SGI® Altix® ICE: Achieving Unprecedented Power and Cooling Efficiency in High Performance Computing

SGI introduces SGI Altix ICE, a high density integrated blade platform that offers a revolutionary new approach to scale-out high performance computing (HPC). SGI Altix ICE provides breakthrough scalability, manageability, reliability, and price/performance without the compromises inherent in many traditional HPC systems. Of particular note, SGI Altix ICE incorporates SGI's innovative power and cooling solutions, for unprecedented efficiencies in the data center.

The Crisis in the Data Center

Today's data centers are in a state of crisis. AFCOM's Data Center Institute predicts power failures and power unavailability will halt IT operations at more than 90% of companies over the next 5-years.[1] An industry survey by Data Center Users' Group (http://www.datacenterug.org/) further projects that 96 percent of existing data centers will run out of capacity by 2011.[2]

Built years ago for a very different computing environment, many data centers today suffer severely from limited power and cooling capacity. The growing predominance of clusters in scale-out computing has been one of the main factors precipitating the crisis. Their rampant growth is overwhelming data center capacity. The environmental inefficiencies of traditional clusters (low density, combined with high power and cooling requirements), barely noticeable on a small scale, become prohibitive when scaling larger installations.

SGI Altix ICE Power and Cooling Solutions

The design of the SGI Altix ICE platform takes into account the environmental constraints of today's data centers and offers high efficiency solutions to meet the challenges. SGI has long been a technological leader in solutions optimizing power and cooling efficiency, mostly recently with its innovative SGI® Altix® 4700 server platform, where it introduced both a power architecture featuring 90% efficiency power supplies and a new generation of its field-proven water-based cooling system. These innovations have now been further optimized and applied to SGI Altix ICE. Together, they represent a major advance in overcoming the constraints of the data center.

High Efficiency Power

SGI Altix ICE utilizes 90% efficiency redundant power supplies that transform AC voltage directly to 12VDC. These high efficiency power supplies are combined with other high efficiency components to minimize losses throughout the entire power architecture. This high level of efficiency results in average electrical savings of 33%, or $21k annually per 10 teraflops of compute power,[3] compared to more typical cluster implementations. If data center facility infrastructure efficiency is also considered, the annual electrical savings doubles to $42k per 10 teraflops of compute power. Data center infrastructure efficiency, commonly described by Power Usage Effectiveness (PUE) = {Total Facilities Power / IT Equipment Power}, is typically 2.0 but ranges from 1.6 to 3.0 or higher.[4]
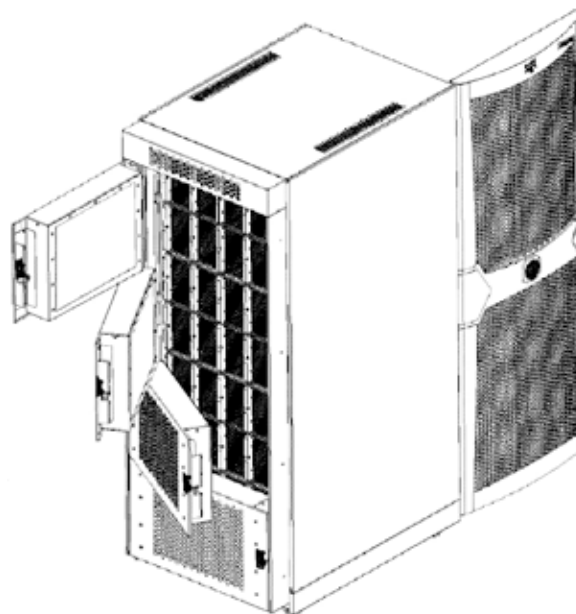
High Efficiency Cooling

SGI Altix ICE employs a combination of high efficiency redundant blowers and optional water-cooled rear doors to deliver impressive cooling efficiency results. With the water-cooled option, SGI Altix ICE has minimal effect on ambient data center temperature, since up to 95% of the rack heat is dissipated to chilled water. While actual performance depends on many site and geographic variables, the SGI Altix ICE water-cooled option significantly reduces cooling equipment power consumption. Electrical operating cost can be reduced by 17% or more, amounting to $11k annually per 10 teraflops of compute power. Use of the water-cooled option also increases overall system reliability by mitigating the common problems of hot-aisle/cold-aisle recirculation and hot spots within the data center.

A common issue with blade-based architectures is the crowding of I/O options across the backplane or mid-plane of the enclosure. The result is often a complex series of baffles and airflow management structures that require small fans or blowers. SGI has greatly improved over other blade-based designs by placing the I/O switches to the sides of the enclosure, enabling large perforations in the backplane. This enables air to flow straight through the compute blade, increasing volume and enabled the utilization of larger, more efficient, and less noisy blowers. The resulting thermal design permits more efficient and consistent cooling across all components, increasing reliability and overall efficiency.

With its innovative approaches to power and cooling, SGI Altix ICE stands in sharp contrast to most scale-out computing platforms. SGI Altix ICE ensures maximum utilization of scarce data center resources.

Bottom Line Advantage: SGI Altix ICE Power/Cooling Efficiency Means Savings in the Data Center

SGI's innovative approach to power and cooling efficiency translates into significant savings in the data center. For each 10 teraflops of compute power, SGI Altix ICE's high efficiency solutions realize a net savings in electricity of $53k:
- $42k overall from high efficiency power
- $11k from high efficiency cooling

SGI Altix ICE incorporates innovative new technology to drive electrical cost savings, but also more efficient power and cooling to deliver an automatic increase in overall data center capacity.

About SGI

SGI is a leader in high-performance computing. SGI delivers a complete range of high-performance server and storage solutions along with industry-leading professional services and support that enable its customers to overcome the challenges of complex data-intensive workflows and accelerate breakthrough discoveries, innovation, and information transformation.

SGI helps customers solve their computing challenges, whether it's enhancing the quality of life through drug research, designing and manufacturing safer and more efficient cars and airplanes, studying global climate, providing technologies for homeland security and defense, or helping enterprise manage large data. With offices worldwide, the company is headquartered in Sunnyvale, California, and can be found on the Web at www.sgi.com .

1) "Five Bold Predictions for the Data Center Industry That Will Change Your Future", AFCOM's Data Center Institute, Data Center World Conference, Atlanta, GA, March 2006.
2) Bob Bauer, Emerson group vice president and Liebert Worldwide president, previewed the results of a survey conducted by the Data Center Users' Group during his keynote address at Emerson's AdaptiveXchange 2006™ (pr dated 11-16-06). See http://www.liebert.com/bottom_news2.asp?id=2386 .
3) Cost calculations throughout this paper are based on a typical electricity cost of $0.092/kWh.
4) "Green Grid Metrics: Describing Data Center Power Efficiency", The Green Grid, February 17, 2007. See http://www.thegreengrid.org/pages/content.html.

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