# Reviewing the Boxx 4850 Extreme workstation

Posted by Alex Herrera on April 2nd 2010

## ... and another look at the AMD FirePro 8750


Front view of the BOXX 4850 Extreme. (Source: Jon Peddie Research)

At JPR, we get several opportunities over the course of a year to check out OEMs' new workstation models. And while we always see or learn one or two new things, by and large, the differences are usually relatively minor. After all, they're all built from similar IHV-based components from Intel, Nvidia and AMD, so companies designing workstations with similar goals of price and price/performance are going to more often than not end up with similar results.

And that's precisely why we were eager to review the 4850 Extreme workstation from Boxx. Boxx doesn't build workstations like everyone else; it can't afford to and knows it. The company's always trying something different, and in the case of the 4850 Extreme, it takes a few very different, noteworthy slants on workstation design, most notably with its choice to integrate liquid-cooling to achieve best-in-class single-socket performance.

Yep, our 4850 Extreme lived up to its name with a Core i7 CPU clocked at an impressive 4.15 GHz, thanks to a liquid-cooling system from CoolIT, a vendor with lots of experience in the field. The fastest single-socket CPU we've seen is complemented with a capable 6 GB of 1333 MHz DDR3 memory, a fast 250 GB SATA drive and topped off with AMD's top-of-the-line professional graphics card: the FirePro V8750.

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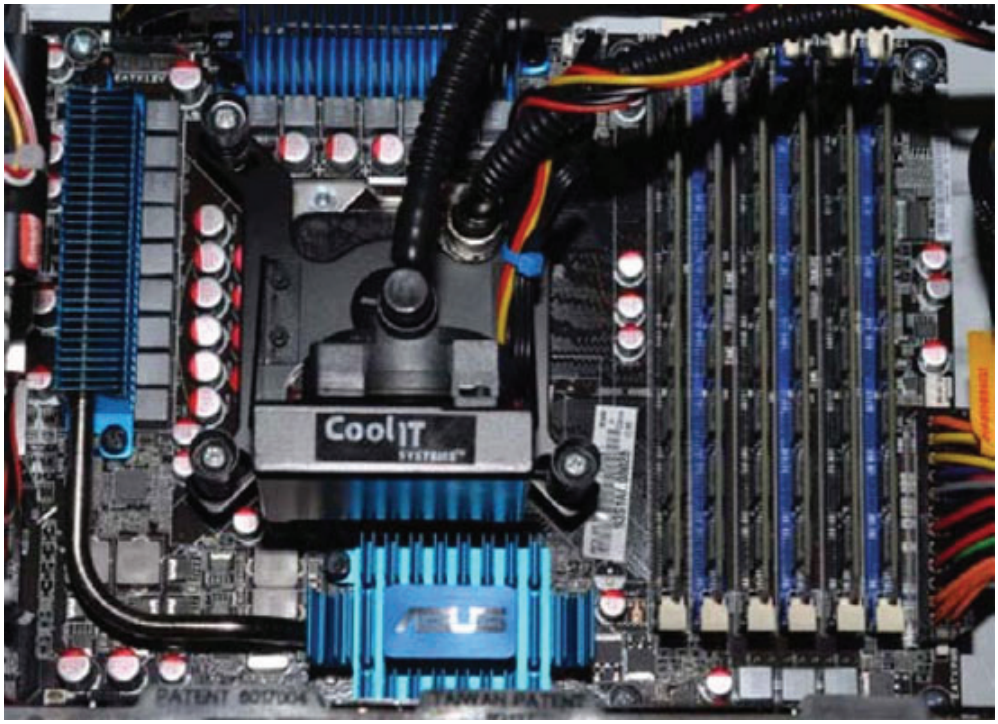
|---|---|
| CPU | Intel Core i7 quad-core, over-clocked and liquid-cooled to 4.15 GHz |
| Memory | 6 GB of 1333 MHz DDR3 |
| Disk | 250 GB 7,200 RPM SATA |
| Graphics | AMD FirePro V8750 with 2 GB memory |
| OS | Windows 7 |

Table 1: Configuration specifications for our 4850 Extreme review machine. (Source: Jon Peddie Research)


Plentiful I/O in the back, accessible I/O for frequent use in the front. (Source: Jon Peddie Research)




The 4850 Extreme's add-in slots. (Source: Jon Peddie Research)

## Aesthetics and ergonomics

With OEMs looking for every possible way to differentiate, and with Apple's obvious success due at least in part to marketing style, aesthetics is no longer overlooked when it comes to workstation design. Consider how much coin HP must have dropped in its outsourcing the styling of the recent Z series to BMW.

The clear trend lately has been leaning toward the beefy, industrial look, showing grill work and—cost allowing—more metal than plastic, for example brushed aluminum enclosures. Boxx isn't winning business by being the price leader, so it can afford to spend a bit more on the metal, including a very burly 1/8th inch alloy plate fastened securely to the enclosure's top.

Offering plenty of I/O with the right subset cleanly accessible isn't just a nicety, it's become essential, and perhaps especially so in digital content creation environments which demand connectivity to a broad range of media devices. The front panel offers accessibility, with dual USB 2.0 ports, audio mic in and mini-jack stereo, along with one 1394 port. And the rear panel offers the plentiful, with two Gigabit Ethernet ports, one 1394 and six USB 2.0 ports, two external SATA ports to expand storage, and the full breadth of audio I/O, including S/PDIF coax and optical output.

## Running counter to big OEMs' offerings, less attention to tool-less

Big-name workstation OEMs have recently been highlighting tool-less hardware maintenance to differentiate their wares from the competition. The convenience of opening up the chassis, installing video cards, swapping drives or even power supplies without so much as a screwdriver is no doubt an appealing feature. This reviewer loves the convenience and has generally been happy with the tool-less solutions we've come across. Recently, HP's Z series workstations upped the ante even further by virtually eliminating cables (not completely, but getting closer).

So how does Boxx approach the idea of tool-less? Well, to simply match what other OEMs are doing wouldn't serve Boxx's aim of differentiation. The company recognizes that reasonable-cost tool-less options can sacrifice reliability, and—to be blunt—often look cheap and flimsy. So when putting together a water-cooled, no-compromise performance machine with unquestioned reliability, well a weak, me-too solution isn't going to cut it.

So no, the 4850 Extreme isn't tool-less. But it is not a difficult to work with system, either. A simple twist of thumbscrews opens the side panel, and swapping a video card can be accomplished with removal of two screws on an L bracket that grips the card's edge.

Sure, the burlier retention device is mostly about ensuring that that $2,000 card—without secure mechanical fixing points—stays solidly in place. But it also ties back into the aesthetics. Like a loyal customer of Apple's Mac Pro, the Boxx workstation buyer is paying a premium, and they want to see it and feel it in the style and strength of the design. With the 4850 Extreme, they get just that.

And relaxing the design requirement for completely tool-less hardware maintenance really isn't much of a trade-off, either. Boxx customers tend to look for complete solutions, purchasing workstations packaged with all the hardware (and often software, for that matter) that they need. Boxx users won't have as much of a need to be opening up the chassis at all.

## Liquid-cooling makes the ultra-fast clock achievable ... but you've got to have the Watts to drive it

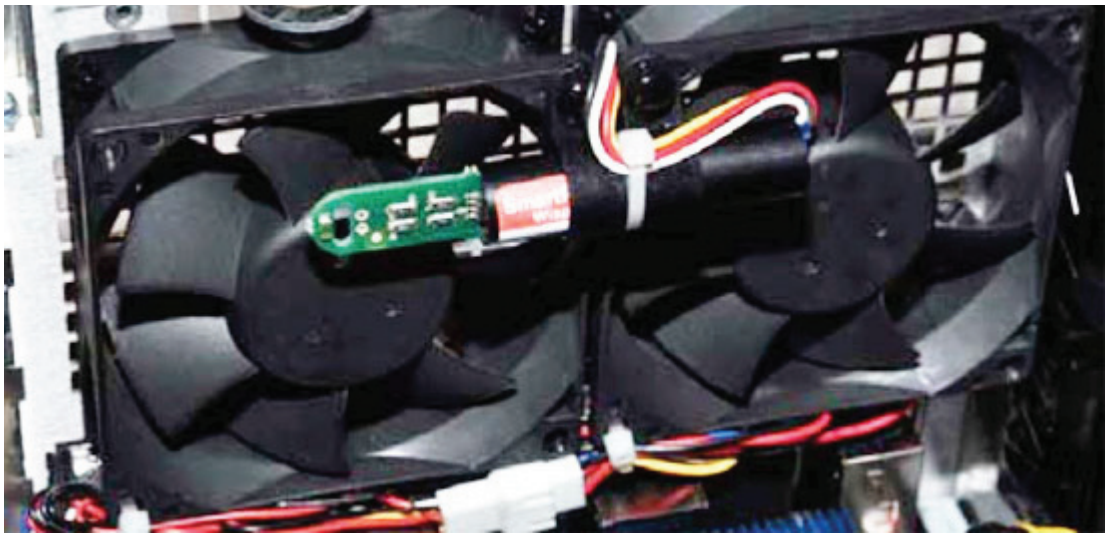
Besides, when you can brag about an exotic water-cooled motherboard, do you really need to be worrying about a screw here or there? Like we've said many times, credit Boxx for doing in workstations what others haven't. The 4850 Extreme is one of the few (and the first we've tested) branded workstations with an overclocked, water-cooled CPU.

No doubt, it's CoolIT's system that's first to catch the eye when opening up the 4850 Extreme. But of course, the liquid-cooling isn't there just for show, but to allow Intel's Core i7 CPU to be cranked up to 4.15 GHz (as compared to the 3.2 GHz frequency, where Intel's standard specs top out). While the clear trend in processor design is multi-core, remember that the degree to which applications can take advantage of multiple cores varies. And sometimes, faster, fewer cores deliver the goods more than slower, more plentiful cores can. It's a premise we explore in benchmarking further ahead.

Now, the idea behind any thermal dissipation scheme, be it a car or a workstation, is to transfer the heat from where it's produced, and where it could interfere with system operation, to some other place where it won't. In a car, coolant circulates through the engine and then to the radiator which transfers the heat to incoming cooler air. Well, the principle behind computer system liquid-cooling isn't very different, though the implementation sure is.

CoolIT's system circulates liquid coolant from the CPU to a radiator on the system's front grill. Two fans pull in outside air to cool the liquid which in turn cools the CPU. In the 4850 Extreme's implementation, only the CPU gets the liquid cooling. Two rear fans complement the front to help push air back out, creating enough airflow to cool the rest of the systems' components that don't have the benefit of liquid-cooling.

Dual intake fans pull in outside air through the front grill's radiator.
(Source: Jon Peddie Research)



A thermal couple measures the temperature exiting air to dynamically throttle the out-bound fans.
(Source: Jon Peddie Research)

But of course in today's workstation market, noise levels can matter just as much as performance. So blowing all four fans full blast all the time won't cut it. Accordingly, the 4850 Extreme can dynamically adjust the air flow both through the front radiator as well as the out-bound fans in the rear. A thermal couple in the rear measures the exiting air and cranks up the out-bound fans if and when necessary. Similarly, a monitor embedded in the liquid cooling system tracks coolant temperature and dials up (or down) the intake radiator fans' speed accordingly.

## Lot and lots ... of slots

Following Boxx and reviewing their products, a consistent theme quickly emerges: differentiate noticeably and differentiate often. That means not simply making a splash in one particular area, but look for every possible avenue to separate your workstation from the crowd. So no, the 4850 Extreme doesn't stop with the industrial styling and overclocked water-cooled CPU. This workstation also stands out for the number of graphics-capable x16 (mechanical) PCI Express slots it houses: six in all.

Just a few years ago, it was hard to find more than one x16 mechanical slot, limited by Intel's chipsets and lack of strong demand for more than one graphics adapter. But while multi-GPU schemes like Nvidia's SLI and AMD's CrossFire have created pull in pockets of client computing markets (more so in gaming than professional spaces), it's the demand for more monitors, more display space, that's driven the need for OEMs to support more than one card. Intel's chipsets have slowly, but surely, complied, and now two x16 PCI Express slots is pretty much the norm in the workstation space.

With its recent X58 (Tylersburg) chipset for Nehalem-generation processors, Intel's upped the ante further, incorporating 36 possible PCI Express 2.0 lanes for I/O use. That improved the manner in which OEMs could provide dual x16 interfaces, as many prior designs had to build mechanical x16 interfaces with fewer (e.g. x8 or x4) electrical lanes, thereby trading off bandwidth to get the extra slot.

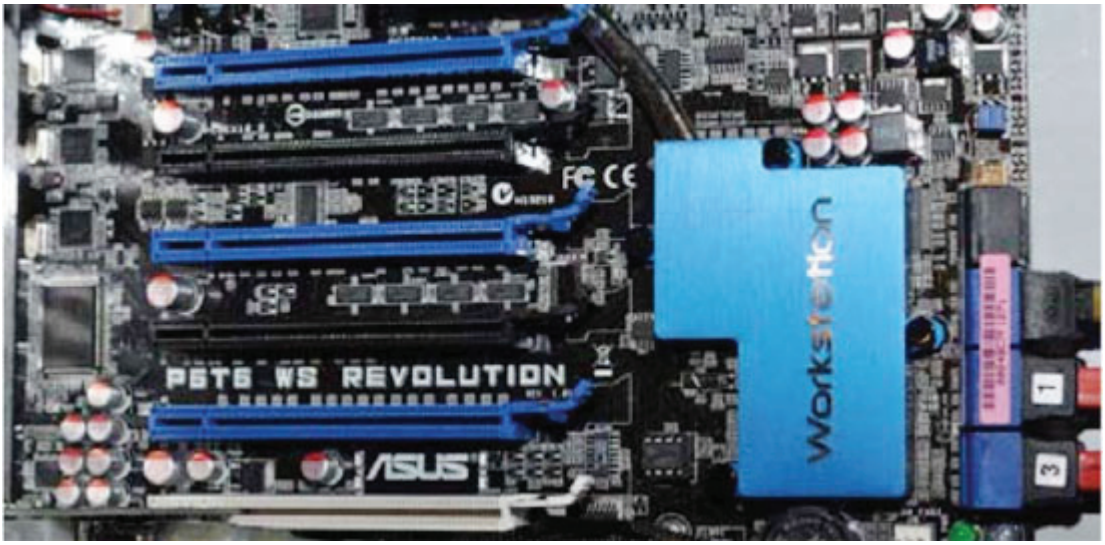
But the X58 and dual x16 slots were enough for Boxx. The company's designers went off and populated the NF200 PCI Express bridge from Nvidia as well (that's the device hiding under the blue alloy plate with the "Workstation" label in the preceding figure). The NF200 bridge accepts 16 of the X58's PCI Express lanes and creates three back-side links, one of 16 electrical lanes and two of eight. That provides the total of six possible interfaces, as illustrated in Figure 5.

Of course, without full x16 electrical links associated with each mechanical connector, there are bandwidth trade-offs to accept. But to ease those trade-offs, Boxx designers have managed to allow two of the x8 electrical slots to be disabled, adding those extra x8's to the two existing x8's. That provides three x16 slots with 16 electrical lanes underneath available, with a fourth at reduced (x4) bandwidth.

With a 4.15 GHz CPU, 6 GB of fast DDR 3 DRAM and up to (in theory) six graphics add-in cards, there's a lot of potential power being consumed. Thankfully, Boxx complies with a 1000 Watt supply from a proven provider, Zalman (ZM1000-HP). Now, we say in theory six cards, because even 1000 Watts wouldn't be enough to allow six high-end cards, assuming thermal dissipation needs could be met, and assuming the user is willing to share PCI Express bandwidth (the Nvidia 200 bridge can't pull bandwidth out of thin air—its secondary PCI Express interfaces will have to share what the primary 2.0 interface can provide).

First off, most high-end cards are dual-slot, and second, they are typically in the 150+ Watt range (the FirePro V8750, for what it delivers, is relatively low at around 154 Watts). So six cards would essentially consume all the system's power, and of course there's plenty of other consumption going on, not the least of which is a 4.15 GHz CPU.

But three or so high-end cards could be accommodated, and that alone is more than what most high-end dual-socket Xeon workstations could pull off (more like two). Boxx is keenly aware it can't just match the competition; it has to constantly raise the bar.




The 4850 Extreme's six—count'em six—x16 (mechanical) PCI Express add-in slots. (Source: Jon Peddie Research)

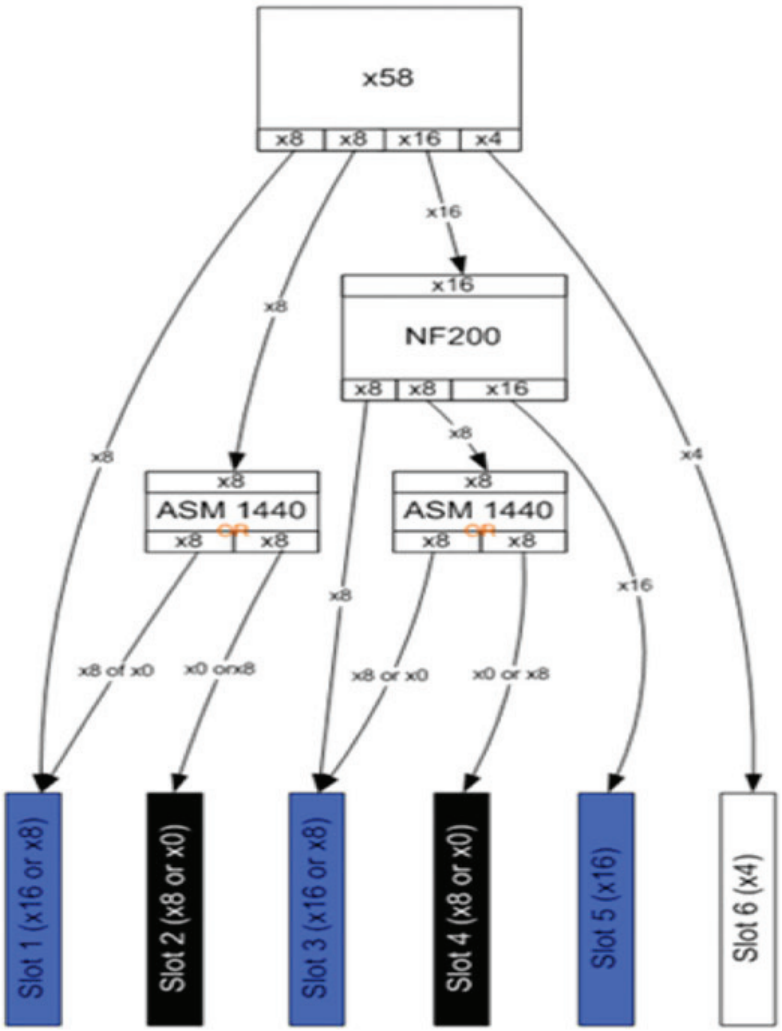
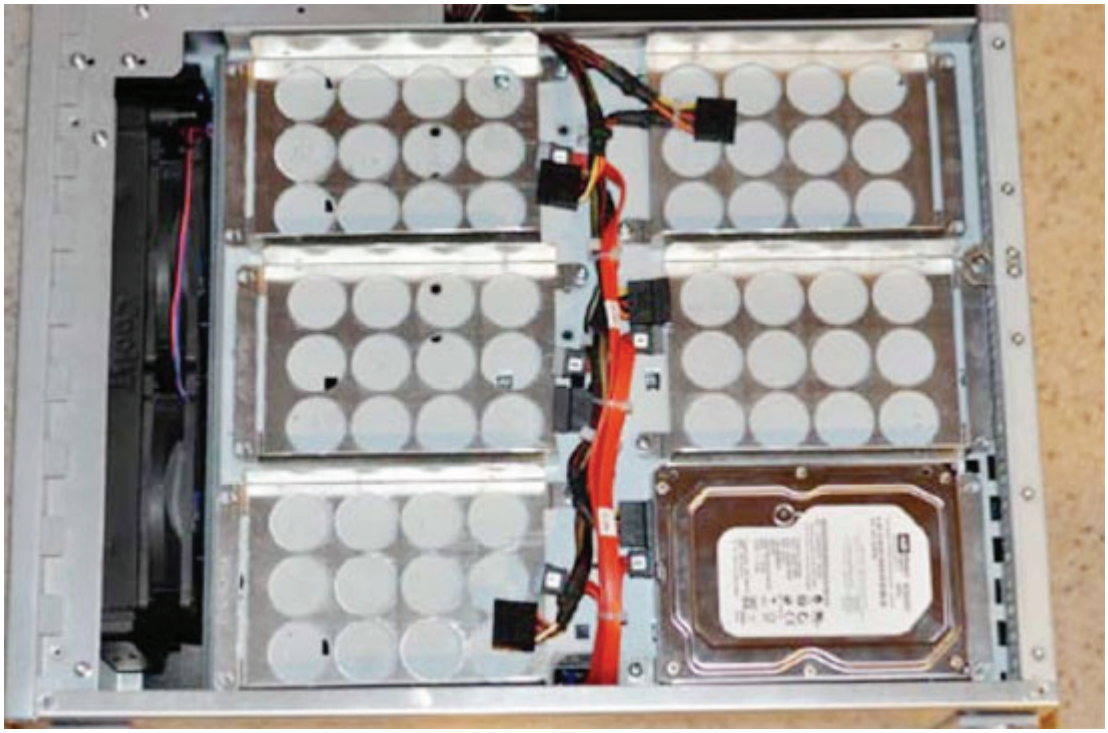



Figure 5: Tylersburg (X58) with the NV200 allows for lots of slots ... and some flexibility in bandwidth per slot.(Source: Jon Peddie Research)

## Spurn convention: an array of drive bays on the backside

We spent so much time examining the fans and liquid-cooled processor and all those slots that we almost forgot to check out the system's drive bays. In fact, we almost missed them completely. Why? Because again Boxx spurned convention, and instead of stacking them in the corner of the main chassis interior, Boxx engineers created an entire separate mechanical partition, accessible from the opposite side panel.

It's a different layout than we're used to seeing, and we liked it: no stack, no rack, but instead arranged in a flat array. The bays are clean and easily accessible, which is no small feat when you're designing in six bays, two more than most mid-range and high-end Xeon-class workstations provide. Boxx is always going to take the road less traveled, and the 4850 Extreme's storage subsystem is no exception.



Not a stack or rack, but a flat array of six SaTa drive bays in a separate chassis partition.
(Source: Jon Peddie Research)

## Benchmarking the 4850 Extreme and FirePro V8750

To assess the performance of Boxx's 4850 Extreme, we employed the same basic tools we have in the past: SPEC Viewperf to stress the graphic subsystem, in this case the AMD FirePro V8750, and SPECapc tests to get a handle on whole-system performance. We find SPECapc tests to be some of the better—though far from perfect or conclusive—indicators of how a system will perform in professional applications, and SPEC's Viewperf tests effectively isolate the rendering load on the cards themselves. Viewperf performs relatively little


AMD's top-of-the-professional-line aMD FirePro V8750.
(Source: Jon Peddie Research)

in the way of CPU computation (basically just making a bunch of OpenGL calls), with the goal of making sure that it's the video card that limits performance, rather than the CPU, memory or I/O.

As luck would have it, we had just recently benchmarked the V8750 in another system, Lenovo's dual-Xeon D20. So we had an opportunity to both: a) sanity-check graphics performance numbers for the V8750, and b) compare system throughput for key digital content creation applications (to represent Boxx's target demographic)—namely Maya, Lightwave and 3ds max— for a fast-clocked single processor system relative to a slower-clocked dual processor system. More on the second task ahead, but first the graphics.

## Benchmarking the V8750 with Viewperf 10

We ran Viewperf 10 in single, dual and quad-thread modes, three iterations a piece, averaging results. We made sure we had the latest, blessed driver from AMD.

Given that we'd already witnessed the V8750 in action just a few months prior (on the Lenovo D20), we didn't expect to learn much running the V8750 on the 4850 Extreme. We were wrong. Neither the experience nor results of the testing were quite what we expected.

First off, we had a consistent system failure running Viewperf's Maya viewset in dual-thread mode. Impossible for us to diagnose (based on what the system reported), we couldn't point the finger at any one thing. And the fact that the Maya viewset seemed to run fine in quad-thread mode added to the mystery. However, despite that bump in the road, we were still able to collect results across all the other viewsets and thread corners.

Now, a major premise of Viewperf is that the test attempts to isolate the stress on the graphics subsystem, removing application overhead. The test makes a sequence of OpenGL calls to render the viewset. But while it removes the effect of the application—which might bog down the CPU, memory or other system components—it doesn't mean that those other components have no impact on the test results. Most significantly, the driver receives and processes the calls, so a faster CPU will improve the speed somewhat.

## But we didn't expect the 4850 Extreme's faster, liquid-cooled CPU to have nearly the impact it appeared to.

For all four thread corners, the V8750 running on the Boxx system trumped the V8750 running on the Lenovo machine three months prior. It didn't just nudge them out, which we would've anticipated, but it beat the numbers by a considerable margin for many viewsets.

Now, the caveat here is that not only is the 4850 Extreme's CPU considerably faster, but it's got a bit more memory and the FirePro driver is more current. Perhaps the latter two factors had a bigger impact than we'd envisioned, but we doubt 6 GB of memory versus four would have such an impact running Viewperf. And while we would of course expect a more recent driver to offer some incremental performance improvement, it's not like the previous driver was alpha or beta level; it had been out for months, supporting the V8750 (and other FirePro cards).

As the number of threads increased, the margin between the V8750-on-Boxx and V8750-on-Lenovo did shrink, which would make some sense to us, as the bottleneck should shift more toward the graphics card, reducing the effect of a faster-running driver. For some viewsets, the delta was quite low, and we disregarded an anomaly here or there (e.g. the drastic difference in tcvis-01 viewset).

Of course, assuming the 4850 Extreme's faster CPU was responsible for the V8750's significantly faster performance doesn't mean the test wasn't fair. Remember even in the "real world," driver performance is critical in determining graphics throughput. Depending on the application and viewset, it can be the bottleneck. So a faster CPU making for faster rendering is fair to acknowledge, though it shouldn't disparage either the V8750 or Lenovo D20.

## 4850 Extreme CPU's GHz superiority shows up in SPECapc for Maya

Those users of Maya, who represent a big chunk of Boxx buyers, would have a special interest in the 4850 Extreme's performance in the SPECapc for Maya 2009 test. Does the blazing speed of a liquid-cooled CPU translate into superior performance over a similar, but slower-clocked machine?

The answer is yes, at least in part. We were able to find a similarly equipped, single-socket Nehalem-class workstation among those for submitted results appear on SPEC.org. With its Xeon 3.33 GHz W5590 CPU, the Dell Precision T7500 works well as a measuring stick for the 4850 Extreme. The 4850 Extreme's CPU sub-score for SPECapc for Maya was 28% higher than the T7500's, a very sensible result, given its CPU runs about 25% faster.

But remember that the SPECapc tests try to assess the full system performance, not just the CPU. The T7500 houses a Quadro FX 4800, similar in price to the AMD FirePro 8750, but yielding a superior Graphics sub-score of 3.43 versus the 4850 Extreme's 2.64. Factor in comparable I/O sub-scores, and SPECapc's weighting results in a slight edge for the T7500 on overall score.

## Boxx's damn-the-power-and-crank-the-GHz single socket, an interesting contrast to the power-conscious Xeon E series in dual sockets

As pointed out in our review of the dual-socket Lenovo D20, there are different rationales behind the OEMs' choices in speed and number of CPUs. For the D20, the goal was to provide more processors (dual) and cores at a reasonable price point, sacrificing maximum GHz in the process. By contrast, the 4850 Extreme's overclocked Core i7 Nehalem processor represents the other end of the spectrum. Give up half the processing cores compared to a dual-socket system, but run those cores much faster, courtesy of water-cooled overclocking that adds some cost.

So how differently would a common DCC application perform on a faster-clock, single-socket workstation versus a slower-clock, dual-socket machine? We used SPECapc for Lightwave v9.6 to provide one sample point, with results as shown.

As we've seen before, Lightwave isn't inclined to reward the population of multiple processor sockets. Though it may be taking advantage of the four cores per processor, it's not efficiently exploiting the D20's second processor. For both the Multi-task and Interactive sub-scores, the single-processor 4850 Extreme beats out the dual-processor D20. Now granted, the D20's 2.53 GHz clock rate lags the 4850's 4.15 GHz by a wide margin, but two 2.53 GHz Nehalems still offer significantly higher theoretical performance (i.e. with all processors and cores busy). Nope, at least in the way SPECapc exercises Lightwave, a faster single CPU is more effective than two slower ones.

Note that the Lenovo D20 did edge out the 4850 Extreme for SPECapc for Lightwave's Render sub-score, indicative of modestly better performance from the D20's Quadro FX 4800, relative to our 4850 Extreme's FirePro V8750. Remember of course that Boxx is a long-time partner of Nvidia, and offers a wider range of Quadro FX cards (580, 1800, 3800, 4800, 4800G, 5800 and 5800G) than we've seen from any competing vendor. So a 4850 Extreme buyer could certainly opt for

more graphics horsepower, if desired. See the review of the Lenovo D20 for more on the head-to-head comparison of the Quadro FX 4800 and FirePro V8750.

## The verdict: Boxx has secured itself a healthy niche, thanks to products like the 4850 Extreme

*Be the cheapest, or be the best: advice we've heard—and often said—many times. Lead in price, or lead in performance and innovation. Boxx can't compete with Dell and HP on price, so it wisely chooses to be measured on other grounds: performance, aesthetics, features, service and dedication to the special needs of the digital media industry. And the 4850 Extreme is yet another product we've seen from the company that wins on those criteria.*

*The liquid-cooled CPU means that for many applications and tasks that don't adequately scale performance with processors and cores (or at least not yet), the system can win on speed. With stylish looks, media-focused I/O and above-and-beyond support for more graphics cards than mainstream users would ever care about—but an artist might demand—the 4850 stands even further apart from the crowd.*

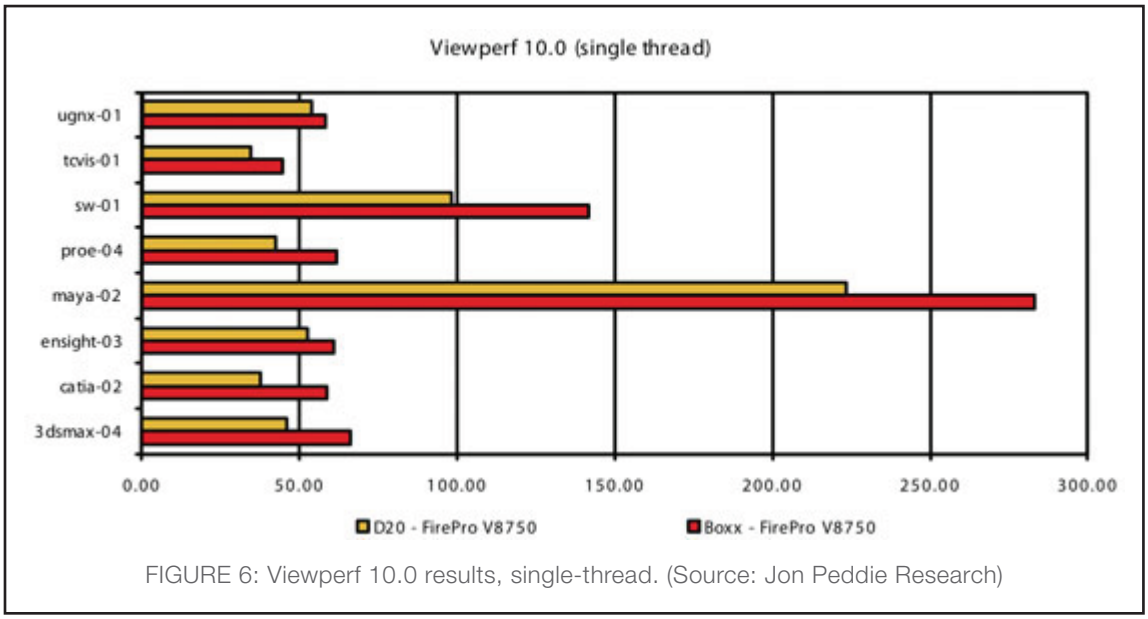



FIGURE 6: Viewperf 10.0 results, single-thread. (Source: Jon Peddie Research)

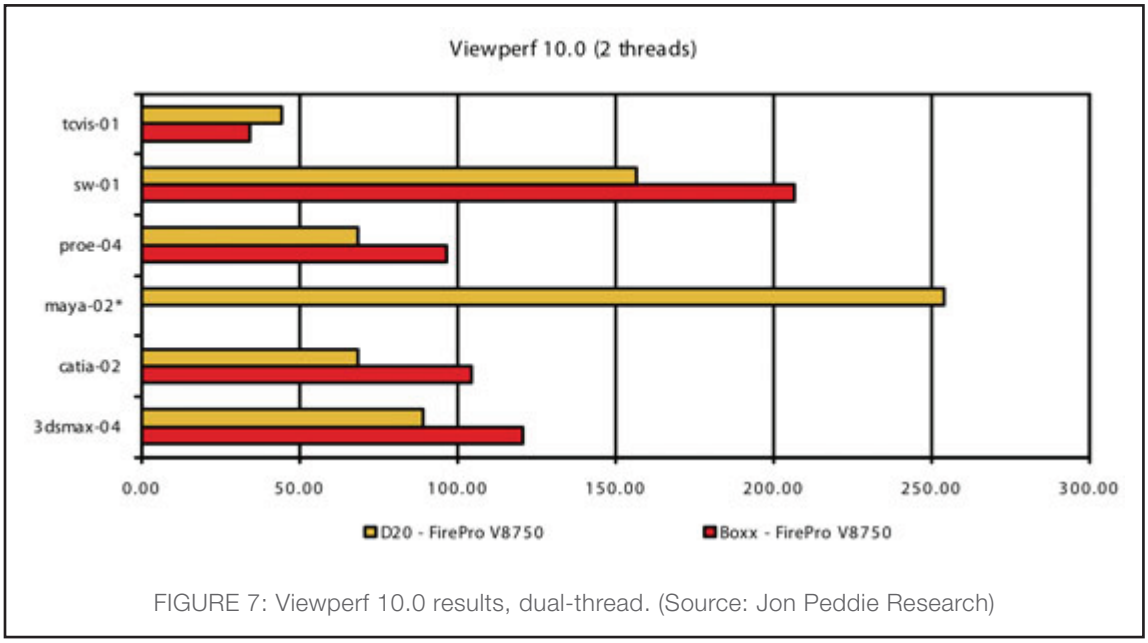



FIGURE 7: Viewperf 10.0 results, dual-thread. (Source: Jon Peddie Research)

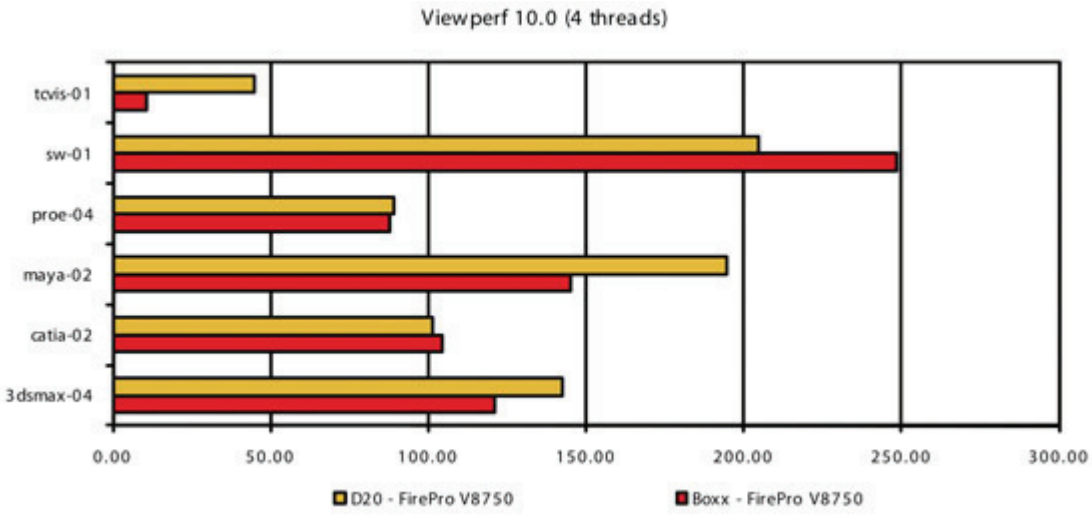



FIGURE 8: Viewperf 10.0 results, quad-thread. (Source: Jon Peddie Research)

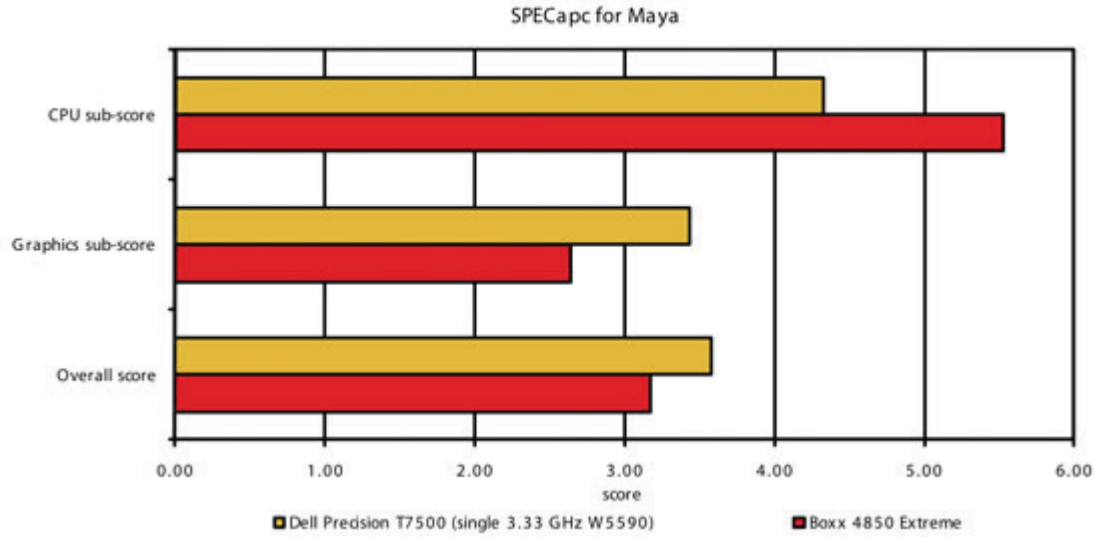



FIGURE 9: SPEcapc for Maya 2009 results: 4850 Extreme versus Dell's T7500 Precision. (Source: Jon Peddie Research)

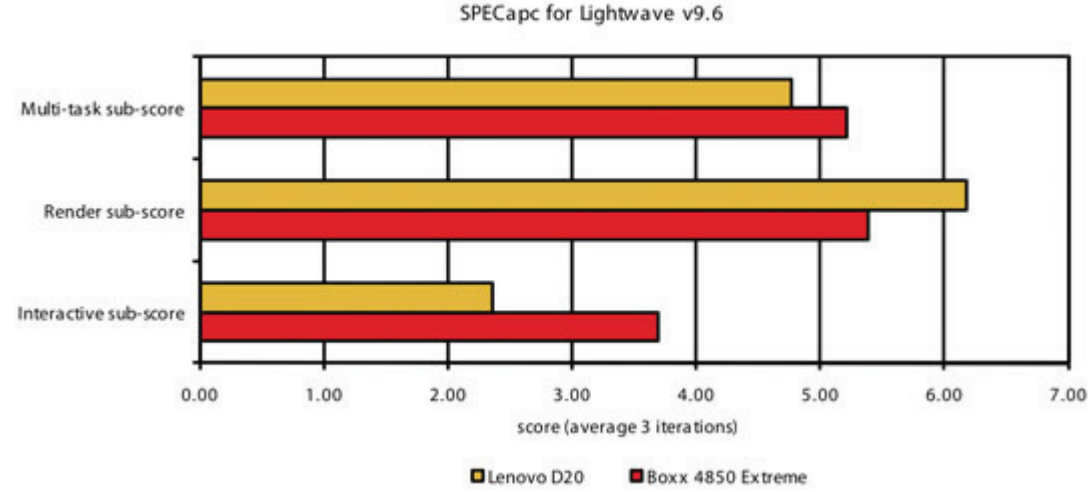



FIGURE 10: SPEcapc for Lightwave results: 4850 Extreme versus the dual-socket Lenovo D20. (Source: Jon Peddie Research)