Reaching New Heights

High-performance computing with ANSYS takes simulation to new levels of power, fidelity and engineering insight — adding tremendous strategic value.

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A decade ago, high-performance computing (HPC) was a relatively new concept for many users of engineering simulation — it was primarily available to those working in large companies that had resources to manage the substantial investments required to create and maintain technology infrastructure. Today, entry-level HPC is available on the typical desktop, and a majority of ANSYS customers have embraced the enormous benefits of using multiple processors, or clusters of computers, to tackle their most sophisticated simulation challenges.

HPC adds tremendous value to engineering simulation by enabling the creation of large, high-fidelity models that yield accurate and detailed insight into the performance of a proposed design. High-fidelity simulations allow engineering teams to innovate with a high degree of confidence that their products will meet customer expectations — because their extremely accurate simulations are predicting the actual performance of the product under real-world conditions.

High fidelity may refer to simulations using high mesh density for improved accuracy, those that include many geometric details, or those that include more-sophisticated treatment of physical phenomena. High fidelity also can encompass simulation models that go beyond consideration of one component to include the interaction of multiple components or entire systems. HPC is a key strategic enabler of high-fidelity results, as it provides the resources required for very large and detailed simulations and enables the work to be performed within the time required to impact engineering decisions.

HPC also adds value by enabling greater simulation throughput. Using HPC resources, engineering teams can analyze not just a single design idea, but many design variations. By simulating multiple design ideas concurrently, R&D teams can identify dramatic engineering improvements early in the design process, prior to and more effectively than physical prototyping alone.

The high throughput enabled by HPC also allows engineering teams to simulate the behavior of their product or process over a range of operating conditions. Companies are mindful of warranty promises and the increasing importance of customer satisfaction — especially in today's world of social media — and HPC provides the capacity to use simulation to ensure that products will perform robustly and reliably once in the customer's hands.

The power of HPC is more vital than ever in today's environment of intensified competition, shorter product life cycles, reduced time to market, sharply targeted product performance, and growing pressure to drive costs out of product development. As businesses seek to minimize physical models and tests by using engineering simulation to study more-complicated multiphysics problems, conduct a larger range of analyses, and understand the interaction of system components, HPC has become a core strategic technology.

Supporting the Hardware Revolution with Software Engineering

The computer industry continues to deliver enormous increases in computing speed and power at consistently lower costs. The average workstation that engineers use today is equivalent in power to the entry-level computer cluster of just a few years ago. Large-scale computing is now within the reach of more and more engineering teams, with the promise of new trends, like cloud computing, to make this access even more widespread.

However, today's hardware paradigm has turned computational speed into a software development issue. For years, computer processors became faster with each new generation. Today, limited by thermal issues, the clock speed of individual processors is no longer getting substantially faster. Rather, computing capacity is expanding through the addition of more processing units, or cores. The ability

HPC Business Values

Would more computing capacity increase the value of simulation to your company?

In a survey of ANSYS customers in 2010, most stated that the benefits of HPC — including faster turnaround and greater fidelity — would add value to their organization's use of engineering simulation.

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of software to scale effectively on a large number of computing cores is critical.

ANSYS has responded with consistent, dramatic solution improvements, developed specifically to sustain speed and scaling on the latest high-performance computing platforms. You can read more about this in another article in this issue of *ANSYS Advantage*: "Bigger, Better, Faster" discusses the many specific HPC-ready capabilities of ANSYS solutions, the result of a longtime focus and investment in HPC software development. This focus ensures that ANSYS customers benefit from leading performance both today and into the future, as HPC technology continues to evolve.

Cloud Computing

While hardware and software enhancements have enabled HPC to deliver significant value to engineering simulation users, important challenges remain in ensuring that every organization is strategically deploying HPC to gain the greatest return on investment.

For smaller enterprises, specifying, provisioning and managing HPC resources can represent a significant learning curve and require new skills. For many years, ANSYS has offered HPC on demand, which enables customers to use offsite clusters that we or our partners manage. Today, there is a resurgent interest in this model, termed "hosted cloud," and ANSYS partners provide HPC hosted-cloud outsourcing for organizations that prefer not to build and manage their own internal infrastructures.

In medium- and large-sized enterprises, centralized HPC resources are often shared by geographically distributed users — creating a host of attendant issues such as file transfer, remote access and visualization, data management, collaboration, and security. Project requirements sometimes dictate the need for intermittent, elastic access to extremes of computational capacity. Solutions are being developed to enable and optimize remote and flexible access, called "private cloud." This is a significant focus area at ANSYS, both in our product strategy and collaboration with key industry partners. ANSYS is committed to working with customers to address the challenges and promise of HPC private-cloud deployments as well as next-generation computing solutions.

Learning from the Leaders

Many companies already leverage HPC resources strategically and successfully to achieve engineering insights that can result in innovation and a sustained market advantage.

In this issue of *ANSYS Advantage*, you'll find a variety of customer case studies that reveal exactly how some organizations are combining HPC environments and ANSYS solutions to accomplish incredibly complex engineering simulations that would not have been possible even five years ago. Through strategic deployment, they are realizing a significant return on their HPC investment.

To meet the sometimes conflicting demands of clients, the commercial aircraft industry is under intense pressure to reduce the cost of every flight, satisfy tightening environmental regulations, and transport passengers whose flight experience expectations are constantly increasing — all the while satisfying regulatory demands for airworthiness and safety mandated by regulators. Parker Aerospace and Volvo Aero, featured in this issue, are two companies that have implemented HPC in innovative ways. Parker Aerospace has turned workstations into a virtual cluster, and Volvo Aero has made ANSYS tools, including HPC, part of its Life Tracking System to determine the life of engine parts and to reduce maintenance costs for customers.

NVIDIA is not only an industry leader in enabling technology for HPC; the company employs simulation and high-performance computing in the design of its own products, including 3-D glasses and PCBs. Consulting company EURO/CFD employs an HPC cluster, the largest among small and medium-sized businesses in France, to solve complex problems for customers in a wide range of industries. This issue features these and many other case studies.

As customer examples demonstrate, ANSYS users today scale their largest simulations across thousands of processing cores, conducting simulations with more than a billion cells. They create incredibly dense meshes, model complex geometries, and consider complicated multiphysics phenomena. While the sophistication and scale of tomorrow's simulations may dwarf today's efforts, one element will remain constant: ANSYS is committed to delivering HPC performance and capability to take our customers to new heights of simulation fidelity, engineering insight and continuous innovation. ■