

## VIRTUAL PERFORMANCE SOLUTION



Audi A4: Comfort testing  
with Dummies



# Audi excels in Safety standards with support from ESI Group and HP

Audi AG is a premium luxury automobile manufacturer and also one of the oldest-established German car manufacturers. Since 1899, Audi has been proposing attractive and sophisticated car models that embody technological perfection.

In 2008, Audi has delivered over 1 million vehicles worldwide, up 4.1% compared to 2007.

## Ensuring optimal safety standards

It is crucial for car manufacturers to ensure that their safety standards are always at an optimum to meet the stringent safety requirements of today's automotive industry. Audi, one of the safest vehicle manufacturers, is constantly implementing enhanced technology to perfect the safety of its cars.

## Benefiting from the best hardware and software technologies to build the fastest Supercomputer

Audi has recently invested in hardware and software to build the automotive industry's fastest supercomputer. This new system is based on ESI Group's PAM-CRASH simulation software and HP Cluster Platform 3000BL BladeSystem providing 29.18 teraflop/s of computing performance for Audi's crash simulation models. The HP Message Passing Interface (HP-MPI) provides the critical layer of middleware between PAM-CRASH and the InfiniBand fabric.

“ ESI products at large rely on HP-MPI for their message-passing layer. HP-MPI's performance, reliability and flexibility significantly help ESI deliver best value solutions to our customers. Recently, our flagship product PAM-CRASH set HP-MPI as the default MPI environment, while maintaining the support of others at the same time. ”

**Antoine Petitot, PhD, HPC lead of ESI's Computational Structure Mechanics Development Group, ESI Group.**

PAM-CRASH, ESI Group's flagship solution for crash simulation, offers realistic virtual testing across the extended enterprise. Audi's partnership with ESI Group has been primarily aimed at establishing and driving its global vehicle safety projects all over the world. **Audi has recognized the unparalleled computing efficiency and ease-of-use of PAM-CRASH and, as a result, the implementation has improved the reliability of its crash, safety and impact simulations.**

## The Challenge

- Safety standards at an optimum: meet the stringent safety requirements of Automotive industry
- Build the automotive industry's fastest supercomputer ever
- Help industrial partners improve their product lifecycle

## The Story

*“ESI Group consistently provides its customers with **affordable simulation turnaround time, greater accuracy and increasingly larger simulation models.** This versatility allows Audi to find a balance between performance and the increased number of realistically simulated design variations for the complete car range.”*

*Peter Ullrich,  
Crash, Impact and Safety Product Manager at ESI Group.*

## The Benefits

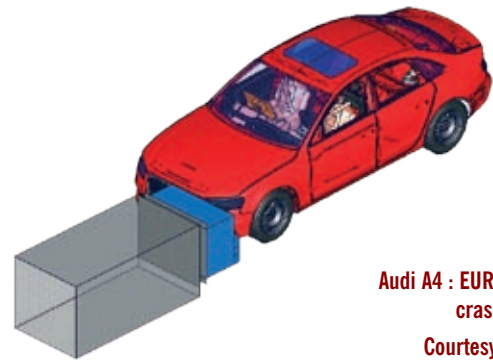
- Optimize car safety
- Improve the precision of crash, safety and impact simulations
- Guarantee an effective design process including vehicle safety analysis
- Save days of computing time and unnecessary costs

## Improving Product Lifecycle

ESI's software also helps industrial partners improve their product lifecycle while saving time and money. PAM-CRASH enhancements combined with compact, fast and power-efficient HP hardware have enabled Audi to run its refined models overnight, thus guaranteeing an effective design process that includes analyzing vehicle safety elements. The latest algorithms in the software have also encouraged Audi to raise its expectations for Simulation-Based Design. For example, airbag models now routinely take into account fluid-structure interactions, leading to realistic interactions of the airbag with structures and occupants. In addition, prediction testing for material rupture, which usually requires high resolution models, can now be treated using a multi-scale approach. All this helps save days of computing time and unnecessary costs.

HP support has also been essential in implementing technology that provides enhanced reliability, high server density and the tremendous computing power required to process the volume of simulation data generated. Audi installed the HP Cluster Platform 3000BL, a system built using 320 nodes based on HP ProLiant BL460c server blades and the InfiniBand cluster interconnect, as well as HP-MPI. This allows for high performance and production quality implementation of the MPI standard for the HPC (High Performance Computing) server. With this HPC system, the supercomputer implemented requires a quarter less floor space and consumes a quarter less power than a traditional rack-based configuration. In addition, the blade configuration provides simple hardware maintenance, cabling and system administration and has outstanding scalability.

The combination of ESI Group software and HP hardware has enabled Audi to implement the automotive industry's fastest supercomputer and at the same time maintain its position as one of the safest vehicle manufacturers in the world.



**Audi A4 : Euroncap front crash simulation**  
Courtesy of AUDI AG.

“ Providing Audi with a high-performance computing solution helps them design better and safer cars while reducing their power consumption and costs. HP has a long history of knowledge and expertise in providing automotive customers high-performance computing that fosters innovation. ”

**Paul Perez, Vice President, Scalable Datacenter Infrastructure, HP Enterprise Storage and Servers, Technology Solutions Group.**

## About AUDI AG

AUDI AG is a premium luxury German automobile manufacturer which is part of the Volkswagen Group since 1964. It manufactures exquisite cars – attractive, sophisticated and technically perfect. Audi's corporate tagline worldwide is "Vorsprung durch Techn" meaning "Advancement through Technology". For more information: [www.audi.com](http://www.audi.com)

## About HP

HP is a technology company that operates in more than 170 countries around the world. It offers a complete and comprehensive technology product portfolio to consumers from digital photography to digital entertainment and from computing to home printing. For more information: [www.hp.com/go/cae](http://www.hp.com/go/cae)

## About ESI Group

ESI Group is a world-leading supplier and pioneer of digital simulation software for prototyping and manufacturing processes that take into account the physics of materials. ESI Group has developed an extensive suite of coherent, industry-oriented applications to realistically simulate a product's behavior during testing, to fine-tune manufacturing processes in accordance with desired product performance, and to evaluate the environment's impact on product performance. ESI Group's products represent a unique collaborative and open environment for Simulation-Based Design, enabling virtual prototypes to be improved in a continuous and collaborative manner while eliminating the need for physical prototypes during product development. The company employs over 700 high-level specialists worldwide covering more than 30 countries. ESI Group is listed in compartment C of NYSE Euronext Paris. For further information, visit [www.esi-group.com](http://www.esi-group.com).



**ESI GROUP HEADQUARTERS**  
ESI Group  
100-102 Avenue de Suffren  
75015 Paris  
France  
Phone: +33 (0)1 53 65 14 14  
Fax: +33 (0)1 53 65 14 12

**ESI Group**  
Parc d'Affaires Silic  
99 rue des Solets - BP 80112  
36800 Woodward Avenue  
Suite 200  
Bloomfield Hills, MI 48304  
USA  
Phone: +1 (248) 203 0642  
Fax: +1 (248) 203 0636

**ESI Group**  
Parc d'Affaires Silic  
99, rue des Solets - BP 80112  
326 00 Pilzen  
Czech Republic  
Phone: +420 377 432 931  
Fax: +420 377 432 930

**ESI FRANCE**  
Parc d'Affaires Silic  
99, rue des Solets - BP 80112  
36800 Woodward Avenue  
Suite 200  
Bloomfield Hills, MI 48304  
USA  
Phone: +33 (0)1 49 78 28 00  
Fax: +33 (0)1 46 87 72 02

EUROPE				SOUTH AMERICA			
<b>CZECH REPUBLIC &amp; EASTERN EUROPEAN COUNTRIES</b> MECAS ESI s.r.o. Brojova 2113/16 326 00 Pilzen Czech Republic Phone: +420 377 432 931 Fax: +420 377 432 930	<b>FRANCE</b> ESI FRANCE Parc d'Affaires Silic 99, rue des Solets - BP 80112 36800 Woodward Avenue Suite 200 Bloomfield Hills, MI 48304 USA Phone: +33 (0)1 49 78 28 00 Fax: +33 (0)1 46 87 72 02	<b>GERMANY</b> ESI GmbH Sales & Technical Headquarters Mergenthalerallee 15-21 D-65760 Eschborn Germany Phone: +49(0)6196 9583-0 Fax: +49(0)6196 9583-111	<b>ITALY</b> ESI Italia srl Via San Donato 191 40127 Bologna Italy Phone: +39 0516335577 Phone: +39 0516335578 Fax: +39 0516335601	<b>SPAIN</b> ESI GROUP HISPANIA, S.L. Parque Empresarial Arroyo de la Jega C/ Francisco Delgado, 11 - planta 2ª 28108 Alcobendas (Madrid) Spain Phone: +34 91 484 02 56 Fax: +34 91 484 02 55	<b>SWITZERLAND</b> Calcom ESI Parc Scientifique EPFL / PSE-A 1015 Lausanne-EPFL Switzerland Phone: +41 21 693 2918 Fax: +41 21 693 4740	<b>UNITED KINGDOM</b> ESI-UK Ltd. The Magdalen Centre Oxford Science Park Oxford OX4 4GA United Kingdom Phone: +44 (0) 1865 784 829 Fax: +44 (0) 1865 784 004	<b>BRAZIL</b> ESI Group South America Technical Support Office Rua Artur de Azevedo, 1857 cj. 45 São Paulo - SP 05404-015 Brazil Phone/Fax: +55 11 3062-3698
NORTH AMERICA				ASIA			
<b>USA</b> ESI North America Commercial Headquarters 36800 Woodward Avenue Suite 200 Bloomfield Hills, MI 48304 USA Phone: +1 (248) 203 0642 Fax: +1 (248) 203 0636	<b>USA</b> ESI US R&D 6767 Old Madison Pike Suite 600 Huntsville, AL 35806 USA Phone: +1 (256) 713-4700 Fax: +1 (256) 713-4799	<b>CHINA</b> ESI-ATE Holdings Limited Room 16A, Base F Fu Hua Mansion No. 8 Chaoyangmen North Avenue Beijing 100027 China Phone: +86 (10) 6554 4907 Fax: +86 (10) 6554 4911	<b>CHINA</b> ZHONG GUO ESI CO., LTD Unit 401-404, bldg G, Guangzhou Soft-Park No. 11, Cainpi Road, Guangzhou Science City (GSC) Guangzhou 510663 China Phone: +86 (020) 3206 8272 Fax: +86 (020) 3206 8107	<b>INDIA</b> ESI India Indrakrupa #17, 100 feet ring road 3rd phase, 6th block, Banashankari 3rd stage Bangalore 560 085 India Phone: +91 98809 26926 Fax: +91 80401 74705	<b>JAPAN</b> NIHON ESI K.K. Headquarters and Sales Division 5F and 16F Shinjuku Green Tower Bldg 6-14-1, Nishi-Shinjuku Shinjuku-ku, Tokyo 160-0023 Japan Phone: +81 3 6381 8490 Fax: +81 3 6381 8488	<b>KOREA</b> Hankook ESI 157-033, 5F MISUNG Bldg., 660-6, Deungchon-3Dong, Gangseo-ku, Seoul South Korea Phone: +82 2 3660 4500 Fax: +82 2 3662 0084	<b>SOUTH-EAST ASIA</b> ESI Group South-East-Asia Office 12A-2, Persiaran Puteri 1 Bandar Puteri Puchong 47000 Puchong, Selangor Malaysia Phone: +603-80607993 Fax: +603-80607861