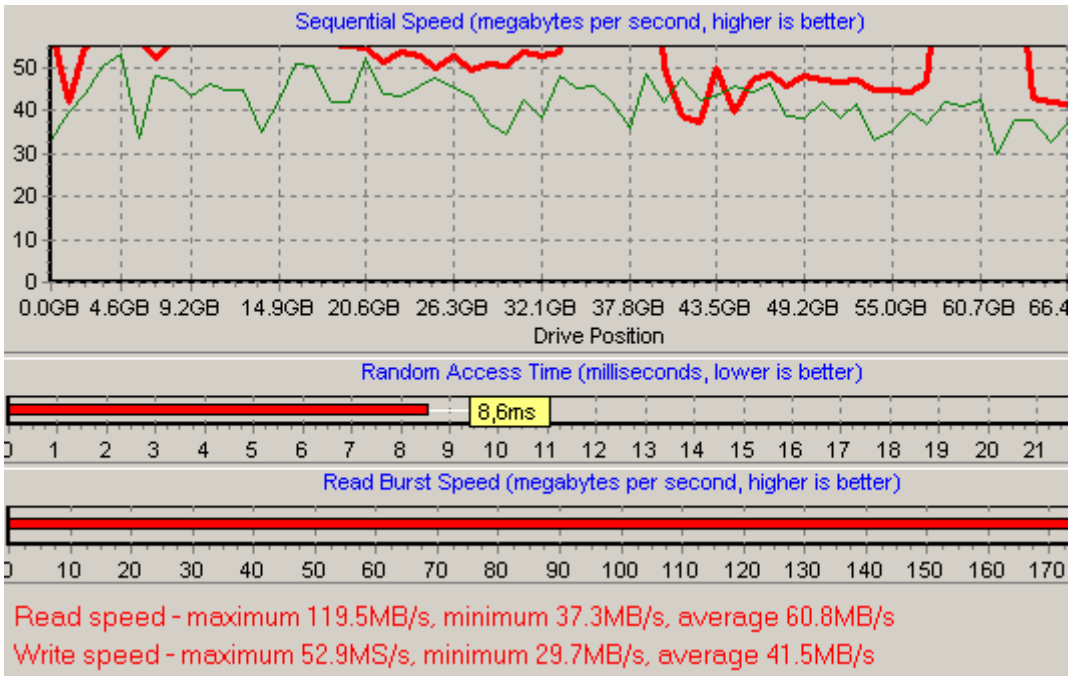
There is something weird about the way that NVIDIA's driver handles RAID. It seems that it only can reach "real RAID-0" performance from time to time, as 55-60 MB/s is the minimum RAID-0 speed we expect, but it is the speed we see sustained most of the time. On the bright side, NVIDIA is able to squeeze excellent burst reads out of the controller (186 MB/s - number has been cut off the graph).

Next up is VIA's SATA RAID performance with the same Raptor RAID-0.

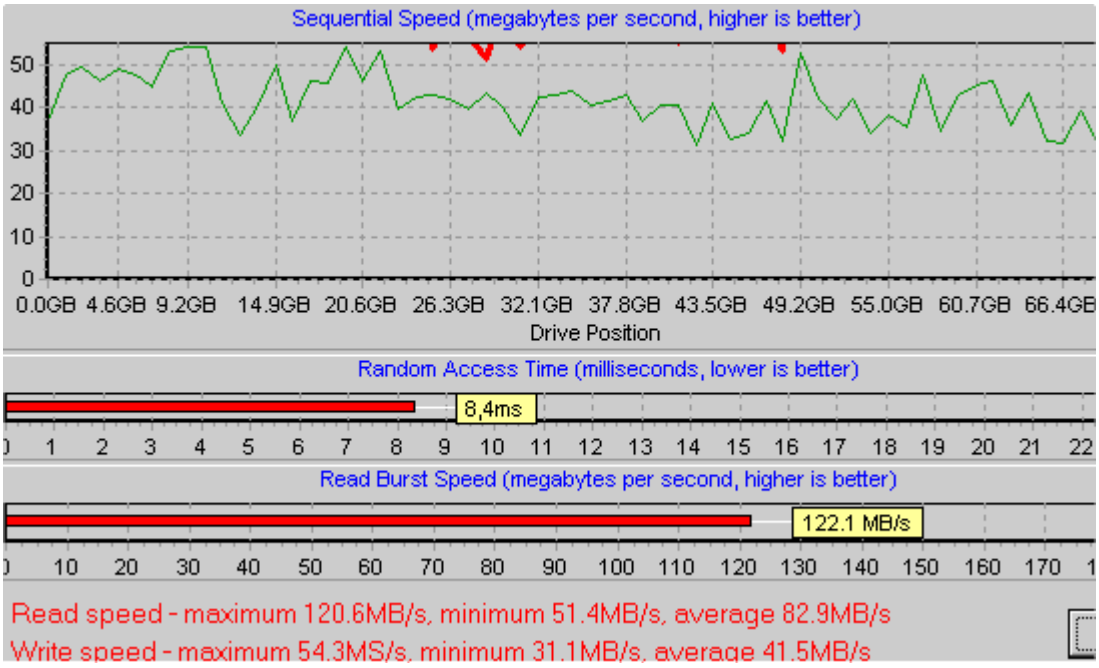


VIA handles RAID-0 quite a bit better: most of the time you really get higher transfer rates than a single drive. The burst read is a lot lower, a disappointing 122 MB/s, where the theoretical limit is close to 300 MB/s. The burst read speed is only important when reading from the SDRAM cache.

Let us take a look at write (green line) speeds. First the nForce 3:

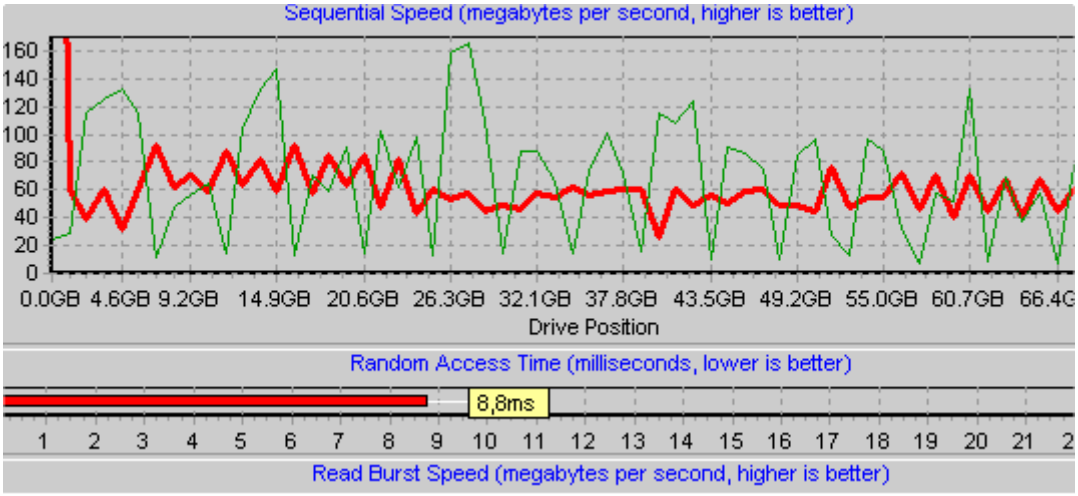


Write speeds are not spectacular but above 35 MB/s most of the time. Let us see if VIA does better.



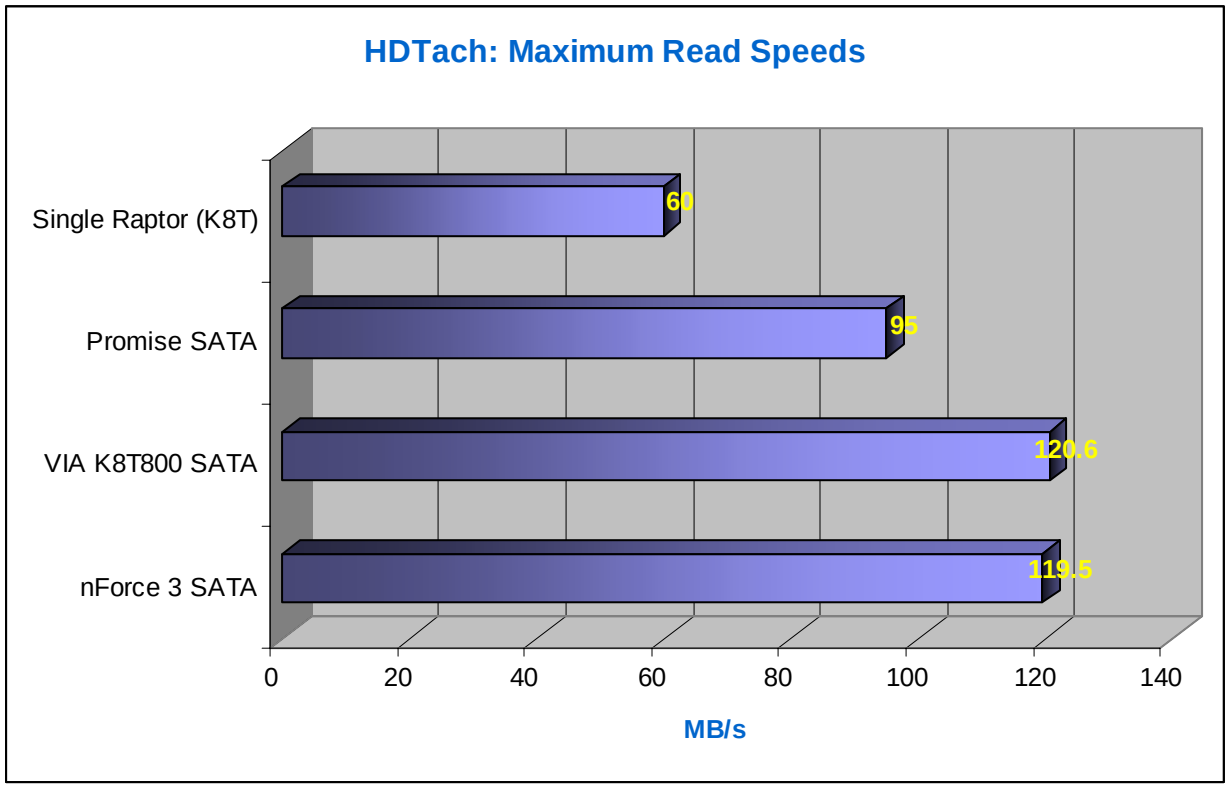
We noticed very similar performance for VIA's SATA RAID controller.

Let us now take a look at the Promise PDC 20378, both write and read speeds:

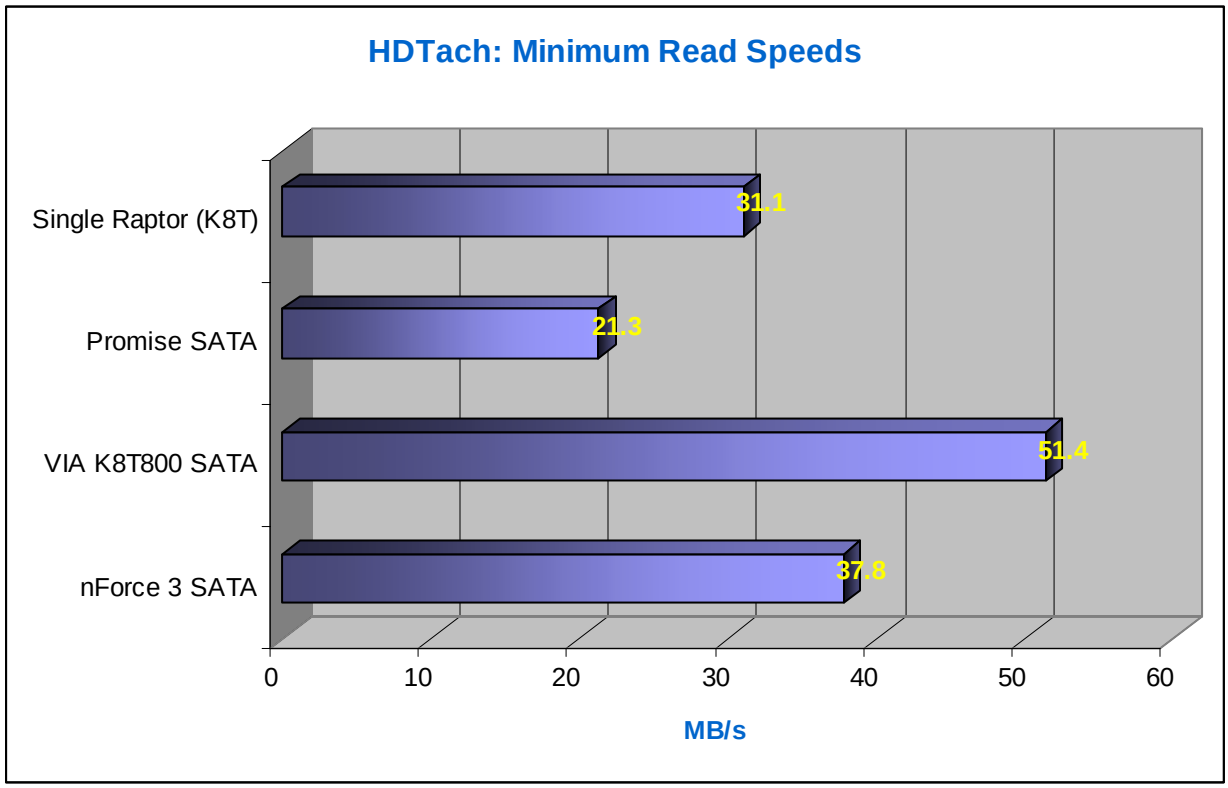


Special driver optimizations allowed the Promise RAID to achieve questionable 600 MB/s burst reads. In our opinion this is impossible as the two SATA channels are limited to 300 MB/s together. So the question: how does the driver trick HD Tach into recording such high speeds at the beginning of disc? It might be a clever but rather useless caching mechanism, because the actual transfer rates are very inconsistent and rather low at times. Writing speeds are weird too, jumping from 150 MB/s to 7 MB/s. Reminds me of AMD or CISCO stock charts...

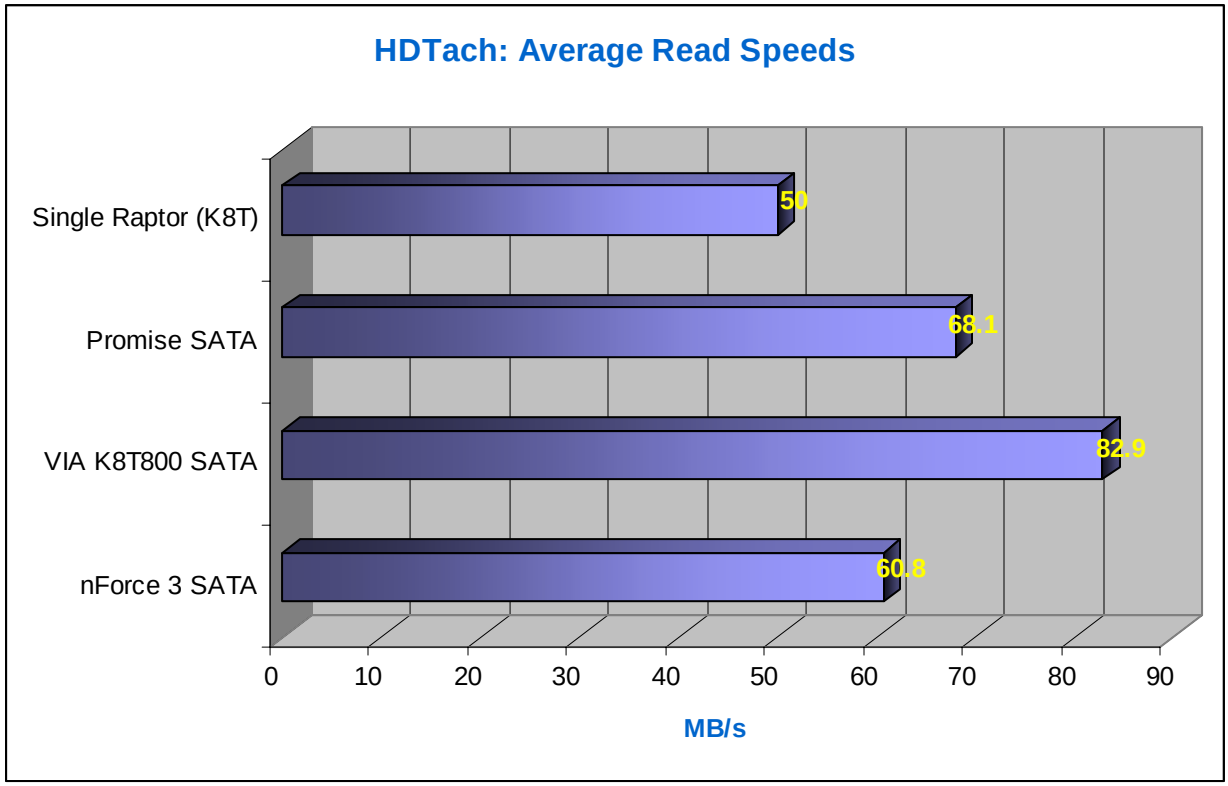
Although the HDTach graphs tell the whole story, they may make the comparison a bit harder. Let us take a look at the most important numbers.



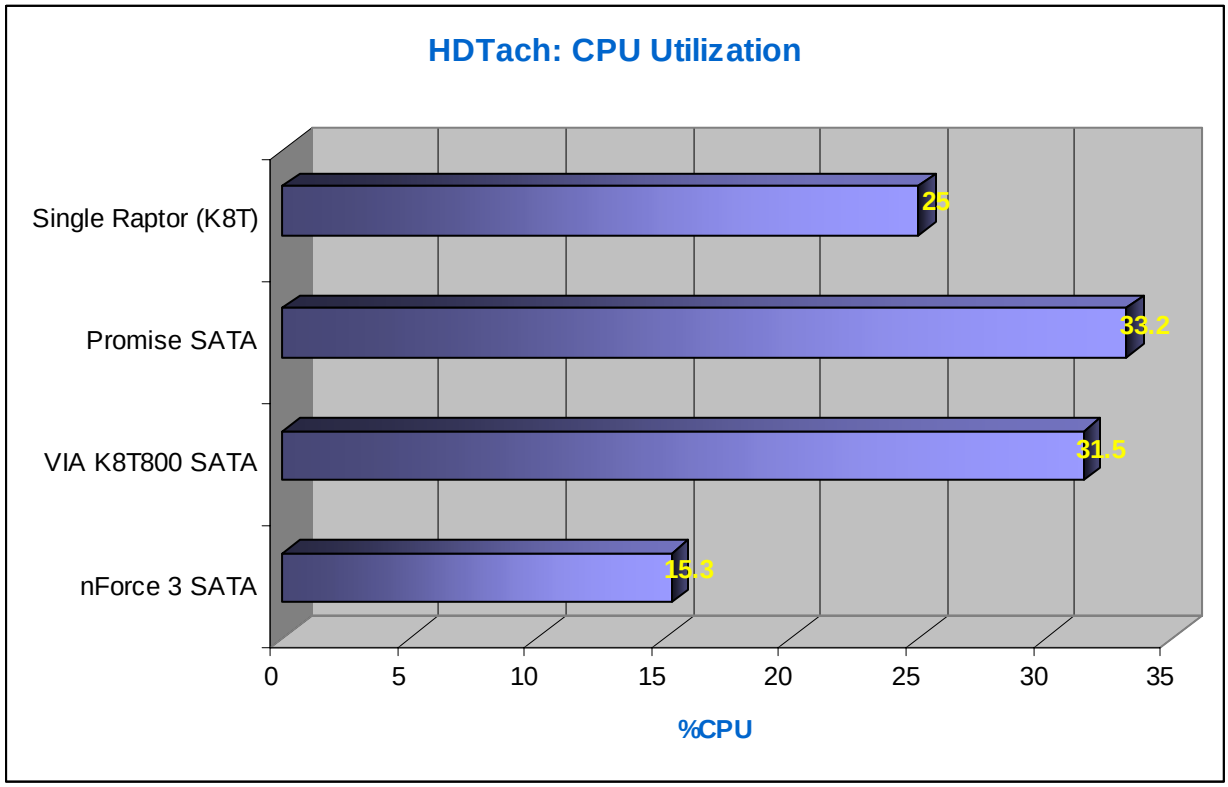
Both VIA and NVIDIA achieve up the maximum possible speed of RAID-0: twice the speed of a single drive.



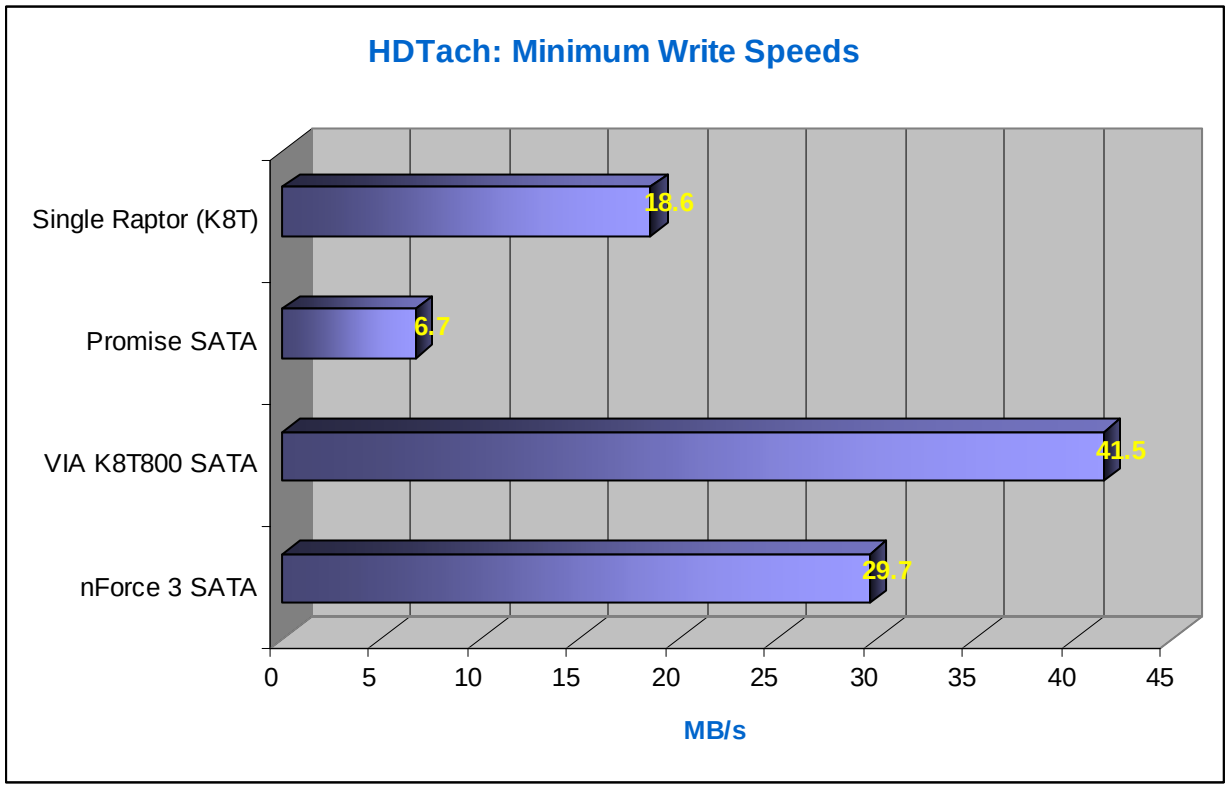
The Promise controller really disappoints with transfer rates that drop as low as 20 MB/s. Remember we are talking about two 10,000 RPM Raptors in RAID 0, even a single drive does 50% better. Why use RAID if a single drive is faster?



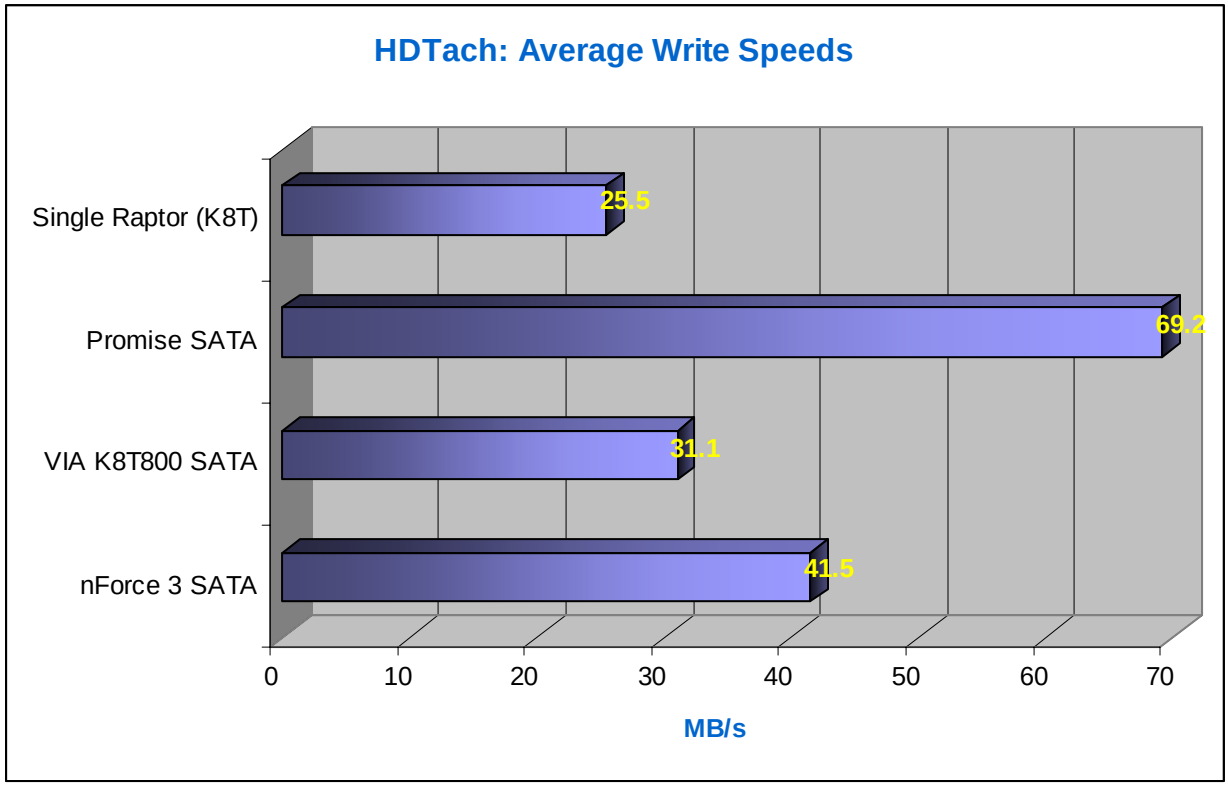
VIA's SATA controller is the only one that really profits from a RAID-0 configuration, with 60% higher average speeds. The only reason why the Promise RAID is able to achieve the 68 MB/s is the questionable 600 MB/s performance level recorded in the first 100 MB of the disks.



The nForce 3 might not be the best RAID controller for Socket 754, but at least it is very economical when it comes to offloading the CPU.



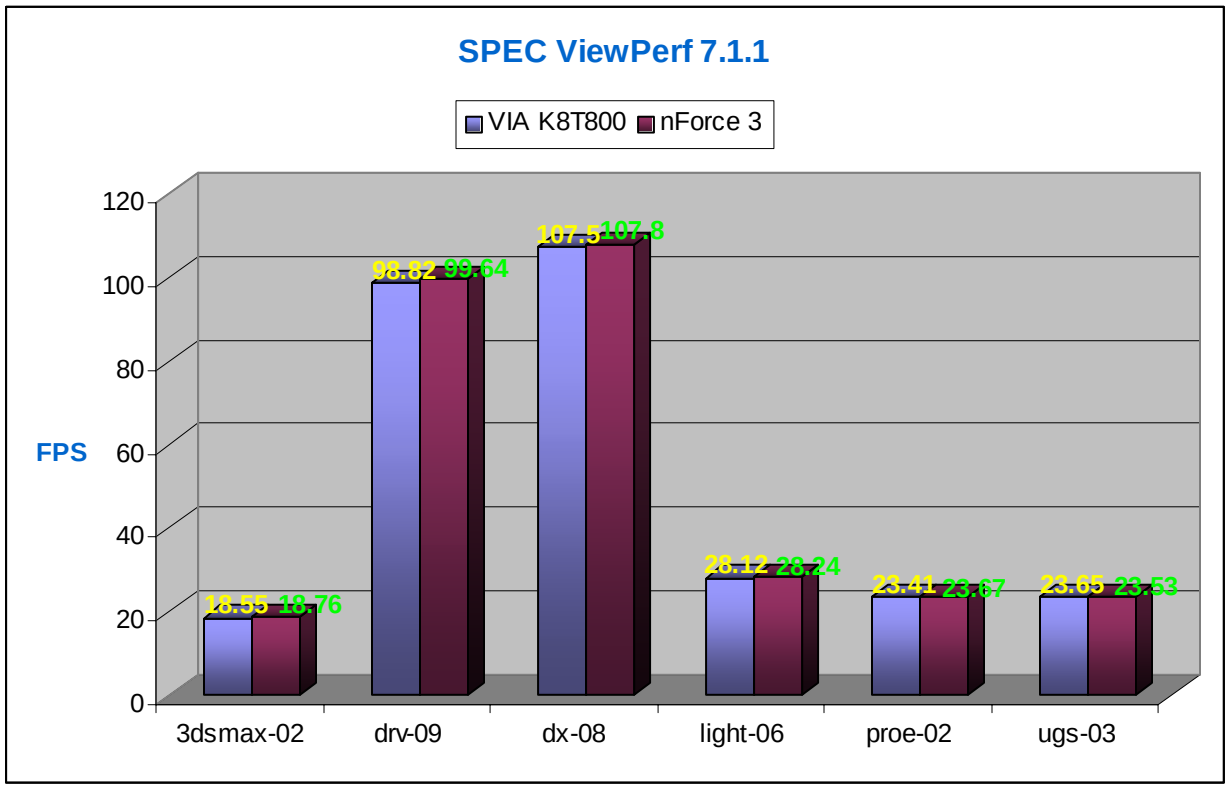
Again, the Promise controller falls flat on its face with minimum transfer rates, which are 3 times lower than a single disk. This makes RAID-0 with the Promise controller pointless.



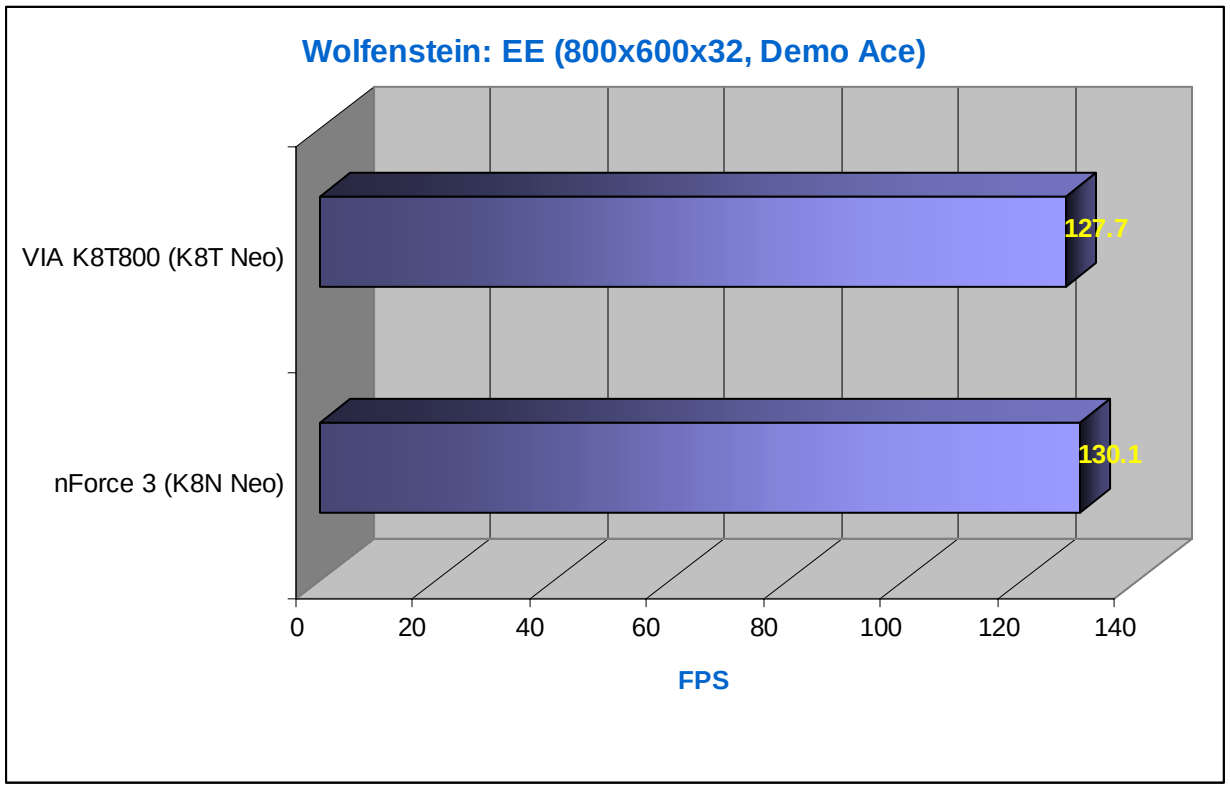
The extreme fluctuation of the Promise controller's performance makes the 69.2 MB/s number very questionable. The nForce and VIA SATA RAID controllers fluctuate between 30 and 50 MB/s, giving solid performance. NVIDIA wins this benchmark.

AGP & Games

The last component that we check is the quality of the AGP bridge. We used the AGP 8x Quadro 980 XGL, the OpenGL workstation card of the NVIDIA's Geforce 4 Ti4800. Thanks to optimized drivers this card is still able to beat the best gaming cards out there when it comes to polygon performance. This ensures that SpecViewperf 7.1.1 is able to stress the AGP bridge as the GPU is fast enough.



Both chipset perform similarly. NVIDIA's AGP disadvantage, as demonstrated by early nForce 3 150 versus K8T800 benchmarks, has disappeared completely. To conclude, a "classic" benchmark: Wolfenstein EE, the popular multiplayer online FPS, set in a fictional World War II universe. We used the "normal Ace demo," as it is less CPU intensive, but more dependent upon the memory and graphics subsystem.



Now we could bore you to death with tens of other benchmarks, but the fact remains, most of the classic benchmarks show no difference at all. Wolfenstein EE was the only exception where the difference was actually larger than the error margin of the benchmark. The nForce 3 is a tiny bit faster.

Conclusion

If there is one thing that I will remember from reviewing these two motherboards, it is the fact that cheap components can be a real waste of motherboard real estate and money. The Promise RAID controller and the Realtek 8110S-32 might make most motherboards look better when you do a typical features/price comparison, but in practice these components are useless when you need them, and add cost if you don't. Who needs a RAID-0 controller that is not even able to outperform a single drive all the time, uses more CPU power than a single drive and features snail write speeds from time to time? Who knows what to think of the Realtek Gigabit solutions that hog up to 80% of one the most powerful CPUs currently available?

Ultimately, both boards are excellent performers and the K8N Neo is an incredible overclocking tool. But frankly, MSI should offer two boards: one without these mediocre components for the people who do not need them and who should not pay for them, and one with slightly more expensive but much better RAID and Network chips.

The most disturbing fact is that many motherboards manufacturers - not only MSI - frequently used decent Broadcom/Intel chips in the past and are now more often selecting these sub-par Realtek chips. To be fair to MSI, they have recognized the fact that there are enthusiasts out there who are willing to pay a little more for much better components. For example, while many of the socket 478 boards feature the Realtek/Promise hardware, their newest "875P Neo-FISR" comes with an excellent Gigabit CSA Intel 82547EI chip.

So what about the nForce 3 250Gb? It is a very good chipset solution for Socket 754, but it is not blowing the competition away. Omitting Soundstorm was a bad decision from our point of view. VIA's RAID SATA chip is a better performer, NVIDIA still has some work there. At the same time, it must be said that the nForce 3 was always the best when it came to minimizing CPU load. The Gigabit Ethernet chip inside the nForce 3 250Gb performs rather well, but there is quite a bit of room for improvement when it comes to raw speed.