Professional Grade

OpenGL Accelerators Reviewed

By Johan De Gelas – December 2001

In the past, we've talked about workstations a great deal and there's no doubt about it: in our rendering, compiling and CAD benchmarks, the Dual Athlon MP 1800+ outclassed the competition. However, professional users of mechanical CAD (MCAD) and Digital Content Creation (DCC) applications spend a great deal of time manipulating wireframes and (Gouraud) shaded models and objects. Even if you simply want to rotate an object with a few 100,000 polygons, you will need all the power you can get, and general purpose CPUs alone will not cut it. That's why a dedicated OpenGL video card is an important part of any MCAD or DCC workstation and it's also why we've now decided to turn our attention towards professional OpenGL accelerators for this new entry in our workstation series.

Our previous article focused on the CPU power of the best workstations available, but this review will take a closer look at another equally important aspect of workstation performance, namely video accelerators. In this review, we'll show you how several different OpenGL video cards perform in 3D Studio Max 4, Maya 4, and many other high-end applications. We'll also examine MCAD performance with the Indy3D and SPEC ViewPerf benchmarks. The competitors in this review are as follows:

- 3DLabs Wildcat II 5110
- 3DLabs Wildcat II 5000
- ATi FireGL 2
- Elsa Gloria III (Nvidia Quadro II)
- GeForce 2 GTS
- GeForce 3

To make it even more interesting, we've also included the Gloria II (Nvidia Quadro). This way, you should be able to estimate how much performance an upgrade to a more traditional professional high-end 3D accelerator (i.e. Wildcat, Gloria III, or FireGL) will buy you.

Some might be surprised to see that we included commodity gaming cards like the GeForce 2 GTS. While such 3D accelerators are optimized for complex multi-texturing, they do come with rather powerful OpenGL T&L acceleration. The quality of the driver implementations may be of issue for these applications in some cases, but this is really only a concern for engineers using high-end CAD/CAM applications. When you consider that a typical GeForce 2-based video board can be purchased for $100 or less, the value of these options simply cannot be denied, especially in the face of the more traditional solutions that, in some cases, sell at 10 times the price.

Some analysts believe that the buyer of an OpenGL video card market does not care much about the price tag, but the reality is very different. Only a small part of the market - the high end CAD/CAM market - is willing to pay a huge premium for slightly better OpenGL performance and accuracy. A good testimony for this claim is the price erosion in the OpenGL market: a typical "low-end" OpenGL card like Elsa's Gloria III and 3DLabs' Wildcat II 5000 can now be bought for roughly $750, while it cost nearly $1000 just a few months ago. This price erosion started in 1999 with the inroads made by NVIDIA and Elsa with the Gloria II and III. Both products were aggressively priced, and the market took notice.

Elsa Gloria III

NVIDIA and Elsa have made significant strides with some amazing price/performance ratios, the likes of which have never been seen before in the professional OpenGL hardware market. From the data that we have assembled, we believe that Elsa has roughly about one third of the professional 3D OpenGL video card market. Notice that we speak of the "3D" market, so we exclude the Matrox cards (G400, G450, G550) that typically power 2D workstations. Now, Consider that Sun has about 25% of the 3D workstation market and that Sun ships all these workstations with either proprietary Sun accelerators or those based on the Wildcat chipset. So it is an understatement to say that Elsa has a firm grip on the x86 Workstation market, as Elsa's marketshare is probably close to 50%. Elsa has totally conquered the "low-end" of this market.

The Elsa Gloria III is powered by NVIDIA's Quadro II. The Quadro II is a slightly modified, highly clocked GeForce 2 with special OpenGL drivers. Elsa has already launched the Elsa Gloria DCC, which is powered by a "workstation version" of the GeForce 3. This card is specially aimed at the users of 3DSMax. We hope to update this article with some benchmarks of this card in the future.

An important advantage of the Gloria III is the fact that Elsa's graphical workhorse can offer the highest resolutions at the highest refresh rates. ISV certification information can be found at the following URL:

http://www.elsa.com/elsa_partner/isv_cert.htm

ATi FireGL-2

The ATI FireGL-2, based on geometry and raster engines from IBM, was first brought to the market by SonicBlue. On April 3, 2001, ATi officially acquired FireGL Graphics from Sonic Blue. The FireGL-2 has two more expensive brothers, the FireGL-3 and FireGL-4. The FireGL-3 is almost identical to the FireGL-2, apart from the fact that it has dual display capabilities and more memory (128 MB instead of 64 MB). The FireGL-4 can be described as a higher clocked FireGL-3. Nevertheless, the FireGL-2 is the most interesting of three: it does not require an AGP Pro slot (FireGL-3 and 4 do), and comes with an attractive price tag.

The FireGL video cards are the underdogs of this test: according to our industry reports they have only 5-7% of the market. ATi launched the FireGL 8800 a few weeks ago, so it will be interesting to see how well this new entry is received in the market.

Interestingly, the FireGL-2 ships with some comparatively huge heatsinks, but no fan. The cooling is more than sufficient, however, and thanks to the fan-free design, it's very reliable as well. Another advantage of the FireGL-2 is the hardware support for 16 lights, twice as many as its most important competitor the Elsa Gloria III. ISV certification information can be found at this location:

http://www.ati.com/na/pages/onboard/isv_partners.html

3DLabs Wildcat II 5110/5000

The 3DLabs Wildcat II 5110 is an extremely powerful feline! A highly optimized dual OpenGL pipeline (two independent geometry and two independent rasterizer CPUs) makes the 3DLabs 5110 the most powerful OpenGL card in existence. The ponderous card occupies the entire length of the ATX form factor and gobbles up 50 Watts of power. You cannot power this beast without an AGP Pro slot and a strong power supply. The Wildcat 5110 is out of reach of the 3D artist or Engineering student who wants to build his or her own affordable workstation. Not only does this card cost almost $2000, it is available strictly through workstation OEMs like Dell and Compaq.

The brute power has made 3DLabs' Wildcat boards very popular, and according to our latest data, 3DLabs has about 15-20% of the 3D OpenGL video card market. It is clear, however, that 3DLabs has to do something to combat the low-cost, high-performance Elsa products.

3DLabs answer to the exceptionally popular Gloria was the Wildcat II 5000, sort of a Wildcat II 5110 cut in half. The most prominent advantage of the single-pipelined Wildcat II 5000 is the fact that it still can handle 24 hardware-supported light sources. The Wildcat II 5000 is much more interesting than the Wildcat 5110 for the DIY workstation user as this cat is available in the retail market and is priced very aggressively at about $750.

The biggest concern is the texture fillrate, which should be around 166 MTexel/s compared to 2000 MTexel/s for the Quadro III. While texture fillrate is not really the first priority in the typical markets for OpenGL cards, it might become a bottleneck in animation previews where some texturing and shading is applied. The Wildcat II 5000 is also as large as the 5110, and demands an AGP Pro slot just like its big brother. We noticed that the Wildcat II 5000 was running in AGP 2x mode, which might slow the card down a bit when processing huge amounts of polygons. ISV certification information can be found at this URL:

http://www.3dlabs.com/product/card/wildcat_II_5110/wildcat_II_5110_certs.htm

The Competitors

Manufacturer	Elsa	Nvidia	Nvidia	Elsa	ATI	ATI	3Dlabs	3Dlabs
Product	**Gloria II**	**GeForce 2 GTS**	**GeForce 3**	**Gloria III**	**Fire GL2**	**Fire GL4**	**Wildcat II 5000**	**Wildcat II 5110**
Price	n/a	$100	$300	$720	$850	$1500-1700	$760	$1900-2000
AGP Interface	AGP 4X	AGP 4X	AGP 4X	AGP 4X	AGP 4X	AGP 4X (Pro 50)	AGP 4X (Pro 50)*	AGP 4X (Pro 50)*
Dual Display	No	No	No	No	No	Yes	No	Yes
1st Display Out	VGA	VGA	VGA	VGA	VGA	DVI-I (analog & digital)	VGA	VGA
2nd Display Out	n/a	n/a	n/a	DVI-I (analog & digital)	DVI-D (digital)	DVI-I (analog & digital)	DVI-I (analog & digital)	DVI-I (analog & digital)
RAMDAC	350 MHz	350 MHz	350 MHz	350 MHz	300 MHz	300 MHz	300 MHz	300 MHz
Max Refresh Rate @ 1600x1200	120 Hz	120 Hz	120 Hz	120 Hz	85 Hz	85 Hz	90 Hz	90 Hz
Max Refresh Rate at 1920x1200	100 Hz	100 Hz	100 Hz	100 Hz	75 Hz	75 Hz	75 Hz	75 Hz
Geometry & Rasterizer	Quadro @ 135 MHz	GeForce 3 (200 Mhz)	GeForce 2 (200 MHz)	Quadro2 Pro (250MHz)	IBM GT1000 (190MHz), IBM RC1000 (120 MHz)	IBM GT1000 (205MHz), IBM RC1000 (150 MHz)	1 x Wildcat II Chipset	2 x Wildcat II Chipset
Memory Type	166 MHz SDR	166 MHz DDR	250 MHz DDR	200 MHz DDR	120 MHz DDR	150 MHz DDR	n/a	n/a
Memory Size	64 MB	64 MB	64 MB	64 MB	64 MB	128 MB	64 MB	128 MB
Memory Bus	128 bit	128 bit	128 bit	128 bit	256 bit	256 bit	128 bit	128 bit
Texture Fillrate (Trilinear, MTexel/s)	540	1600	1600	2000	200	250	166	332
Polygon Rate (MPoly/s)	15	25	n/a	31	27	29	15	15
No. of Hardware Lights	8	8	8	8	16	16	24	24

* Reported to be AGP 2x by Powerstrip.

Visual Inspection

Below you'll find a picture of the three OpenGL powerhouses that we reviewed. From top to bottom: the Elsa Gloria III, ATi FireGL-2, and 3DLabs Wildcat II 5000.

The Wildcat II 5000 shares the same board as the Wildcat II 5110, in fact, as you can clearly see the pads where the second geometry and rasterizer units belong.

Benchmark Configuration

Almost all tests were performed on the following machine, except where noted otherwise.

- Dual 1.2 GHz Athlon MP (dual 1800+ where indicated)
- Tyan Tiger MP - Tyan Thunder K7 (for Wildcat II 5000/5110)
- 512 MB (PC2100, 266 MHz) Samsung ECC DDR SDRAM CAS2
- AMI MegaRAID express 500 Ultra160 controller, 32 MB SDRAM cache
- Seagate Cheetah 18 GB Ultra160 ST318451LW (15,000 RPM)
- Mitsumi 48xFX4830T IDE-CDROM
- Allied Telesync 2700-TX NIC
- Creative Labs Soundblaster Live!
- Windows 2000 Service Pack 1

All tests were performed under Windows 2000, as we believe that most companies and professionals are still running Windows 2000.

Drivers

- All Elsa boards used the official 21.81 drivers from NVIDIA
- All Wildcat boards used the 05.03.00.15 driver
- The FireGL-2 used the 5.12.2195.2070 driver

For the Maya benchmark, we also included for reference the Dell Precision 530, equipped with two 1.7 GHz Intel Pentium 4 Xeon processors. The system was configured with exactly the same video card and disk subsystem and featured 512 MB of PC800 ECC RDRAM.

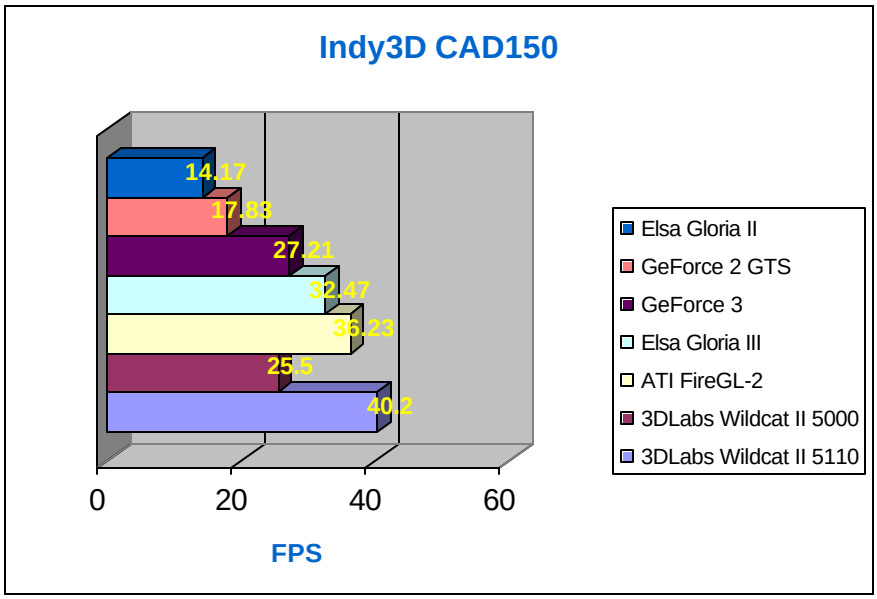
We would like to thank the following helpful people for their support and contributions to this review:

- Bernie Pruissen (Dell) made sure we could test the Precision 530 and the Wildcat 5110.
- A big thanks to Damon Muzny (AMD) for sending us the AMD Athlon MP 1800+.
- Our thanks also goes to Kim Stowe (3DLabs), who sent us the 3DLabs Wildcat II 5000.
- Renate Helewaut (ELSA) was so kind to provide our lab with the Elsa Gloria III.

All tests were carried out at 1024x768x32bpp at 85 Hz.

CAD Benchmarks

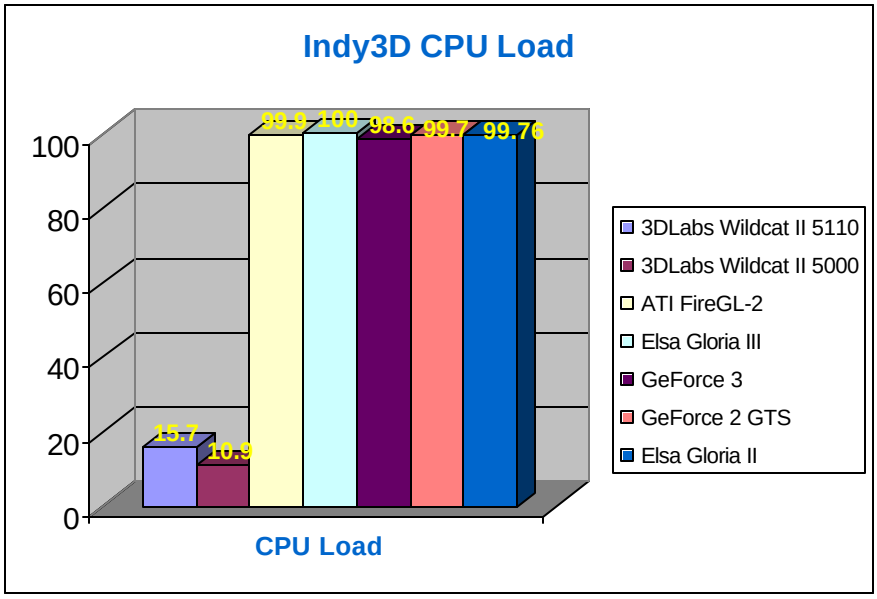
We start with some CAD benchmarks. After all, CAD applications used to be the primary market for these cards. The first benchmark is Indy3D, a cross-platform industry standard benchmark for OpenGL and CAD. The CAD150 subtest rotates an engine with 150,000 polygons and applies smooth shading to the model at the end of the test.



The cards of 2000, like the Intense3D Wildcat 4110 or 3DLabs Oxygen GVX210 are barely able to push the frame counter beyond 6 to 8 frames per second even with today's fastest CPUs. Now, the Wildcat II 5110 is rotating a model with 150,000 polygons like it is playing some first person shooter. Impressive! While 3DLabs' dual-headed monster is the clear winner of this test, the Wildcat II 5000 holds its own quite well.

CPU Utilization

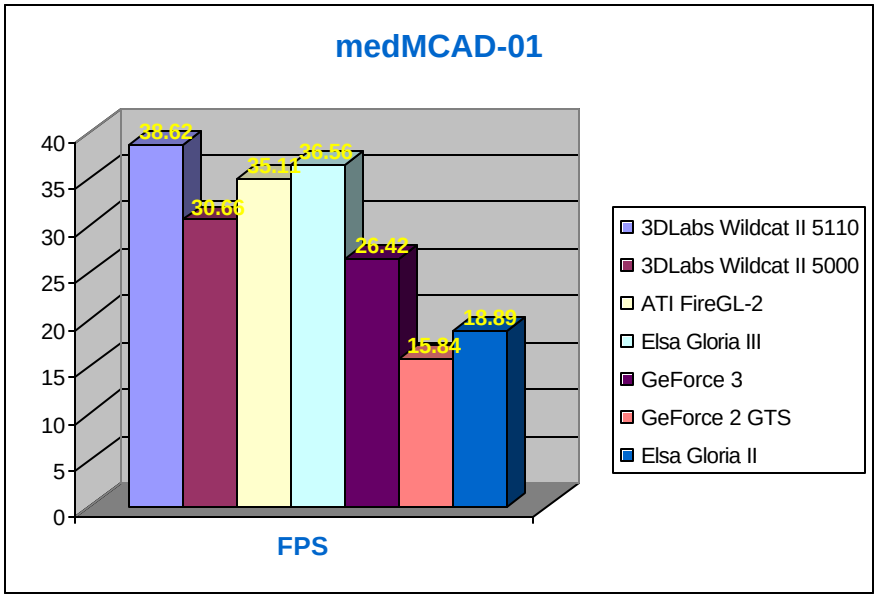
Pure frame rate is not the only factor under consideration, however. If a certain action requires tens of seconds, you expect the CAD software to remain responsive. For example, if you start a rotation in one viewport, you want to be able to switch to another viewport to watch it from another angle. The Indy3D suite also notes the CPU utilization when running the CAD150 benchmark and helps us to understand how CPU hungry a video card is.



With the exception of the Wildcats, all video cards gobble up the available CPU power. This makes a CAD application (the menus, for example) less responsive when you are busy manipulating complex models.

Mechanical CAD

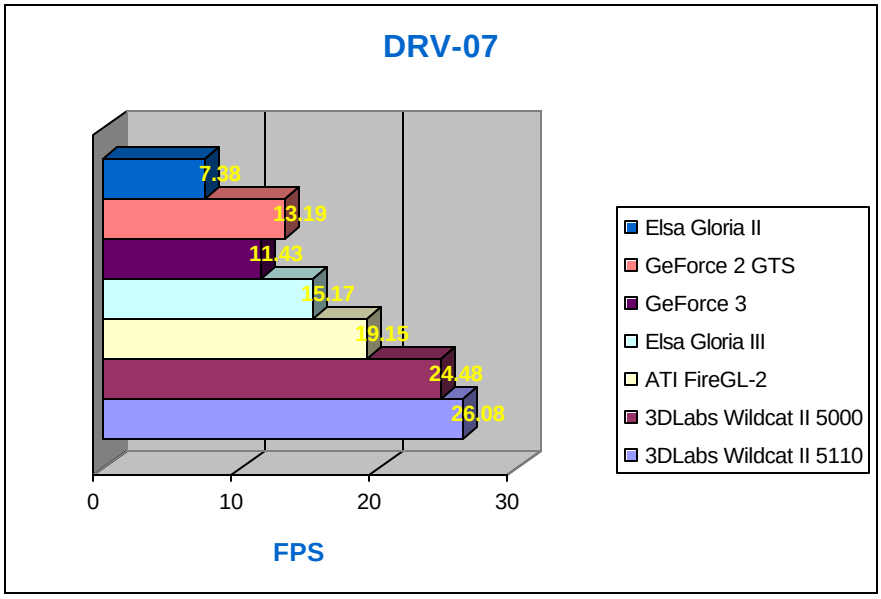
We didn't have Solidworks or Pro/Engineer in the labs, but the medMCAD-01 viewset from SPEC ViewPerf is intended to model the graphics performance of these Mechanical CAD applications closely. This benchmark consists mostly of wireframe (40%) and shading (60%) tests, so it should be a home run for the typical OpenGL cards. The latter are optimized for shading so they should make a clean sweep of the gaming cards, which are optimized for texture intensive applications.



The Wildcat II 5110 takes the crown once again, but is becoming clear that its little brother lacks some polygon power to beat the rest of the pack. This test makes a clear distinction between a gaming card and a OpenGL card. The Quadro and the GeForce 2 GTS are both based on the same chip, but the Quadro is more than twice as fast. The answer for this huge gap lies of course in the Quadro's drivers, which are optimized for shading and wireframe modes. In fact, the Gloria III delivers a very impressive performance in this benchmark, as it manages to pull slightly ahead of the FireGL-2 and almost catches up to the Wildcat II 5110.

SPEC ViewPerf: DRV-07

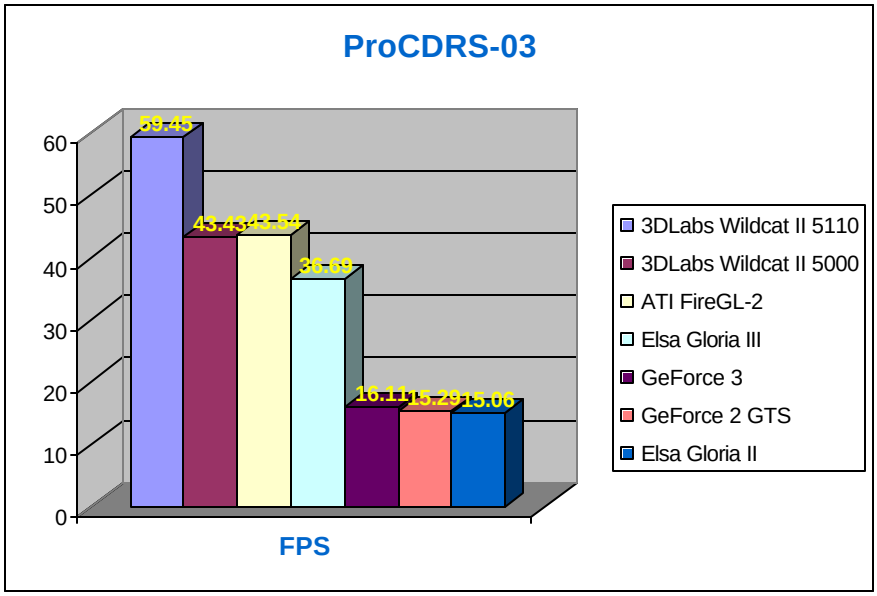
The SPEC ViewPerf DRV-07 test uses DesignReview, a 3D computer modeling package often used for designing plant models consisting of structural elements like electrical raceways and piping. Views are rendered by transforming high-order objects like pipes and valves into triangles or line strips. This test also includes texturing models with linear blending and transparency. The updated DRV-07 shaded model contains 367,178 vertices and 42,821 primitives.



The Wildcats take a clear lead, with the FireGL-2 in a strong third place and the NVIDIA accelerators taking up the rear. We will investigate this in more detail in just a moment.

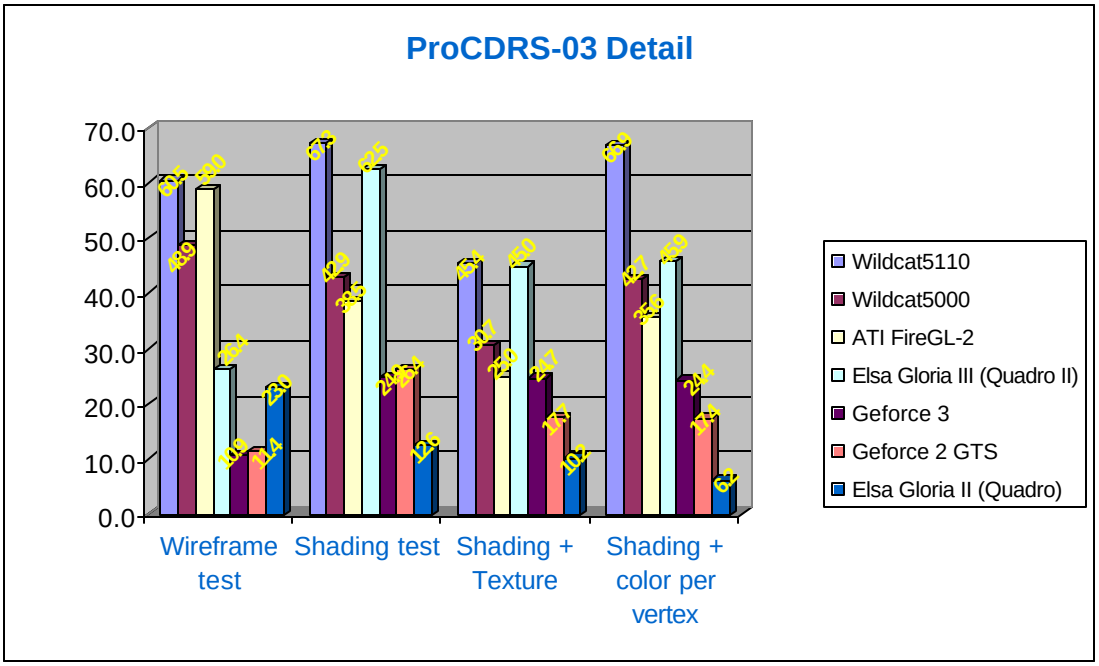
SPEC ViewPerf: ProCDRS-03

The SPEC ProCDRS-03 benchmark models the graphics performance of Parametric Corp.'s industrial design software, CDRS. The test consists of ten viewsets, two using a wireframe model and eight using a shaded model. The wireframe model consists 404,000 vertices in 37,000 strips, for a total of 388,000 anti-aliased lines. The shaded model consist of no less than of 262,000 triangles. On the shaded model, a 512x512x24bpp texture is applied in a few tests.



Once again, the Wildcat II boards take the lead, with the 5110 in the top slot and the 5000 in third, ever so slightly behind the FireGL-2. But why? I decided to average the wireframe, shading, texture + shading, and shading + vertex coloring results separately. This way we can get some insight in the strengths and weaknesses of each card.

ProCDRS-03 Benchmark Detail

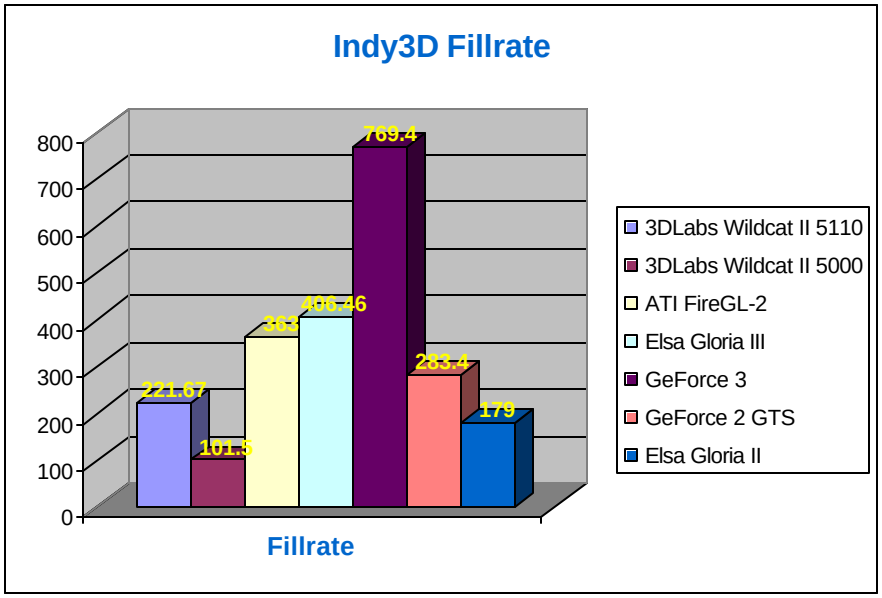


This graph explains it all. The raw (anti-aliased) polygon power of the Wildcat II and the FireGL-2 accelerators is superior to that of the GeForce-based boards. Shading and texturing is the playground of the Elsa Gloria III, on the other hand, and only the mighty Wildcat II 5110 can maintain even a small lead. In vertex coloring, the Wildcat again holds the lead. Now we can understand why Elsa's card can beat the Wildcat II 5000 in some tests. The MedMCAD test consists of 60% shading results, which lowers the impact of the slower wireframe speed of the Quadro chip. The Indy3D test reaches very high frame rates in the shaded test, and those frame rates influence the average result very much.

The test that contributes 75% of the total DRV-07 score consists of a smooth-shaded, vertex colored object. The DRV-07 confirms what we have found out in the CDRS test: the Wildcats excel in vertex coloring.

Pixel Fillrate

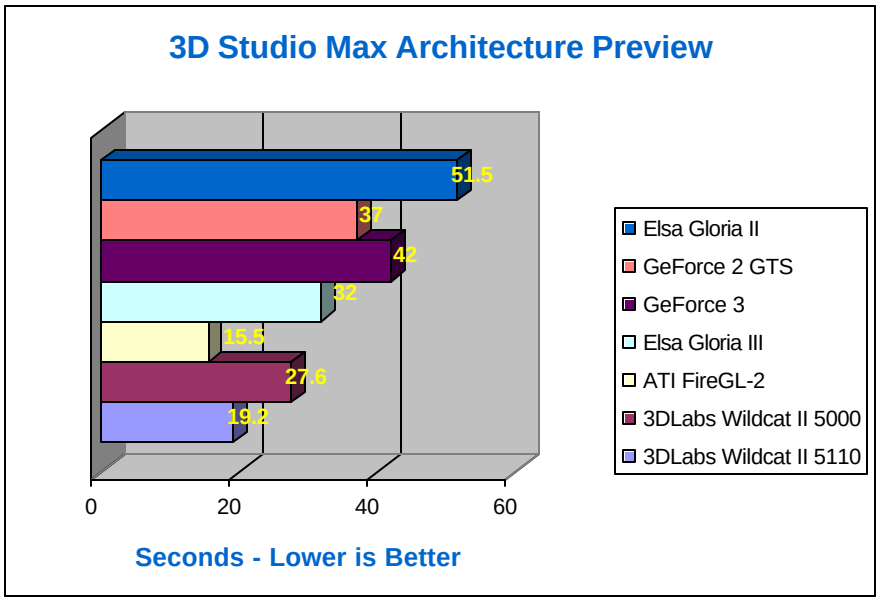
Another interesting test is the Indy3D fillrate benchmark: a benchmark to determine raw texturing fillrate.



NVIDIA's Quadro II (Elsa Gloria III) cannot deny its gaming roots: it is the fastest OpenGL video card in this fillrate test. The GeForce 3 shines thanks to its bandwidth saving features. The architectural differences between pure professional OpenGL solutions like the Wildcat II and the gaming bred GeForce 3 is like night and day. Both have very different focuses, and here the strength of the GeForce shines through.

3D Animation

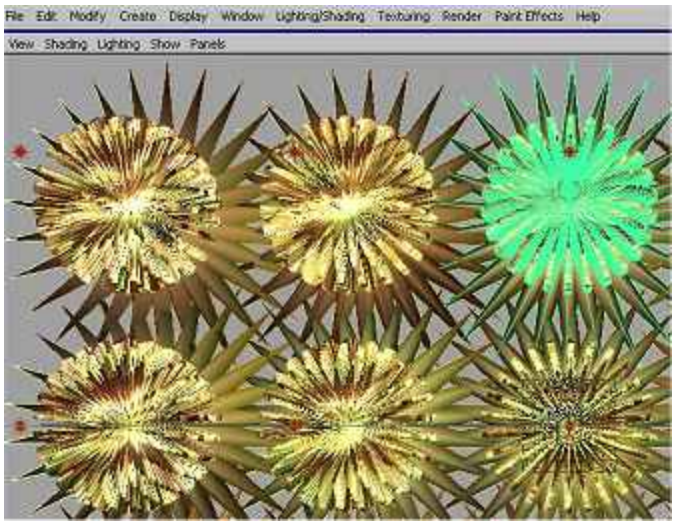
3D animation is the second reason why people buy professional OpenGL video accelerators. Our first test is the architecture scene for 3D Studio Max 4.26. This time we do not render it, but we preview the animation and measure the time it takes to view 100 frames. The fly-through is smooth shaded (gouraud shading, no textures).



Most cards ship with specially optimized drivers for certain applications. The FireGL-2 came with the most optimized 3DSMax drivers, enabling special settings for 3DSMax lowered the preview time from 20 seconds to 15.5 seconds. Else's optimized settings for 3DSMax, on the other hand, resulted in only a 5% speedup on the Gloria III. As a result, the FireGL-2 is the clear winner of our 3DSMax preview benchmark.

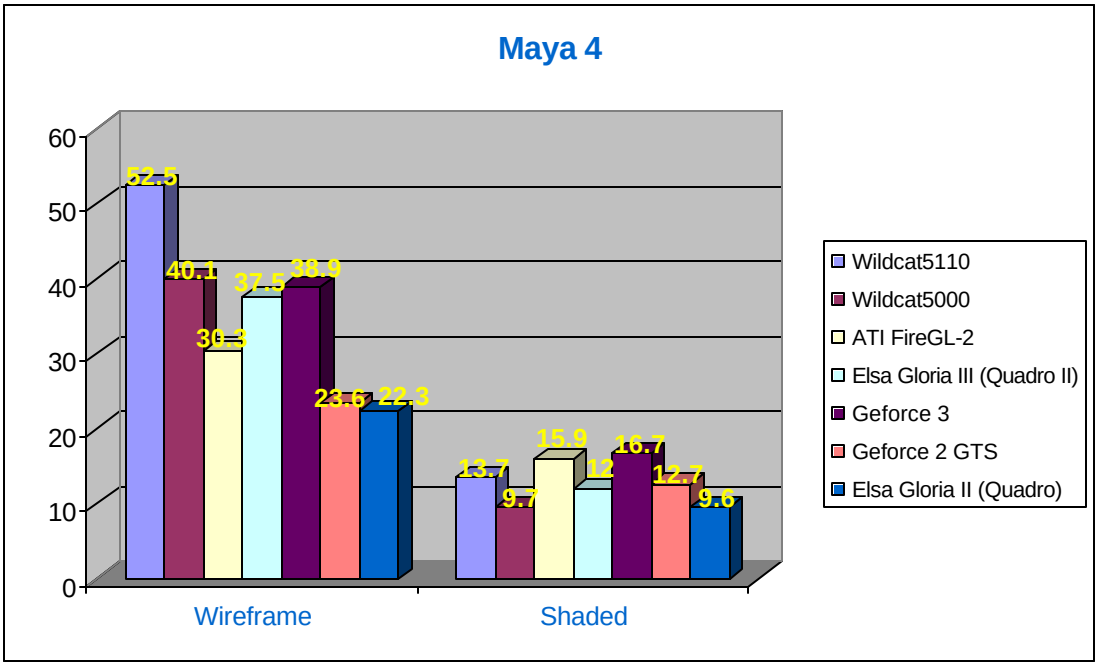
Maya 4

While SPEC ViewPerf and other CAD tests typically use flat or Gouraud shading, the following Maya 4 tests use a much more complex form of shading. In our test setup, smooth Blinn shading was used. This form of shading is excellent for representing metallic surfaces that typically have soft specular highlights. Our test was based on the 3D test from the Maya Test Center (http://www.maya-testcenter.de/).



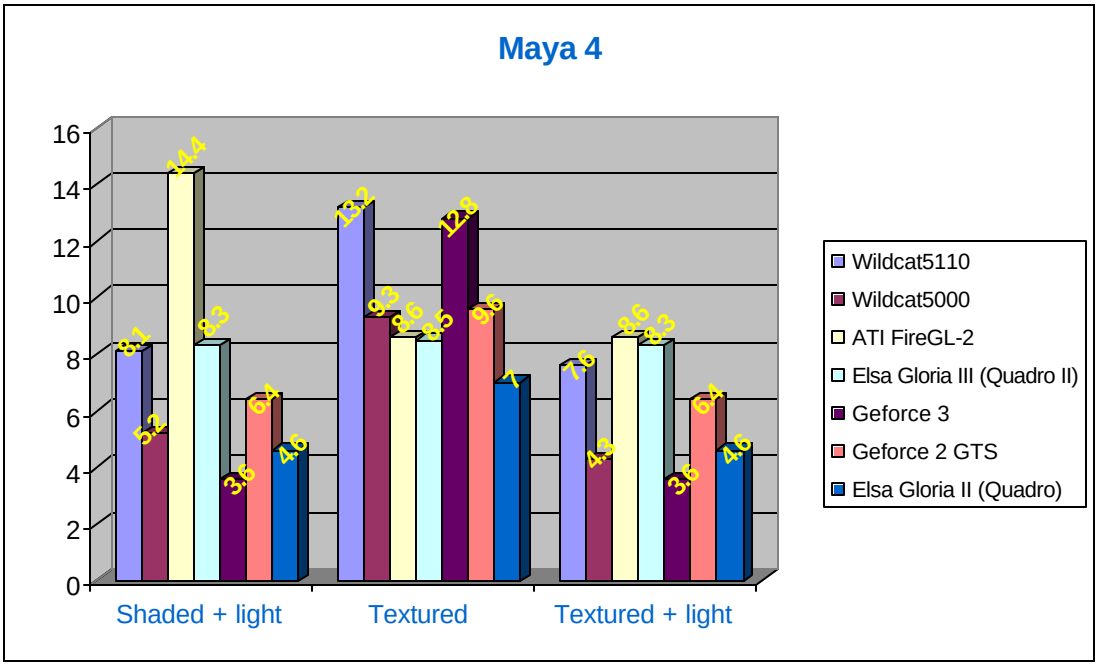
A real production environment with lots of polygons, extrudes, split faces, construction history, instances, 15 lights, textures and so on...

The results are very interesting. First we test in the wireframe and shading modes.



The Wildcat II accelerators are masters in the wireframe mode, but the shaded mode is owned by...the GeForce 3! Looks like the GeForce 3's vertex shader has done some real magic. The Gloria DCC, based on the GeForce 3 and with optimized drivers for typical 3D animation software, should be able to sweep the competition away. We can't wait to test that one...

Nevertheless, the results are pretty surprising, as we have seen so far that the Wildcat II boards are by far the fastest in shading. But the shading types used in CAD (Gouraud, flat) are much simpler than the ones used in 3D animation (phong, blinn, etc.). It is clear that the Wildcat architecture and driver is more suited for CAD than 3D animation, especially if we look at the textured and lighting tests.

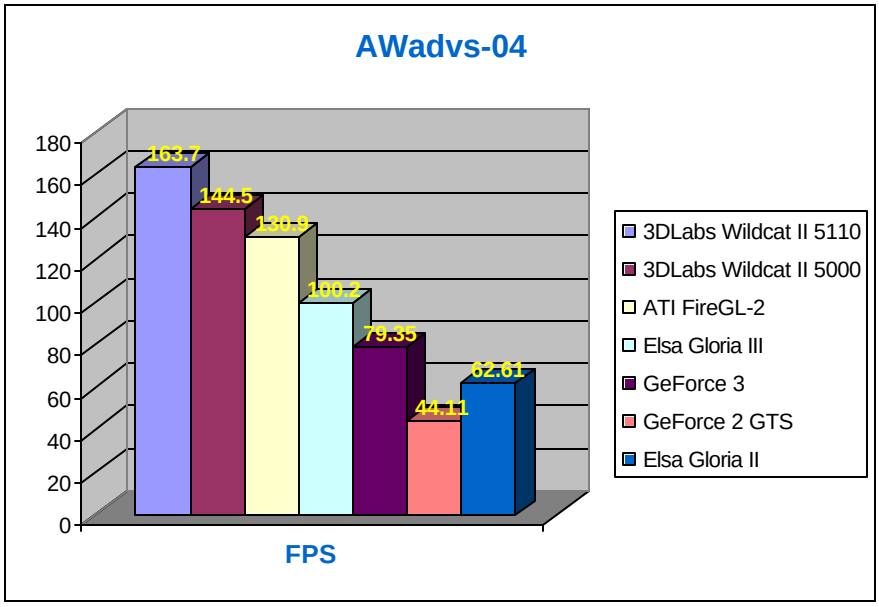


These three tests tell us a lot about the strengths and weaknesses of the each of the competitors. The GeForce 3 is the card to get if you work with huge textures and want those textures to be displayed when you are manipulating objects. It is interesting, however, that the flexible GeForce 3 engine handles complex lighting worse than the GeForce 2 card here.

The tests that use light make the FireGL-2 shine. Our Maya test uses 15 lights, 7 more than the NVIDIA family can accelerate in hardware. The Wildcats can accelerate up to 24 lights, but they are not optimized for the complex shading methods. The FireGL-2 lacks fillrate, but handles complex shading very well, and is wizard at calculating lighting. The result is that the FireGL blows the competition away in the shading + lighting test, but has to share the performance crown with the Gloria III.

SPEC ViewPerf: AWadvs-04

The SPEC AWadvs-04 test runs Advanced Visualizer, from Alias/Wavefront, which is an integrated workstation-based 3D modeling and animation program. Some of the more heavily weighted subtests include material shading and wireframe rendering of polygonal animation models with perspective and orthogonal projections. SPEC Awadvs-04 showed huge performance differences between the top-performing Wildcat II and the rest of the pack.



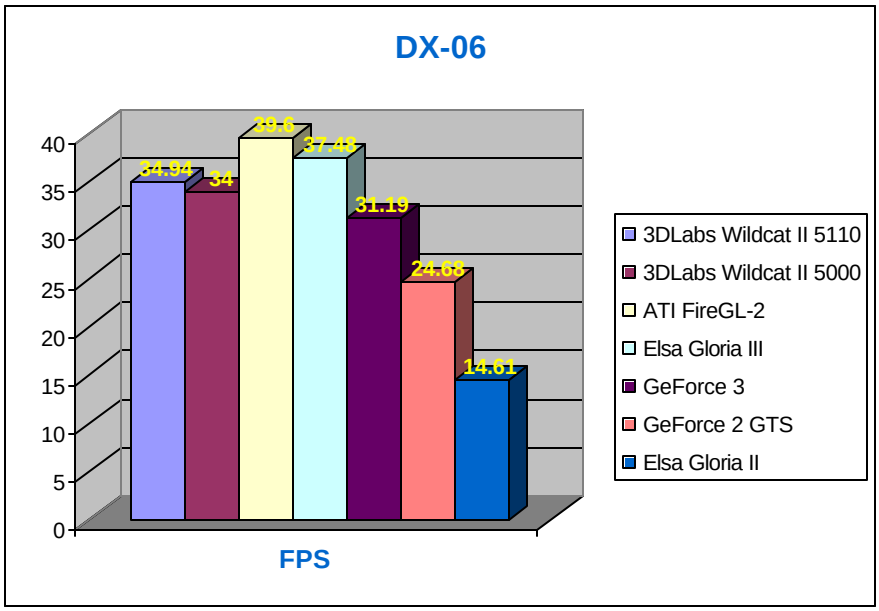
In this test, the both of the Wildcat II boards clearly prevail. At first sight, this is surprising after the Maya tests. Both animation programs are designed by the same company, use OpenGL, and are somewhat related. So, why have the tables turned? A more detailed view on this test will give us the answers.

AWadvs-04	Wireframe	Flat Shading	Smooth Shading	Material Shading
3DLabs Wildcat II 5110	127	126	265	123
3DLabs Wildcat II 5000	123	123	216	122
ATi FireGL-2	122	130	123	116
Elsa Gloria III	92.8	92.8	123	92.3
GeForce 3	86.8	86.8	61.4	86.1
GeForce 2 GTS	23.6	30	18.8	54.5
Elsa Gloria II	55	56	90.2	54.5

The Wildcat II family clearly excels in smooth gouraud shading, and this incredibly high score pushes the average score of the Wildcats far above the competition.

Scientific Visualization

The SPEC DX-06 test uses IBM Visualization Data Explorer (DX), a scientific data visualization and analysis program. The subtests simulate a set of particle traces flowing through a vector flow field, and the object represented contains about 3,000 triangle meshes with approximately 100 vertices each. All tests use Z-buffering with one light source and a specific color per vertex.



I included this test for the few readers that might be active in the field, but I have to admit that I have little experience with this kind of application. In any event, the FireGL-2 takes the lead, followed by the Gloria III and the two Wildcat accelerators. You will notice that there is not a substantial difference in performance between the Wildcat II 5000 and the dual-pipeline 5110.

CPU Performance

Now that CPU power is so affordable, would it make sense to buy some extra CPU power to compensate for an older or slower OpenGL video card? We decided to test this theory with the Maya 4 by using the impressive power of a Dual Athlon MP 1800+.

Maya 4 Wireframe	Dual Athlon MP 1200	Dual Athlon MP 1800+	Difference
3DLabs Wildcat II 5110	52.5	55.7	**6%**
3DLabs Wildcat II 5000	40.1	42.1	**5%**
ATi FireGL-2	30.3	42	**38%**
Elsa Gloria III	37.5	41.7	11%
GeForce 3	38.9	38.9	0%
GeForce 2 GTS	23.6	30	27%
GeForce MX400	17.3	20.2	17%

A dual Athlon MP 1800+ cannot turn a GeForce MX400 in to a fast OpenGL card. But there are some interesting things to note here. The FireGL-2 is clearly not a card to use with a wimpy CPU. The FireGL card turns every bit of CPU power into better performance. It falls far behind the Wildcat II 5000 when fed by a 1200 MHz Athlon, but it performs equally when it can work with a 1533 MHz Athlon.

The Wildcat boards do not benefit from more CPU power, but that is no surprise as they take a lot of load away from the CPU, as you will remember from our earlier test. The shading test confirms our wireframe findings.

Maya 4 Shading	Dual Athlon MP 1200	Dual Athlon MP 1800+	Difference
3DLabs Wildcat II 5110	13.7	14.2	**4%**
3DLabs Wildcat II 5000	9.7	10.1	**4%**
ATi FireGL-2	15.9	20.5	29%
Elsa Gloria III	12	15.8	32%
GeForce 3	16.7	20	19%
GeForce 2 GTS	12.7	16.7	27%

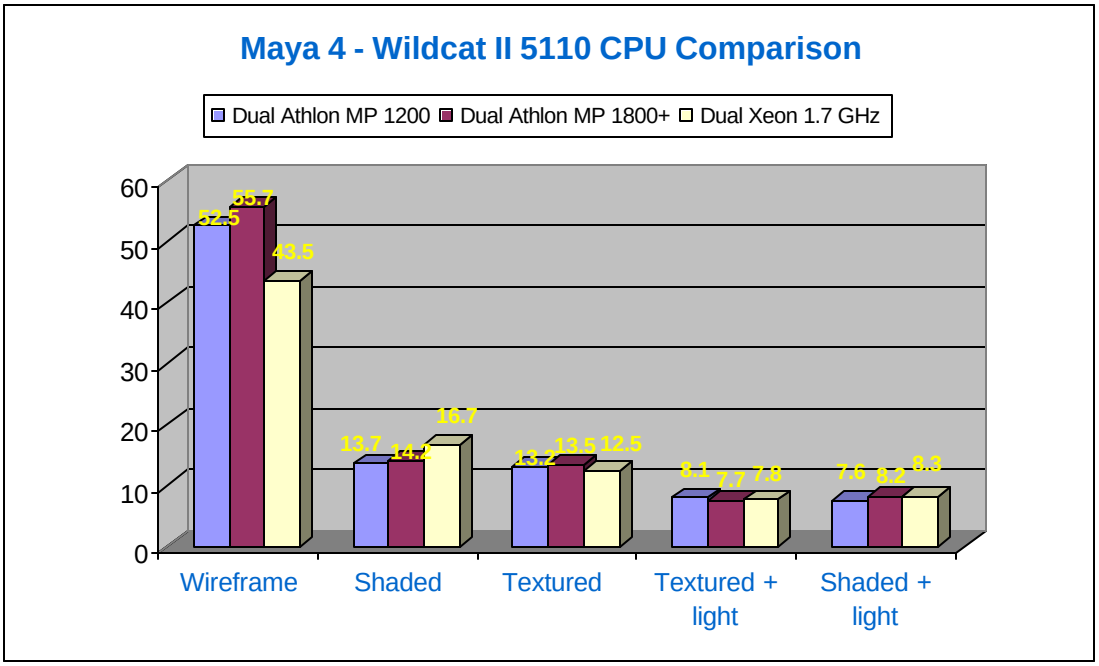
The texture and light tests did not show any improvement as the video card only limits them. So far we have always been testing on dual CPU machines, but does the second CPU help when it comes to manipulating wireframes?

Maya 4 Wireframe	Single Athlon MP 1800+	Dual Athlon MP 1800+	Difference
3DLabs Wildcat II 5110	53	55.7	5%
3DLabs Wildcat II 5000	40.2	42.1	5%
ATi FireGL-2	43.1	42	**-3%**
Elsa Gloria III (Quadro II)	41	41.7	2%

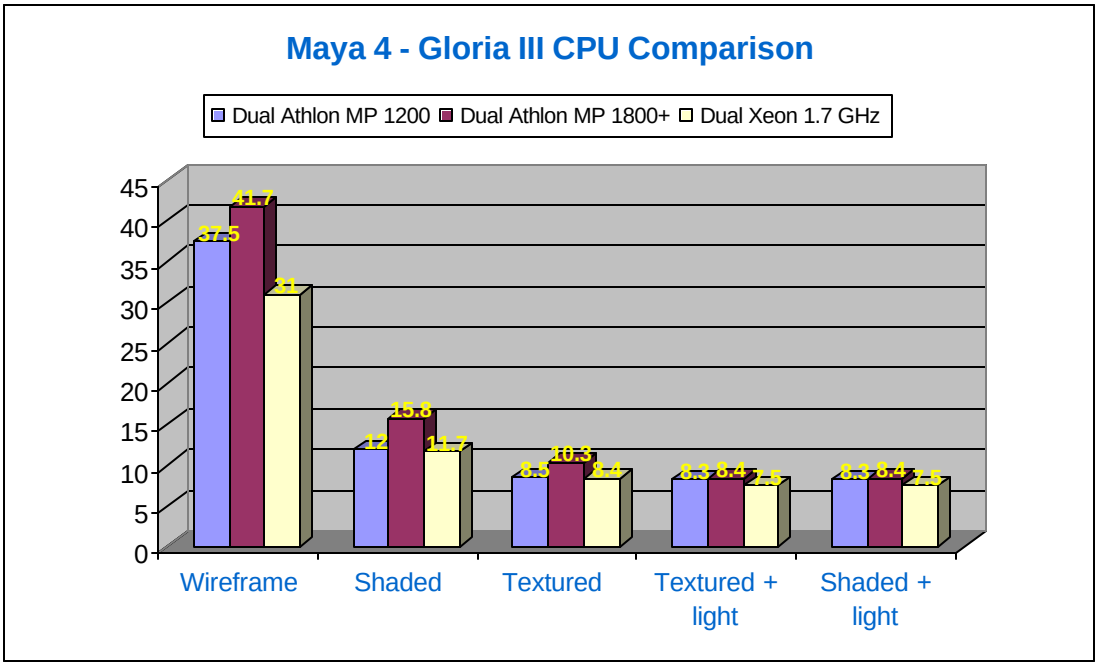
The Wildcat II drivers seem to be slightly multi-threaded as the 3DLabs cards benefit most from the second CPU. The Fire-GL2's performance is actually worse with a second CPU. The most likely explanation is that the FireGL doesn't like the fact that a second CPU eats some of the memory bandwidth. Nevertheless, the objective benchmark data points out that a second CPU hardly pays off in object manipulation tasks. My own subjective experiences tell me otherwise, however.

The second CPU seems to improve the responsiveness of the system, especially when it is equipped with CPU hungry video cards like the FireGL-2. As noted in the CAD tests, a system with a 3DLabs cards is most responsive, courtesy of the low CPU load. Therefore, it is strange but true: the Wildcats are a good option if for some reason you are limited on CPU power. Consider someone who bought a dual 800 MHz Pentium III workstation a year ago. A dual 800 MHz Pentium III will render rather well, but will not be able to offer the "object manipulation performance" of a single Athlon MP.

While our primary focus for this article has been strictly on the OpenGL accelerators themselves, we also ran a couple of Maya 4 benchmarks on our 1.7 GHz dual Xeon workstation, courtesy of Dell. We benchmarked Maya 4 with both the 3DLabs Wildcat II 5110 and the Elsa Gloria III in the dual Athlon MP 1200, Athlon MP 1800+, and 1.7 GHz Xeon. The results are indicated below for the wireframe, shaded, textured, textured + light, and shaded + light tests.



As you can see above, the Wildcat II 5110 produces very similar results across all three systems with the most substantial difference seen in the wireframe benchmark. Here, the dual Xeon falls slightly behind the two dual Athlon systems. The Xeon edges out the other two systems in the shaded and shaded + light benchmarks, however. Now let's have a look at the Gloria III:



The differences between the systems are a little more significant in this case. As you will recall from the Indy3D CPU load results, the Gloria III drives the CPU load up to 100% while the Wildcat II boards relied on the CPU far less, resulting in a load of 10 to 15%. Therefore, the differences we see in this graph are to be expected, as the Gloria III is clearly more heavily dependant on the CPU than the Wildcat II 5110. The dual Athlon MP 1800+ (1.53 GHz) takes the lead here, as it is the fastest of the pack. The 1.7 GHz dual Xeon falls behind in the wireframe benchmark, but otherwise manages to hold close to the 1.2 GHz dual Athlon MP in the remaining benchmarks.

Conclusion

The **3DLabs Wildcat II 5110** is by far the fastest CAD video card on the dual Athlon platform. It is up to 37% faster in some CAD tests than the nearest rival and it achieves this amazing performance with a fraction of the CPU power that its competitors demand. The CAD professional who works with 3D-CAD applications every day will gladly pay the heavy price tag attached to this card, as the improved responsiveness and superb performance will pay back the price premium in no time. However, it is clear that this is not the card for the people who want a high-performance workstation without the cost, as it is at least three times more expensive than the other cards we tested.

ATI's FireGL-2 is the all around OpenGL card for the 3D-animator. It is the fastest card in complex shading tests, it supports twice as many hardware lights as the Gloria III and, as a result, performs very well in every 3D-animation test and holds its own in most CAD tests. In other words, it is a excellent and well-balanced choice with a very attractive price tag. There is only one but: this card needs all the CPU power it can get. Do not use it to upgrade an older workstation, as it will probably disappoint. Give it an Athlon MP 1900+ and it will perform incredibly well.

Elsa's Gloria III lacks some raw polygon power for the CAD tests, but it is not blown away. It is the best card if you want textured previews of massive 3D-animation sequences, and it is the only card that allows you to work comfortably with high refresh rates at very high resolutions (1900x1200x100Hz).

Although, it is stripped of the second pipeline that makes the Wildcat II 5110 the strongest OpenGL card in our lineup, the **3DLabs Wildcat II 5000** is still one of the most affordable professional 3D-CAD accelerators. CAD Performance is, most of the time, slightly better than the competitors, and exceptionally low CPU utilization makes sure that the system remains very responsive in all circumstances, even on a single CPU system. The Wildcat II 5000 performs reasonably well in 3D animation software, as long as you do not demand more than gouraud shading. The FireGL-2 and Elsa Gloria III give the "Cat" a beating in the complex shading and texturing benchmarks and are better alternatives for 3D modeling software, in our humble opinion.

Can a gaming card really be a good alternative? In the case of CAD applications, it is advisable to get a real OpenGL card if you need to handle very large amounts of polygons. The SPEC ViewPerf tests with 300,000 polygons and more show that a $700 Wildcat 5000 can perform up to five times faster than a gaming card. Scenes with less than 100,000 polygons can be handled pretty well by gaming cards, however. The GeForce 3 is a very good 3D animation solution, as long as you do not expect to see the effects of lighting in real time. While support for hardwired T&L engines is ubiquitous, it will take some time before every 3D animation program can make good use of the potential of the vertex shader. Even a GeForce 2 GTS can give you decent performance, as long as your scenes are not overly complex.