

# IBM Automotive Engineering Innovation Framework

*Integrated infrastructure for product innovation*

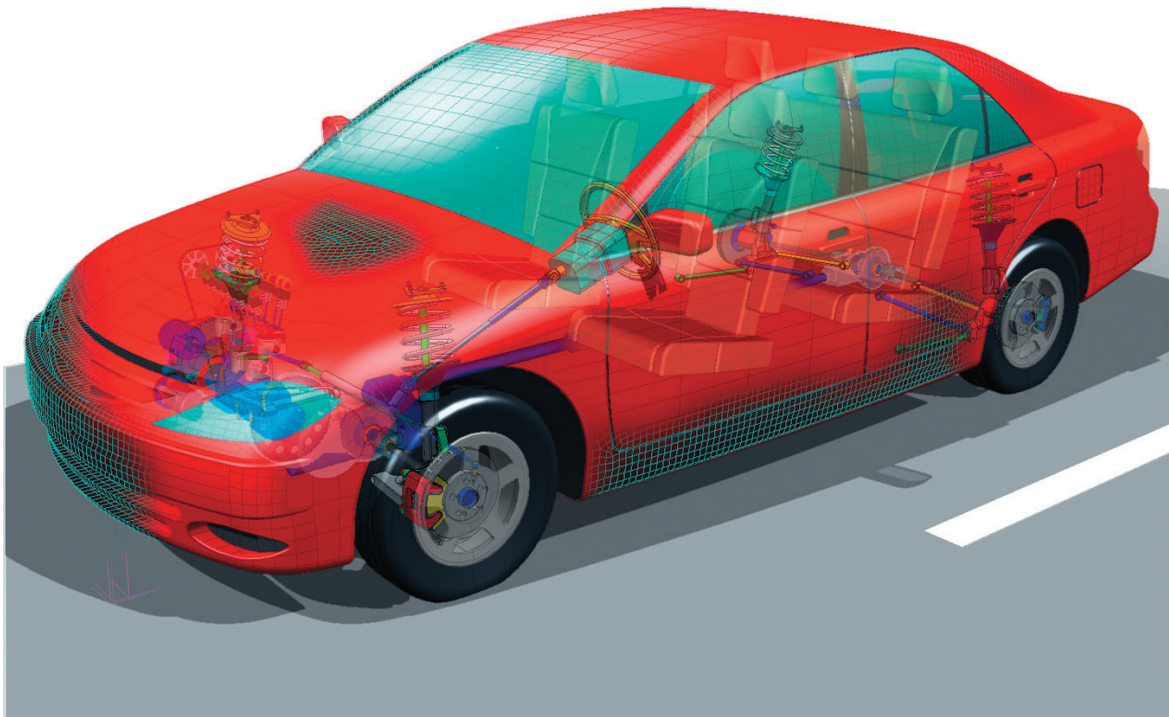


Image provided by MSC.Software

## **An on demand PLM infrastructure framework for the future**

Like most other industries, the pace in the automotive industry is accelerating at an astonishing rate. Consumers expect much more for less money. Facing fierce competition, automotive manufacturers subsidize sales with attractive incentives that erode profits. Besides low-cost financing and higher rebates, vehicle recalls also contribute to profit erosion.

A recent strategic review of automotive product development practices indicates that the demand to develop more vehicles with less budget will continue well into the next decade. In an effort to restore eroded profits, automotive manufacturers are striving to improve efficiency and cut costs, such as by introducing more vehicles with greater reuse than ever before and by deploying new and innovative forms of collaboration, in particular with their suppliers. The winners in the marketplace will be those who have a flawless execution of the right strategy. This has put a tremendous pressure on the engineering departments of automobile manufacturers and suppliers and has strained the information technology (IT) infrastructures that support them.

Automotive companies have to shrink the time to market for new vehicles and hence the time for product design and development. One of key areas to address in achieving this acceleration is the analysis and simulation process in which engineers collaborate closely with designers in an iterative design/analysis cycle. Because of the increasing number of vehicles, vehicle variants, shorter product lifecycles, and the increasing number of boundary conditions imposed by government regulations, engineers have to perform more complex analysis in less time. This has led to increased reliance on virtual prototyping and testing to replace the more traditional physical prototyping and testing. Simulation and analysis in this virtualized world is complex and involves a wide variety of technologies. Current Computer-Aided Design (CAD) and Computer-Aided Engineering (CAE) environments are typically fragmented, with islands of resources managed independently and dedicated to specific workloads. As a result, the engineering staff has to manually combine the capabilities of multiple disparate systems and manually exchange data between them. These are tedious, time-consuming and error-prone tasks.

IBM has been a provider of world-class PLM solutions for automotive companies for many years. The solutions are based on Design and Lifecycle Management application software developed by Dassault Systemes, such as CATIA and ENOVIA, and highly tuned IBM hardware and middleware. IBM PLM solutions provide a broad range of capabilities to support product development, design and innovation. These capabilities enable an automotive enterprise to effectively and efficiently innovate and manage the overall product lifecycle, from inception to end of life. In addition to PLM design solutions, IBM is a major provider of high performance computing capabilities in support of analysis and simulation workloads, and is a leader in advanced computing solutions such as grid and process integration.


Now IBM is bringing all these capabilities together into an architectural framework—called the Automotive Engineering Innovation Framework (AEIF)—that is based on and leverages the IBM on demand operating environment. AEIF provides an integrated and simplified way to combine and leverage advanced and evolving technology for complex CAE and

design environments. The business benefits are compelling and can potentially include:


- Reduction in analysis and simulation time and effort to reduce engineering cost and increase productivity
- More informed decision-making through introduction of predictive power early in the development process
- Improved collaboration across a dynamically changing value chain through synchronous collaboration using methodology standards
- Increased ability to reuse knowledge and maximize return on investment
- Improved protection of intellectual property through a collaborative extended value net
- Access to supercomputing power on an “as needed” basis that can help save costs and speed time to market
- Enhanced product quality and innovation

New technology provides capabilities that, together, can address these demands


**Core technology components**




High performance 64-bit computing platforms...




Large symmetric and/or distributed multiprocessing clusters...



High density blade servers...

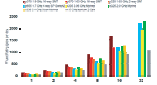


Advanced data storage capabilities...




Open source operating environments...


**Solution integration components**




Application integration and optimization




Grid computing and resource virtualization....



'Capacity on Demand'



Simulation Data & Process Management / Design optimization



Low cost advanced visualization solutions...

**An innovative foundation**

IBM has long been recognized as an industry leader in advancing technology and currently offers a wide range of industry-leading technologies. IBM has leveraged these technologies in the AEIF, both in the core components of the infrastructure and in the integration of processes, data and resources supported by the infrastructure.

IBM realizes that although advanced technologies are essential, automotive companies need more. They need to be able to

combine and leverage these technologies within an integrated framework on which they can build solutions that address their particular problems. And they want help to do this quickly and cost-effectively. That's precisely what AEIF can provide.

AEIF is based on a high-performance systems infrastructure designed to seamlessly support numeric and data intensive business processes along with their respective software applications and deliver results to enterprise users over a

network of services. Several factors distinguish AEIF from traditional approaches to automotive engineering infrastructure, including:

- **Integrated.** Consolidates separate workloads, software applications, systems and middleware into a unified, holistic computing environment.
- **Virtualized.** Takes advantage of advanced compute and storage virtualization techniques to help deliver power and capacity when and where it's needed, without over-buying resources.
- **Shared.** Simultaneously serves multiple users and workloads in a flexible and automated fashion.
- **Standardized.** Built on open standards supporting multi-vendor hardware and software integration.
- **Scalable.** Provides scale up, scale-out multi-site and multi-cluster support, with the option of additional deep computing capacity on demand from IBM.
- **Services-oriented.** Built on services-oriented architecture to maximize flexibility and facilitate application development.

Key to the innovative capabilities delivered by AEIF is its use of advanced IBM storage and compute virtualization technologies. Virtualization enables organizations to get the storage capacity and computing power they need—including deep computing performance—cost-effectively and with efficient utilization of IT resources.

### **Storage virtualization**

Because storage is typically fragmented across multiple analysis and simulation applications, storage devices may be inefficiently deployed and difficult for system administrators to visualize, manage and optimize. AEIF helps simplify storage administration with automated storage management and storage virtualization, which pools storage resources and automatically and dynamically allocates them to workloads.

The IT staff can manage the infrastructure using Storage Infrastructure Management software, control growth with Hierarchical Storage Management software, manage cost with Archive Management software and facilitate recoverability with Recovery

Management software. This advanced software allows the IT staff to manage more storage with fewer administrators. Companies can also deploy IBM TotalStorage® SAN Volume Controller to simplify and centrally manage pools of heterogeneous storage. And they can deploy the IBM TotalStorage SAN File System that can help clients to lower the cost of storage management and enhance productivity by providing centralized and policy-based storage and data management for heterogeneous server, OS and storage platforms.

IBM is pursuing a key objective in AEIF storage, which is to provide a federated storage environment that integrates simulation data management and product data management. The federated storage environment can help organizations tighten the integration of design, simulation and analysis to reduce cycle times and improve the integrity of the processes.

The combination of storage virtualization and automated storage management can help automotive companies manage storage efficiently, contain storage costs, eliminate time-consuming data administration tasks currently performed by engineers, and maintain the integrity of models to help ensure simulation validity.

### **Computer virtualization (engineering grid)**

Like storage resources, compute resources are also fragmented across various platforms and engineering centers, resulting in inefficient deployment and complex systems management. This problem is particularly odious in automotive engineering environments because design, analysis and simulation applications require a mixture of computing architectures including large clusters that are comprised of many smaller systems or nodes. These expensive resources are often sized based on peak loads, which can result in inefficient utilization and significantly higher costs.

AEIF has the potential to virtualize computing resources into an engineering grid from which it can dynamically allocate required resources to workloads. It can manage resources and workloads according to defined business policies and priorities, sharing computing power across the enterprise based on service-level objectives and business policies.

In addition, AEIF clients can take advantage of the IBM Deep Computing Capacity on Demand (DCCoD), a recent IBM innovation that provides supercomputing power to clients over the Internet.

DCCoD offers scalable computing resources that clients can access on a pay-as-you-go basis via a VPN connection over the Internet. With DCCoD, clients can enjoy the power of a super-computer without having a large super-computer budget.

### **Building on the foundation**

Once the AEIF foundation is in place, clients can build solutions that address the complete design, simulation and analysis process. These include PLM solutions for data management, CAD/CAE integration, process integration and design optimization, CAE application optimization and Deep Computing Visualization.

### **AEIF solution offerings**

- CAD/CAE integration
- Deep computing visualization
- CAE application optimization
- Deep Computing Capacity on Demand
- Process integration and design optimization
- Simulation data management

### **AEIF foundation**

- Compute virtualization (engineering grid)
- Storage virtualization

### **Simulation data management**

A major challenge that automotive engineering organizations face is controlling and managing the huge volumes of data generated by design, analysis and simulation processes. Traditionally, engineers have had to perform these functions manually, taking a considerable amount of their time and hampering their ability to locate and reuse historical data. To address this challenge, the IBM AEIF framework is open and will incorporate specialized data management or storage management software from partners and IBM. Examples include:

- *SimManager from MSC.Software.* Simplifies the management of analysis data at the object level and helps to eliminate laborious file check-in/out procedures. SimManager provides the capability to track the sequence of steps performed during the course of a simulation.
- *IBM DB2® Content Manager.* Provides transaction, security, process integration and services to manage all types of digitized content—including HTML and XML Web content, document images, electronic office documents, printed output, digital audio and video.

IBM has initiated a proof of concept with MSC.Software to provide solutions that permit federated access to simulation data that are scattered across multiple sites. These solutions provide a systematic approach and the supporting infrastructure to manage all processes and data related to simulation of a virtual product. The solutions free engineers from the task of managing the data while enabling them to easily find and reuse valuable enterprise data.

IBM is working to extend the data management capabilities within AEIF to include integration with product data management solutions such as ENOVIA, developed by Dassault Systemes.

(ENOVIA comprises a set of products for managing and distributing design data and knowledge.) Consolidating the management of simulation and product data further simplifies data administration and helps streamline the interaction between design and engineering.

#### **CAD/CAE integration, process integration and design optimization**

The development cycle involves iterative interaction between designers and engineers. The problem is that the design

process is supported by different software applications than those supporting analysis and simulation. As a result, engineers have to manually transform design model data into a form usable by the analysis and simulation applications, and then retransform the output back to a form usable by the design applications. Since the data is complex and extremely voluminous, engineers have to spend a considerable amount of time in data translation and retranslation, introducing long delays into the analysis process. Moreover, the design data may have become obsolete during the long translation process, causing engineers to perform analysis and simulation on inaccurate data.

Working with leading ISVs such as Engineous Software, MSC.Software and Dassault Systemes, IBM is applying innovative on demand technologies to enable the automation, integration and optimization of the iterative design and analysis processes. These technologies can help clients exploit the full power of new simulation techniques such as stochastic analysis. By integrating CAD and CAE processes, IBM can help automotive clients reduce their design and development times to achieve a fast time to market while at the same time helping them improve product quality.

#### **CAE application optimization**

Currently, automotive engineers have to work with multiple CAE applications, such as crash simulation and impact analysis, computational fluid dynamics, structural, durability, thermal, kinematics and NVH (noise, vibration and harshness) analysis resulting in fragmented and error-susceptible islands of information. To address the problem, IBM is working with major CAE vendors to provide an integrated platform for CAE and CAD application suites. These offerings are being built on and optimized to leverage the breadth of the IBM hardware portfolio and the broad and deep expertise of the IBM Deep Computing and PLM teams.

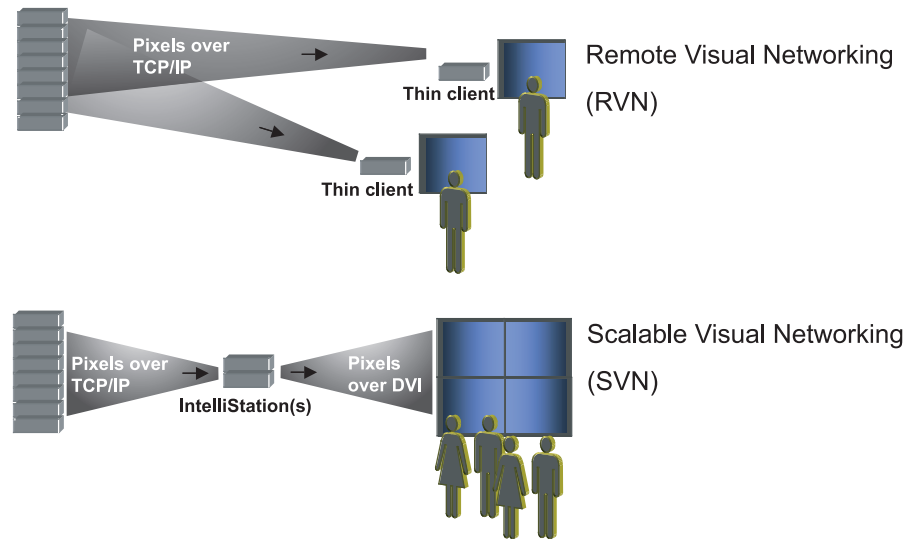
There are a variety of technology options available to clients on which to run their CAE software applications. These include Shared Memory Processing, Distributed Memory Processing clusters, and choices of processor architecture, interconnect and I/O technologies. IBM has expertise in all the major CAE software applications and can help clients select an optimized system for multiple CAE applications based on clients' performance requirements and budgets.

## IBM Deep Computing Visualization

Because of the complexity of automotive analysis and simulation, visualization of results requires high performance computing (HPC) capabilities. Traditionally, high-end visualization has been provided by special purpose, high-performance graphics computers, significantly driving up the cost of visualization facilities. As a result, those companies that can afford these facilities have typically implemented a very small number of caves or viewing stations, requiring engineers and designers to manually transfer design data and travel to the sites for design review. This introduces delays and further drives up cost.

IBM is taking a new and innovative approach to visualization that combines integrated high performance computing and real-time visualization with independent scaling for each subsystem component. The result is real-time, high-resolution at low cost. With this approach, IBM should be able to provide two functional capabilities for large-scale visualization—scalable visual networking and remote visual networking. Scalable visual networking should potentially permit clients to implement high-end visualization

## Two Functional Capabilities for Deep Computing visualization.



facilities at much lower cost. Remote visual networking allows clients to distribute remote visualization stations globally to permit virtualized collaboration in real time.

In developing its deep computing visualization solution, IBM is pursuing the following objectives:

- Facilitate collaboration, either remote or local (immersive)
- Permit scale-up of clusters, users, problem size, display size and resolution

- Manage applications data, hardware and software centrally
- Provide modularity to support hybrid solutions (mix-n-match)
- Offer updateable components such as graphics and network hardware
- Provide investment protection through interoperability with existing IT infrastructures
- Deliver attractive price/performance



## Delivering the solution

To help clients implement AEIF-based solutions, IBM has established AEIF Centers of Innovation in Europe and Michigan. Through these centers, clients can tap into the expertise of IBM and its Business Partners in a variety of ways, including:

- **Technology briefings.** Sessions that can help clients understand the implications of the new technologies and how they can deliver value. Includes demonstrations of real-world solutions to typical engineering integration and collaboration scenarios.
- **ISV workshops.** Joint workshops with leading CAE ISVs to identify opportunities to exploit the AEIF and deliver added value to clients.
- **Design workshops.** In-depth workshops to analyze specific client problems and provide high-level solution designs.
- **Proof-of-concept projects.** Full realization of solution scenarios to prove viability and reduce implementation risks.
- **Implementation services.** Help in transforming proof-of-concept solutions into production environments.

## For more information

For more information on how AEIF can help companies meet the challenge of engineering in today's automotive industry, see [www-1.ibm.com/industries/automotive/us/en/contacts](http://www-1.ibm.com/industries/automotive/us/en/contacts)



© Copyright IBM Corporation 2005

IBM Systems and Technology Group  
Route 100  
Somers, NY 10589

Produced in the United States of America  
January 2005  
All Rights Reserved

IBM reserves the right to change specifications or other product information without prior notice. This publication could include technical inaccuracies or typographical errors. References herein to IBM products and services do not imply that IBM intends to make them available in other countries. IBM PROVIDES THIS PUBLICATION "AS IS" WITHOUT WARRANTY OR CONDITION OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING THE IMPLIED WARRANTIES OR CONDITIONS OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Some jurisdictions do not allow disclaimer of express or implied warranties in certain transactions; therefore, this statement may not apply to you.

The material included in this document regarding third parties is based on information obtained from such parties. No effort has been made to independently verify the accuracy of the information. This document does not constitute an expressed or implied recommendation or endorsement by IBM of any third-party product or service.

Visit [ibm.com/servers/deepcomputing](http://ibm.com/servers/deepcomputing) periodically for the latest information.

IBM, the IBM logo, DB2 and TotalStorage are trademarks of IBM Corporation in the United States, other countries, or both. For a list of additional IBM trademarks visit [ibm.com/legal/copytrade.shtml](http://ibm.com/legal/copytrade.shtml).

Other company, product and service names may be trademarks or service marks of others.