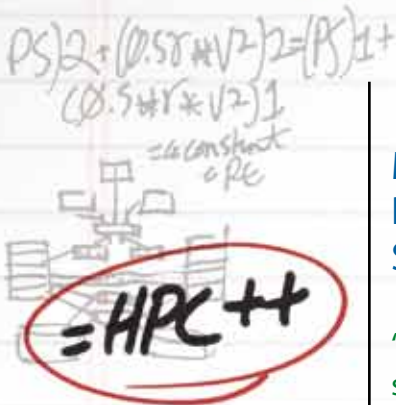


LY PRODUCTIVE HIGH PERFORMANCE COMPUTING



CUSTOMER PROFILE

Microsoft Corporation is the world's largest software company, with subsidiaries in 94 countries and regions.

SOFTWARE AND SERVICES

ANSYS, Inc. is a global innovator of engineering simulation software and technologies used by engineering organizations to predict how product designs will behave in manufacturing and real-world environments.

Simulation Driven Product Development™ solutions from ANSYS help engineers develop innovative products and processes that meet customer requirements. Simulation helps reduce the number of physical prototypes and tests required, leading to a faster and less expensive design process.

BUSINESS SITUATION

Microsoft Reliability Engineering needed to use engineering simulations from ANSYS to understand possible problems with the interconnections in the Xbox console. This design study involved a large number of simulations using a highly detailed model, which required increased computing resources.

MICROSOFT DELIVERS XBOX CONSOLE DESIGN RELIABILITY USING ANSYS® AND WINDOWS® HPC SERVER 2008

"There is an ever increasing pressure from the market in shipping products with shorter development cycles and this is further aggravated with increasing complexity of the hardware. HPC enables us to achieve this goal via shorter and more effective design cycles in new product development through quicker and parallel computation of complex jobs."

Santosh Shetty, Reliability & Component Engineer, Reliability Engineering, Microsoft Corporation

SUMMARY

Early in the design cycle, the Microsoft® Reliability Engineering team performs numerical simulations of Microsoft hardware designs, including the Xbox® console and Zune® MP3 player. A highly detailed simulation of the Xbox console's printed circuit board (PCB) was required in order to assess the reliability of the interconnections and to provide insight into a more robust product design. This evaluation involved running computationally intensive analyses using engineering simulation software from ANSYS® to evaluate the damage to critical interconnections under an accelerated thermal cycling load. In order to make the process more flexible, efficient, and to lower outsourcing costs, the team wanted to run the simulation in-house. The Reliability Engineering team used Microsoft Windows® HPC Server 2008, a next generation, 64-bit, High Performance Computing (HPC) solution from Microsoft, combined with the ANSYS simulation software, to provide the necessary computing resources.

SITUATION

Xbox 360® is a premier video game and entertainment system that blends content with an online social network that spans the globe. With localized versions available in 40 regions worldwide, in 20 languages, the Xbox 360 is a leader in delivering consumer services and online advertising opportunities for businesses.

THE XBOX CONSOLE

Santosh Shetty, the Reliability & Component Engineer for Reliability Engineering, was tasked with developing the infrastructure needed to analyze the effect of thermal cycling loads on the current Xbox console board. This analysis involved a large number of simulations using a complex model that included the entire Xbox console PCB and internal processor, including thousands of solder joints.

Multiple simulations were required in order to predict the risk of an interconnection failure under different stress scenarios and to optimize the design to achieve a more robust product.



$$ht_2 - ht_1 = q - vsh$$

$$(ht_2 = ht_1)$$

$$c_2 + (\rho av)^2 + (-.5 * v^2) 2$$

$$= c_1 + (\rho av)^2 + (-.5 * v^2) 2$$

LIMITED COMPUTING RESOURCES

The Reliability team had limited computational resources available. Dual core workstations were available in-house and were used effectively to perform routine, less computationally intensive ANSYS simulations - roughly 20 percent of the project workload. However, the Xbox console simulations required substantially more computing power and could not be conducted on the in-house workstations due to memory and time constraints.

Outsourcing had been used for the remaining 80 percent of simulation work with quad-core systems and greater memory capacity available. However, in order to meet desired time requirements, even outsourcing hardware would need to be enhanced resulting in much higher production costs. Outsourcing the large simulations also included unknown risk, given that unplanned extra simulations might be required in order to address errors or consider new design proposals.

The cluster capacity was also designed to accommodate a majority of the workload that had previously been outsourced, reducing outsourcing to no more than 25 percent. By reducing outsourcing, the new in-house cluster saves outsourcing costs and provides better control and more flexibility to make iterative changes to the design.

The solution was based on Windows HPC Server 2008, which combines the power of a 64-bit Windows Server platform with rich, out-of-the-box functionality, to improve productivity and reduce the complexity of the HPC environment. Windows HPC Server 2008 provides increased computing power on industry-standard processors and uses the existing corporate infrastructure and Microsoft Active Directory® Domain Services for security, account management, and operations management using tools such as Systems Center Operations Manager 2007.

SOLUTION

The importance of the Xbox simulation study offered a valuable opportunity for innovation. Microsoft chose to expand its in-house computing resources to include an HPC solution that could handle the Xbox study and similarly complex problems.

The HPC solution was composed based on a requirement that the turnaround time for a single Xbox simulation be no more than 24 hours. A cluster comprised of four nodes, each with quad-core processors, was determined to provide the required turnaround time. Running the Xbox console simulations on the cluster, Microsoft was able to complete a simulation in just over 12 hours, well within the stated goal.

The cluster solution fits well with the Microsoft roadmap for simulation, which has set a goal to shorten the average turnaround time for the ANSYS simulations by 50 percent from current levels. This shorter computational time will allow the team to react faster and analyze possible risk situations caused by design changes. In addition, the faster turnaround time will enable consideration of additional scenarios and verification testing.

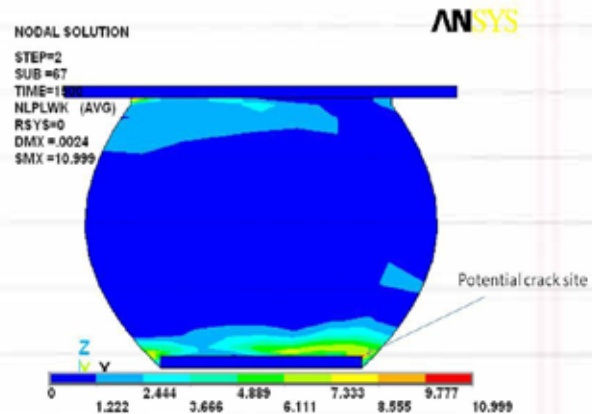


Figure 1: Damage accumulation in critical solder joint under thermal cycling loads

$$(\rho av)^2 + (.5 * v^2) 2 = (\rho av)^2 + (.5 * v^2) 2$$

$$(\rho av)^2 + (.5 * v^2) 2 = (\rho av)^2 + (.5 * v^2) 2$$

$$(P_{AV})^2 + (0.5P_{AV})^2 = (P_{AV})^2 + (0.5P_{AV})^2$$
$$(P_{AV})^2 + (0.5P_{AV})^2 = (P_{AV})^2 +$$

= HPC ++

BENEFITS

By adopting an HPC infrastructure to allow powerful ANSYS simulations to run efficiently and using Windows HPC Server 2008, the Reliability team will be able to offer significantly reduced computing times, the ability to consider highly-detailed models, the capacity to run multiple jobs simultaneously, and reduced outsourcing costs.

REDUCED COMPUTING TIME, ACCELERATED DECISION MAKING

The HPC solution reduced the turnaround time for a single Xbox simulation from 4 days to 12 hours. This speedup enabled the design team to consider multiple scenarios and still make product development decisions within the required project timeline. Using the in-house cluster, the team can react quickly to new design proposals and increase the productivity of the engineering process.

"HPC is a vital resource for product developers who need robust and accurate solutions to complex design problems. The combination of ANSYS software and cluster computing using Windows HPC Server 2008 enhances productivity and enables the insight required for successful design. Such HPC capacity can only increase the value of simulation in the engineering process — allowing engineers to work with higher-fidelity models, larger data sets, and perform complex analysis with shorter turnaround time."

*Dipankar Choudhury,
Vice President, Product Strategy, ANSYS, Inc.*

HIGH FIDELITY MODELING INSIGHT

The HPC solution enables the Microsoft team to perform detailed simulations and obtain insight that would be nearly impossible to obtain any other way. Using HPC, more detailed geometry and high-fidelity physical phenomena can be studied and understood, ultimately leading to better, more robust products.

CAPACITY

The Windows HPC Server 2008 cluster provides a scalable solution that is capable of expanding to address added simulation capacity. Initially deployed to run at least two simultaneous simulations, the cluster solution is easily expanded to grow with the team's simulation workload.

REDUCED COST

The HPC solution clearly helped the Reliability Engineering team to reduce the cost of outsourcing their most complex simulations, with outsourcing reduced from 80 percent to a target of 25 percent. Increased productivity of the engineering team, due to faster decision making, is also a key return on investment (ROI) associated with the in-house solution.

FURTHER INFORMATION

Microsoft Windows HPC Server 2008 is the next generation HPC solution from Microsoft. Building on the strengths of its predecessor, Windows Compute Cluster Server (WCCS) 2003, HPC Server 2008 provides customers with a compelling platform that enables them to deploy, manage, and sustain scalable, efficient HPC clusters while boosting the productivity of HPC system administrators and end users alike.

HPC Server 2008 combines the power of a 64-bit Windows Server platform with rich, out-of-the-box functionality to help improve the productivity, and reduce the complexity, of an HPC environment. HPC Server 2008 is unique in its ability to scale to a granular level easily and quickly.

For more information about Windows HPC Server 2008 and HPC please visit <http://www.microsoft.com/hpc>

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