A History of High-Performance Computing

Originating Technology/NASA Contribution

Faster than most speedy computers. More powerful than its NASA data-processing predecessors. Able to leap large, mission-related computational problems in a single bound. Clearly, it’s neither a bird nor a plane, nor does it need to don a red cape, because it’s super in its own way. It’s Columbia, NASA’s newest supercomputer and one of the world’s most powerful production/processing units.

Named Columbia to honor the STS-107 Space Shuttle Columbia crewmembers, the new supercomputer is making it possible for NASA to achieve breakthroughs in science and engineering, fulfilling the Agency’s missions, and, ultimately, the Vision for Space Exploration.

Shortly after being built in 2004, Columbia achieved a benchmark rating of 51.9 teraflop/s on 10,240 processors, making it the world’s fastest operational computer at the time of completion. Putting this speed into perspective, 20 years ago, the most powerful computer at NASA’s Ames Research Center—home of the NASA Advanced Supercomputing Division (NAS)—ran at a speed of about 1 gigaflop (one billion calculations per second). The Columbia supercomputer is 50,000 times faster than this computer and offers a tenfold increase in capacity over the prior system housed at Ames. What’s more, Columbia is considered the world’s largest Linux-based, shared-memory system.

The system is offering immeasurable benefits to society and is the zenith of years of NASA/private industry collaboration that has spawned new generations of commercial, high-speed computing systems.

Partnership

To construct Columbia, NASA tapped into years of supercomputing experience, dating as far back as the early 1980s, when computational fluid dynamics (CFD) computer codes originated, and as recent as 2004, when the Agency adopted novel immersive visualization technologies to safely pilot the Spirit and Opportunity Mars Exploration Rovers. In addition, NASA looked to Silicon Valley for some extra support and found a friend it had helped back in the heyday of early microprocessing technology.

In the first few years of the 1980s, Ames scientists and engineers assisted Mountain View, California-based Silicon Graphics, Inc. (SGI), by providing technical input to improve the company’s high-performance workstation product line. NASA had purchased 18 of SGI’s IRIS workstations and helped make them commercially viable with several improvements. By 1984, NASA was SGI’s biggest customer.

“NASA was a huge help to us as a young company, not only by being our biggest customer at a time when a lack of sales would have been disastrous, but they were one of our best customers in the sense that the engineers there gave us all sorts of valuable feedback on how to improve our product. Many of the improvements to the original workstations are still part of our most modern products,” according to Tom Davis, former principal scientist and a founding member of SGI.
SGI’s investment in NASA was helping to build the behemoth Columbia supercluster, the world’s largest computer chip maker and a leading manufacturer of supercomputers. In addition, Jet Propulsion Laboratory, Massachusetts Institute of Technology, and Scripps Institution of Oceanography scientists from a consortium called Ocean-Weather, Inc., collaborated with the Columbia project team to produce a highly advanced supercomputer architecture for high productivity. The resulting system is an SGI Altix supercomputer, based on SGI’s NumaFlex™ shared-memory architecture.  

The resulting system is an SGI Altix supercomputer, based on SGI’s NumaFlex™ shared-memory architecture. It is comprised of 2,048 processors, each with 512 processors, 1 terabyte of memory, 1 terabyte of memory per 512 processors, and 20 terabytes of storage. The total memory capacity is 4 terabytes per processor, 1 terabyte per 512 processors, and 20 terabytes per processor. SGI’s NumaFlex™ architecture provides the world’s largest Linux-based, shared-memory system in just over 4 months.

The team achieved what many in the supercomputing community considered impossible: conceiving, planning, and constructing the world’s largest Linux-based, shared-memory system. The resulting system is an SGI Altix supercomputer, based on SGI’s NumaFlex™ shared-memory architecture. It is comprised of 2,048 processors, each with 512 processors, 1 terabyte of memory, 1 terabyte of memory per 512 processors, and 20 terabytes of storage. The total memory capacity is 4 terabytes per processor, 1 terabyte per 512 processors, and 20 terabytes per processor.

The lessons learned while SGI provides NASA with engineering prototype systems continue to improve the scalability and reliability of the machines. When SGI and SGI are on the cusp of a new age of scientific, engineering, and creative uses.

The Columbia project team achieved what many in the supercomputing community considered impossible: conceiving, planning, and constructing the world’s largest Linux-based, shared-memory system in just over 4 months. The resulting system is an SGI Altix supercomputer, based on SGI’s NumaFlex™ shared-memory architecture. It is comprised of 2,048 processors, each with 512 processors, 1 terabyte of memory, 1 terabyte of memory per 512 processors, and 20 terabytes of storage. The total memory capacity is 4 terabytes per processor, 1 terabyte per 512 processors, and 20 terabytes per processor.

Meanwhile, NASA continues to lend technical advice to support the advancement of SGI products. The Columbia project team is working on the high performance system to improve the scalability and reliability of the machines. When SGI and SGI are on the cusp of a new age of scientific, engineering, and creative uses.

The Columbia project team achieved what many in the supercomputing community considered impossible: conceiving, planning, and constructing the world’s largest Linux-based, shared-memory system in just over 4 months. The resulting system is an SGI Altix supercomputer, based on SGI’s NumaFlex™ shared-memory architecture. It is comprised of 2,048 processors, each with 512 processors, 1 terabyte of memory, 1 terabyte of memory per 512 processors, and 20 terabytes of storage. The total memory capacity is 4 terabytes per processor, 1 terabyte per 512 processors, and 20 terabytes per processor.

The lessons learned while SGI provides NASA with engineering prototype systems continue to improve the scalability and reliability of the machines. When SGI and SGI are on the cusp of a new age of scientific, engineering, and creative uses.

The Columbia project team achieved what many in the supercomputing community considered impossible: conceiving, planning, and constructing the world’s largest Linux-based, shared-memory system in just over 4 months. The resulting system is an SGI Altix supercomputer, based on SGI’s NumaFlex™ shared-memory architecture. It is comprised of 2,048 processors, each with 512 processors, 1 terabyte of memory, 1 terabyte of memory per 512 processors, and 20 terabytes of storage. The total memory capacity is 4 terabytes per processor, 1 terabyte per 512 processors, and 20 terabytes per processor.

The lessons learned while SGI provides NASA with engineering prototype systems continue to improve the scalability and reliability of the machines. When SGI and SGI are on the cusp of a new age of scientific, engineering, and creative uses.

The Columbia project team achieved what many in the supercomputing community considered impossible: conceiving, planning, and constructing the world’s largest Linux-based, shared-memory system in just over 4 months. The resulting system is an SGI Altix supercomputer, based on SGI’s NumaFlex™ shared-memory architecture. It is comprised of 2,048 processors, each with 512 processors, 1 terabyte of memory, 1 terabyte of memory per 512 processors, and 20 terabytes of storage. The total memory capacity is 4 terabytes per processor, 1 terabyte per 512 processors, and 20 terabytes per processor.

The lessons learned while SGI provides NASA with engineering prototype systems continue to improve the scalability and reliability of the machines. When SGI and SGI are on the cusp of a new age of scientific, engineering, and creative uses.

The Columbia project team achieved what many in the supercomputing community considered impossible: conceiving, planning, and constructing the world’s largest Linux-based, shared-memory system in just over 4 months. The resulting system is an SGI Altix supercomputer, based on SGI’s NumaFlex™ shared-memory architecture. It is comprised of 2,048 processors, each with 512 processors, 1 terabyte of memory, 1 terabyte of memory per 512 processors, and 20 terabytes of storage. The total memory capacity is 4 terabytes per processor, 1 terabyte per 512 processors, and 20 terabytes per processor.