More Cores or Faster Cores: What's Best For CAD?

by Alex Herrera

This newsletter reflects industry analyst Alex Herrera's views and does not necessarily reflect the opinions, product plans, or strategies of Dell or Intel.

The process of measuring and choosing processors for workstations has changed dramatically over the past few years. It used to be, that when it came to assessing the merits of a CPU, all we really cared about was clock frequency — the GHz. Today, it's all about how many cores a CPU has. Why the shift in focus? And, is the CAD computing landscape really so different now? It's a great question, and one that has no black-and-white, one-size-fits-all answer.

The Shift from GHz to Multi-core

Five years ago, GHz was the ultimate metric for discerning CPU superiority, and generation-to-generation vendors such as Intel were able to crank up chip clock frequencies at an incredible pace. That quest slowed dramatically, however, as the irresistible force of Moore's Law has bumped into an immovable object: the physical limitations imposed by power consumption, measured both in terms of Watts and BTUs.

Processor architects had long been successfully extracting every drop of instruction-level parallelism out of existing software. Silicon process engineers were just as busy and successful, driving transistor density and switching speed regularly and frequently. The trouble is, both efforts were so successful that each pursuit began to yield diminishing returns.

Superscalar designs had become incredibly complex, while the performance rewards for doing so were shrinking. At the same time, driving up clocks without dropping voltages meant power use was going through the roof. Beyond the issue of climbing electric bills, was the thermal issue. It was simply becoming impossible to effectively cool chips as frequencies climbed. Add it all up, and the industry was beginning to create chips that didn't offer a whole lot more than the last generation, while they consumed inordinately more Watts and were literally almost melting in their sockets.

A dramatic shift in approach was clearly necessary, and that shift has proven to be multi-core technology. Instead of using each generation's higher density to build a bigger core at higher frequency, the industry has moved its attention to building chips with multiple cores of similar (or modestly higher) complexity and frequency. That change in design philosophy has enabled major boosts in computing throughput, with far more modest increases in Watts. (And, by combining this approach with reductions in voltage, engineers can even reduce power.) No doubt about it, the multi-core age has arrived for reasons that are not likely to change any time soon.

What's Best for CAD Today?

Of course, just because a technology supplier has determined that one approach to designing hardware is better than another doesn't necessarily mean it's going to be the right solution for users. While multi-core technology is a great way to gain speed-ups in theory, some of the most critical stages of common CAD workflows involve algorithms that, at least today, still don't effectively take advantage of multi-core.

Parametric modeling is first and foremost on that list. The foundations of packages such as AutoCAD and SolidWorks, don’t currently lend themselves well to multi-threading, and therefore don’t take

particularly efficient advantage of additional processing cores. As such, CAD buyers should pay close attention to new and continually improving technologies such as Turbo Boost, an Intel® processor technology available in all Dell Precision workstation models, both mobile and deskside. Turbo Boost cleverly monitors the amount of power the platform can tolerate and dials up clocks when application demands throttles up. Processing often produces heat well below the thermal limits of the machine, meaning clocks can often be temporarily over-driven, yielding significant improvements in throughput without exceeding operational limits.

Why CAD Professionals Need Multiple Cores — Today and Tomorrow

So if CAD computing still demands fast cores, then is the push to multi-core a marketing ploy, to convince the CAD community to buy what the industry wants to sell, rather than what's the best fit? No, not at all. It's a long-term technology we're all using and more and more applications — and users — are exploiting to better their ultimate metric: productivity.

Today's demanding CAD workflows are far from one-dimensional, relying on tasks and applications that range far beyond modeling. Yes, for many, it starts with design and drawing, but it certainly doesn't end there. In this day and age, we're all being asked to do more. Product designers can't just draw up a component and call it a day; they also must simulate for stress, kinematics, fatigue, durability, production quality, and fluid dynamics. Architects and civil engineers not only need to lay out eye-pleasing shapes and lines, they must align form with environmental constraints and aesthetics with structural integrity.

Fortunately, many of those types of jobs *do* efficiently exploit multiple compute cores found in Intel® Xeon® processor-based workstations. Applications performing finite element analysis (FEA), computational fluid dynamics (CFD), and visualization have all very naturally evolved to take advantage of available CPU cores. CAD professionals that rely on such applications will see effective scaling from generation to generation as processors integrate more cores. And furthermore, while some other CAD-relevant computing tasks are fundamentally more difficult to map to a multi-threaded approach, the fact is they will evolve as well, simply because that's the way platforms are headed.

But multi-core architectures offer additional appeal for CAD use, regardless of how well each of your many computing applications can effectively exploit extra CPU cores. And that's because there's one — and the most critical — component in the equation that has consistently proven capable of leveraging multiple computing resources: you. Consider all those aforementioned compute-intensive tasks that litter your CAD workflow today. Long gone are the days when you'd let one compute task run at a time — your schedule simply won't afford you the luxury to work serially. So, even if each of your applications are limited to single-core processing, by overlapping and juggling multiple compute tasks at a time — modeling, rendering, simulation, office tasks — you'll still be making effective use of extra compute cores.

With up to eight cores in the single-socket Intel® Xeon® processor E5-1600 based Dell Precision T3600 and up to 16 cores in the dual-socket Intel® Xeon® processor E5-2600 based Dell Precision T5600 and T7600, Dell workstations maximize performance for modern, multi-threaded CAD applications like AutoCAD, Autodesk Inventor, and SolidWorks. And, they pack the parallel-processing punch to keep pace as you keep all those plates spinning — and keep hitting all those deadlines.

The Bottom Line

In this period of transition, there simply is no one-size-fits-all answer to your processor needs. Rather, CAD pros need to find the right balance of a faster core and multiple cores. If drawing and modeling tends to chew up more of your hours than anything else, you'll want to allocate more of your

workstation budget to buying a faster core (e.g. higher clocks and bigger caches). Conversely, if you spend most time simulating designs, rendering prototypes, or simply juggling a whole bunch of compute-intensive tasks at one time, then slant your budget toward more cores.

Whether your demands or budget make the T3600, T5600, or T7600 a better fit, Dell Precision Workstations can deliver the processor technology to make your custom configuration the ultimate CAD workhorse. Dell offers the widest range of Intel® Core™ and Xeon® processor models, blending different degrees of core speeds and core counts, giving you the freedom to build the right machine to achieve your ultimate end-goal: maximum productivity.