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COVER STORY

Microsoft Windows

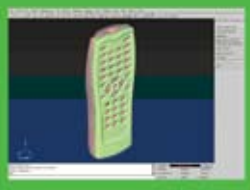
Compute Cluster Server 2003 FAQ

PRODUCT SPOTLIGHT

eta/VPG

Transitioning from

FEMB to VPG



CONFERENCE SPOTLIGHT

LSTC

9th International

LS-DYNA Users Conference

June 4-6, 2006 Dearborn, MI

FEA Information Worldwide Participants

Contents

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FEA Information Announcements

New Participant Article:

Microsoft Windows Compute Cluster Server 2003 FAQ and “The Future of Computing in the Sciences” remarks by Bill Gates.

9th International LS-DYNA Users Conference - June 4-6, 2006

- Rouge Factory Tour
- Agenda

ETA Announcement and read this month’s article

Transitioning from FEMB to VPG
By Tim Palmer, Director, VPG Business Development

Sincerely,
Trent Eggleston & Marsha Victory

Microsoft Windows Compute Cluster Server 2003 FAQ

"The Future of Computing in the Sciences"

Remarks by Bill Gates, Chairman and Chief Software Architect, Microsoft Corporation
SC05 (Supercomputing 05 Conference) Seattle, Washington - November 15, 2005
"Transcript courtesy of Microsoft."

Microsoft Windows Compute Cluster Server 2003: Frequently Asked Questions

What is Microsoft Windows Compute Cluster Server 2003?

Microsoft Windows Compute Cluster Server 2003 is an integrated, standards-based compute clustering platform built on top of Windows Server 2003 x64 Edition.

Windows Compute Cluster Server 2003 is comprised of two CDs. The first CD is Windows Server 2003 Compute Cluster Edition (CCE), and the second CD is the Microsoft Compute Cluster Pack (CCP)—a combination of interfaces, utilities, and management infrastructure that makes up Windows Compute Cluster Server 2003.

What is Microsoft's vision for Windows Compute Cluster Server 2003?

Microsoft's goal is to empower end users by allowing them to easily harness distributed computing resources to solve complex problems. The beta version of Windows Compute Cluster Server 2003 is the first step in that effort. With subsequent versions, Microsoft will continue to focus on making distributed computing resources easier to use, more efficient to deploy, and less expensive to operate.

On what platform is Windows Compute Cluster Server 2003 supported?

Windows Compute Cluster Server 2003 is based on Windows Server 2003 Standard x64 Edition and can only be installed on 64-bit hardware.

How do I obtain Windows Compute Cluster Server 2003?

The second beta release of the product can be downloaded by following the instructions on the Windows Compute Cluster Server 2003 Beta Program page.

Are there minimum hardware requirements for Windows Compute Cluster Server 2003?

Minimum hardware requirements can be found on the Windows Compute Cluster Server 2003 system requirements page.

Is Windows Compute Cluster Server 2003 considered a Microsoft high-availability solution?

No. "High availability" describes systems designed for fault tolerance. Windows Compute Cluster Server 2003 is designed to support scientific and technical high-performance computing

applications that take advantage of parallel processing.

Are there any Windows Hardware Quality Labs (WHQL) certification requirements for Windows Compute Cluster Server 2003?

Windows Compute Cluster Server 2003 hardware requirements are identical to the requirements for 64-bit versions of Windows Server 2003.

Will my 32-bit application run on Windows Compute Cluster Server 2003?

Although Windows Compute Cluster Server 2003 requires 64-bit computers for use as compute nodes, 32-bit applications running on 64-bit compute nodes is a fully supported configuration. The 32-bit application will not be able to use the larger memory-addressing available on the compute node, but it will run. Developers will find both 32-bit and 64-bit Microsoft Message Passing Interface (MPI) libraries included in the Windows Compute Cluster Server 2003 Software Development Kit (SDK).

Will my current UNIX- or Linux-based applications run on Windows Compute Cluster Server 2003?

The application vendor will need to make that determination. Windows Compute Cluster Server 2003 can take advantage of the 64-bit version of Services for UNIX (SFU) 3.5. This may be required to run UNIX or Linux applications.

Will there be a 32-bit version of Windows Compute Cluster Server 2003?

There are no plans at this time to release a 32-bit version of Windows Compute Cluster Server 2003.

Is licensing different for Windows Compute Cluster Server 2003?

Licensing for Windows Compute Cluster Server 2003 will be restricted to computers that are used as dedicated computational servers only. Customers wishing to use compute nodes for other purposes (for example, using a cluster head node as a database server) should purchase the appropriate version of Windows Server 2003 x64 Editions (Standard, Enterprise, or Datacenter) for installation on those nodes. The cluster management components encapsulated in the Microsoft Compute Cluster Pack support installation on all editions of Windows Server 2003 x64

Will Windows Compute Cluster Server 2003 run on Windows Server 2003 R2?

Yes. The Microsoft Compute Cluster Pack (in other words, the second CD of the two CDs that make up Windows Compute Cluster Server 2003) can be purchased separately and will run on 64-bit versions of Windows Server 2003 R2.

Will Windows Compute Cluster Server 2003 run in a corporate/managed network?

Yes. Windows Compute Cluster Server (CCS) 2003 supports the security requirements for these environments by leveraging Active Directory directory service for user authentication. CCS also provides a Microsoft Management Console plug-in that simplifies managing the head node and compute nodes, which make up a compute cluster.

Now, tools such as Microsoft Operations Manager (MOM) and Microsoft Systems Management Server (SMS) can be used to manage CCS.

Are there special networking requirements for Windows Compute Cluster Server 2003?

There are no special networking requirements for Windows Compute Cluster Server 2003. However, the product is designed to take advantage of high-speed networking technologies such as Gigabit Ethernet, Infiniband, 10 Gigabit Ethernet, Myrinet, and other interconnects by way of the Microsoft Windows Sockets Direct Interface.

Do I need to use the Microsoft Message Passing Interface (MS MPI) stack with my applications?

Windows Compute Cluster Server 2003 will come with the Microsoft Message Passing Interface (MS MPI), an MPI stack based on the MPICH2 implementation from Argonne National Labs. Windows CCS 2003 will also work with other MPI stacks written to the MPI2 standard.

Do I need to use the job scheduler that comes with Windows Compute Cluster Server 2003?

It is recommended that the Microsoft job scheduler be used with Windows Compute Cluster Server 2003. However, there are also third-party job schedulers that will work with Windows Compute Cluster Server 2003.

Can I use the Command-Line Interface (CLI) to schedule jobs in Windows Compute Cluster Server 2003?

Yes. Use of the command line to create and submit jobs is supported. The command-line interface also supports submission of jobs to the scheduler by script or batch file.

Can I automate the installation of compute nodes?

Yes. Windows Compute Cluster Server 2003 compute nodes can be deployed using Remote Installation Services (RIS), which is included with Windows Compute Cluster Server 2003.

How can I back up my head node and compute nodes?

Customers can use Windows ntbackup to back up Windows Compute Cluster Server 2003 head nodes and compute nodes. Third-party backup applications that are certified to run on Windows Server 2003 products can also be used to back up Windows Compute Cluster Server 2003 nodes.

Can there be more than one head node per Windows Compute Cluster Server 2003 cluster?

Each 'individual' cluster can have only one head node.

Does Windows Compute Cluster Server 2003 support high-availability failover for the head node?

Version one of Windows Compute Cluster Server 2003 does not support head-node failover. However, high-availability functionality is being considered for future versions. Windows supports a number of techniques for recovering from a system failure, from using backup utilities to using disk mirroring.

Is there a maximum number of compute nodes that I can configure in a cluster based on Windows Computer Cluster Server 2003?

There is no limit to the number of nodes in a Windows Compute Cluster Server 2003 cluster except for the number of hardware systems and node interconnects available, and the demands placed on the infrastructure by the applications running across the nodes.

Can I use the full version of Microsoft SQL Server 2000 with Windows Compute Cluster Server 2003?

Version one of Windows Compute Cluster Server 2003 comes with the Microsoft SQL Server Desktop Engine (MSDE 2000), which is installed by default and is used to track jobs. Due to licensing restrictions, customers cannot install the full version of SQL Server on compute nodes running Windows Compute Cluster Server 2003. Customers wishing to install full versions of SQL Server should purchase Windows Server 2003 x64 Standard, Enterprise, or Datacenter Edition. The Microsoft Compute Cluster Pack supports installation on these platforms.

Do I need to use Windows Services for UNIX (SFU) with Windows Compute Cluster Server 2003?

Services for Unix (Services for UNIX-based Applications—SUA—in Windows Server 2003 R2) is not required to use Windows Compute Cluster Server 2003. SUA may be helpful in building and porting high-performance computing applications to Windows. More information on SFU 3.5 can be found at the Windows Services for UNIX Web site.

Which programming languages are used to develop applications for a Windows-based cluster?

Supported programming languages for Microsoft MPI are Fortran77, Fortran90, and C. However, customers can use any language or scripting facility available from Microsoft or a Windows-oriented independent software vendor (ISV) to create and control applications on a compute cluster.

Can I run interactive programs on Windows Compute Cluster Server 2003?

Windows Compute Cluster Server 2003 can be operated as a back end for a number of interactive parallel-computing programs with graphic user interfaces. How this is done and how tightly coupled the parallel processes are depends on the individual program.

Are special techniques required for creating applications that will run on a Windows-based cluster?

No, but it should be kept in mind that an application started from a scheduler must be able to run unattended, with input from a file or a built-in default. This is a common requirement for any application run in batch mode or in the background. Interactive programs can run on Windows Compute Cluster Server 2003, but in this case, the scheduler is called by the application, which acts as a front end. A session-type application of this kind must have an interface to the scheduler and also a way to display the output.

Where can I find a list of applications that can be run off the shelf on a Windows-based cluster?

Microsoft is currently working with its partners to port key applications to Windows Compute Cluster Server (CCS) 2003. A list of applications compatible with Windows Compute Cluster Server 2003 will be available at product launch time. In the interim, visit the high-performance computing partners page for a list of Microsoft CCS partners. For information on a specific application, please contact the vendor. For general information about an application area, please send e-mail to HPCinfo@microsoft.com.

Can Switched Ethernet be used to link the servers in a compute cluster together?

Yes. In general, the lower the performance of the interconnect (both bandwidth and latency), the greater the requirement to limit inter-node communication—that is, to move from a tightly-coupled formulation of a problem to a loosely-coupled formulation. Many applications do not require tight coupling. For example, when you simultaneously run 100 SAS analyses, you are in fact running 100 independent jobs with no dependence on microsecond-level communication between the nodes during the computation. That said, most traditional massively parallel, scientific-related applications do rely on high-performance interconnect and will require significant investment in node interconnect.

How does a Windows-based compute cluster compare with a cluster running UNIX or Linux?

There is little substantive difference, but UNIX-based solutions should be fully ported to Windows to realize the full benefits of the Windows operating system. There are several differences between UNIX-based operating systems and Windows. For example, I/O operations and threading are different on UNIX-based systems than they are on Windows. I/O intensive applications will benefit from using Windows native I/O APIs rather than UNIX style I/O APIs.

Is the architecture of the cluster peer to peer, or does one server act as a scheduler and control point?

The head node hosts the scheduler, which dispatches tasks to the compute nodes. A parallel application (as opposed to multiple serial applications running in a parametric sweep) runs as a distributed application with a process on each of the nodes—one of them a master process that spawns the others and handles input and output files. When a massively parallel application has been started on all nodes, it can effectively be running peer to peer with its other instances on the other nodes.

Founded in 1975, Microsoft (Nasdaq “MSFT”) is the worldwide leader in software, services and solutions that help people and businesses realize their full potential.

Excerpt Remarks by Bill Gates -"The Future of Computing in the Sciences" Excerpt - The complete Transcript can be found at:

http://www.microsoft.com/billgates/speeches/2005/11-15SuperComputing05.asp

"…Computational Modeling" Now, of course, at the core of lots of supercomputing has been the idea of modeling things computationally and doing that at a finer and finer level of detail. And that leads to this really unbelievable demand for computation. Many of these problems are of the type that can be parallelized in a very straightforward way. And so the arrival of lots of low-cost microprocessors, the ability to connect those together with a fairly high-speed data network has led to an exciting new way of thinking about running these high-end applications. More and more things run against lots and lots of these microprocessor-based systems. That's complementary, of course, to the problems that require vector supercomputing, and we'll have a mix of those two techniques there.

We see as a key trend here is that we'll have supercomputers of all sizes, including one that will cost less than $10,000 and be able to sit at your desk or in your department and be very, very accessible, and you'll be able to use that for preliminary results or simple problems and yet will have an architectural continuity that means that when you want to take that same computation and do it with a finer level of detail, submitting it off to a cluster that's dramatically larger and can do more will be extremely straightforward. So we need an approach here that scales from the smallest supercomputer that will be inexpensive up to the very largest.

Now, the grains inside these machines more and more will be multi-core type devices, and so the idea of parallelization won't just be at the individual chip level, even inside that chip we need to explore new techniques like transactional memory that will allow us to get the full benefit of all those transistors and map that into higher and higher performance.

Technical Computing - So the computational modeling piece is a very important piece, but I think in terms of where software can help out, where we can do a better job, we should think about the entire workflow. In a sense, one way to measure this is to say, what is the time to insight? If you're a scientist who wants to gather a lot of information, compute around that information, look into that information, how can we make all the steps involved there far more efficient than they are today? And here we can see that for many problems the man hours involved in terms of changing the data formats and bringing up the different software tools and trying to see what the data is saying, that's the overwhelming percentage, and breakthroughs there would have incredible leverage, even beyond just the part about the computational modeling.

And so now we need to take the techniques that have been developed for things like business intelligence and data mining that goes on around that and think how we can apply those in these realms as well, how we can take every step of the process and have it be very visual and only require as much software understanding as is absolutely necessary…."

Transitioning from FEMB to VPG – New Opportunities for LS-DYNA PC Users

By Tim Palmer, Director, VPG Business Development, ETA Software, Inc.

When someone undergoes some sort of transition, they often see this as a time to reflect, and think about the paths chosen, the bigger picture view of just what's been accomplished, and thoughts about what the future may bring.

That's the way I've been looking at the current migration of FEMB to eta/VPG. With a bit of reflection and anticipation, let me explain the decision to make this migration to eta/VPG.

Thinking back to 1996, these past 10 years have drastically changed the engineering simulation environment. We were using computers like the SGI Power Challenge, Digital RISC workstations and HP730 workstations to build our finite element models. Those models were reaching limits we'd never seen before – 150,000 elements! We'd construct those models over a period of weeks using a team of engineers, and then run simulations that would require days to complete. A gigabyte hard drive has a luxury, with a price tag of $2,000.

Also in that time there was an emerging trend; PCs for high performance computing applications. Of course, if we heard of someone using a PC for finite element analysis, *we knew* they weren't serious simulation people, or were in some academic environment. In our minds PCs were for WordPerfect and email. Even though the speed of the PCs of that time were only in the 100's of MHz., and memory was still very expensive, we all new that the time would come when PCs would be accepted for advanced simulation work.

With that as a backdrop, Dr. Ted Belytschko and Mr. Jim Kennedy at KBS2 accompanied by Dr. John Hallquist came to ETA and signed an agreement to deliver a unique product in the CAE market; LS-DYNA PC. Packaged with LS-DYNA PC was ETA's pre-post processing software, eta/FEMB.

FEMB had already established itself as a competent set of meshing tools for LS-DYNA. In use at Ford Motor Company, and in ETA's Engineering Services Group since the mid 1980's, FEMB was tuned in to the LS-DYNA users, and was able to support all of the LS-DYNA entities, something that was quite difficult to do. FEMB was, as someone once called it, "a lean, mean finite element building machine".

That solid partnership between ETA and LSTC continued through the end of the 90's and into the 00's, enabling a shift in CAE and engineering computing. The entry of LS-DYNA into the PC market allowed many users who could not afford the expensive infrastructure required by the UNIX systems the ability to run dynamic nonlinear simulations, further expanding the applications and scope of LS-DYNA and FEMB applications.

Several LS-DYNA User Conferences later, we look around the office and see

that the UNIX workstations are set aside and used as a secondary systems. Digital merged with Compaq, who was bought by HP. The $250,000 multi-CPU Unix computer has been replaced by a Multi-CPU LINUX cluster, that runs our 1,000,0000 element model overnight at ¼ the cost. The PC has become our everyday desktop, with FE pre-post processing software integrating with our business applications.

There's some parallels that we can see in the Pre-Post processing development. While we developed FEMB PC as a product that would be able to meet the needs of a 1990's CAE engineer, those needs have changed. The first LS-DYNA PC users were limited to model sizes that matched their computers. Today's 3+ gigahertz PCs with multi-gigabytes of memory and hundreds of gigabytes of disk space now allow for a million element model to be run on a PC.

This change in hardware capabilities has driven changes in the pre-post processing software as well. The need for multi-million element models is here today, and the trend for these detailed structural models is following the growth curve of CPU speed.

A Change in Direction

While the CAE world of the 1990's was embracing LS-DYNA as the mainstream nonlinear structural analysis software, ETA was looking for new applications of LS-DYNA; applications that would make use of the broad capabilities of the solver to handle an integrated simulation model. Those models would encompass the mechanism models, in conjunction with the structural models to provide a true mechanical system model. These new models were termed "VPG" or "Virtual Proving Ground" simulations, due to the ability to simulate the test environment and predict a time domain response.

This new VPG simulation drove many enhancements in the CAE toolset developed by ETA. In parallel, both FEMB and the new VPG product were developed to meet the needs of each market segment. VPG itself had at its core the FEMB modeling tools.

As the VPG product matured, and its application scope broadened to include tires, suspensions and a crash tool library, the software was divided into modules focused on more vertical applications:

- **VPG/PrePost** for the meshing market
- **VPG/Structure** for the mechanical system market segment
- **VPG/Safety** focused on the crash and occupant safety simulation market

These all embrace an idea of "process guidance", to help guide the user through the steps needed to set up a model. This is the first step to a process automation.

One example of this process automation is the development of the Drop test Module. This is a set of menus that allows users to set up and execute a drop test simulation using a few easy steps. The users doesn't need to know the details of the LS-DYNA analysis to run the simulation, VPG handles many of the details which the new user may not need to know to successfully run the simulation

Still at the core of all of these modules was the FEMB software – built around

an efficient graphics engine, a complete LS-DYNA interface and a straight forward approach to building models.

Motivation to Merge

To best serve all users and to provide a future platform for software development, ETA made a decision to merge the FEMB and VPG products. The modularity of the product was an enabler to retain support for the FEMB users. The FEMB users would still be able to use VPG/PrePost to support all of their modeling needs. This new product would be able to support all of the LS-DYNA modeling, with new features available to increase the user's efficiency and provide an architecture which would be able to serve them for years to come.

In November 2004, this was finally achieved in VPG version 3.0. This version was previewed at the LS-DYNA Users Conference in 2004, and got many positive reviews.

This merge achieved several milestones for ETA :

- consolidating our software into a single platform for development
- speeding the implementation of new features
- synchronization of the capabilities between the UNIX/LINUX version and the PC version. No longer was the PC version months behind the UNIX platforms.

With all of the enhancements, the improved GUI, a new Post Processor, the opportunity for future product enhancements, and the support of all LS-DYNA entities, the stage was set for the migration of Users from the FEMB product to VPG.

Feature	FEMB	VPG
Complete meshing and model checking toolset	X	X
Complete Support of LS-DYNA 970	X	X
Support for LS-DYNA 971 +		X
Support for translation of RADIOSS, ABAQUS, NASTRAN Models into LS-DYNA formats		X
System Level Simulation Tools		X
Drop Test Module	X	X
VPG/Safety Dummy and Barrier Library		X
Process Guidance Tools		X
ADAMS to LS-DYNA Interface		X
Material Thickness Calculation using One-Step Metalforming		X
Macro Definitions		X
Material Library		X
Tire Modeling		X
Fatigue Analysis of LS-DYNA results		X
Stand Alone 3D Player for Post Processing		X
CAD Interfaces for CATIA, ProE, UG	X	X

Feature Comparison of FEMB version 28 versus VPG version 3.1

FEMB Migration to VPG

ETA understands that the migration to VPG might raise a lot of questions for FEMB users. ETA is very sensitive to the fact that people become attached to a particular way of using a software and specific features. Therefore, as many of the FEMB commands and functionality as possible was retained in VPG. Still you may have some questions:

Can I move to VPG immediately?

Yes, call your local distributor or contact ETA.

I only use meshing tools, not tires and suspension models. Why do I need VPG?

VPG 3.1 also provides the latest software architecture, and has many features which make your modeling tasks easier. Tools such as Enhanced Mesh and Automated Spot Welding are just 2 of the over 100 new features which are available to VPG users.

I know the FEMB menu system. I am afraid I won't be able to find the functions I need in VPG.

Here is some good news for FEMB Users: the menus in VPG can be configured to look like the FEMB menus. This is set in the Utilities Menu, using the Setup command. Once this option is set, each time the user opens VPG, only the FEMB menus will be shown.

How will I learn how to use VPG? Will there be a lot of time involved in learning how to use the software?

Since VPG/PrePost is built from the core FEMB product you will notice that the majority of the menus are identical to FEMB. Many new features have been added to help the user construct models more efficiently, but these functions have been added to the bottom of each menu with the attempt to minimize any reorganization of the menus.

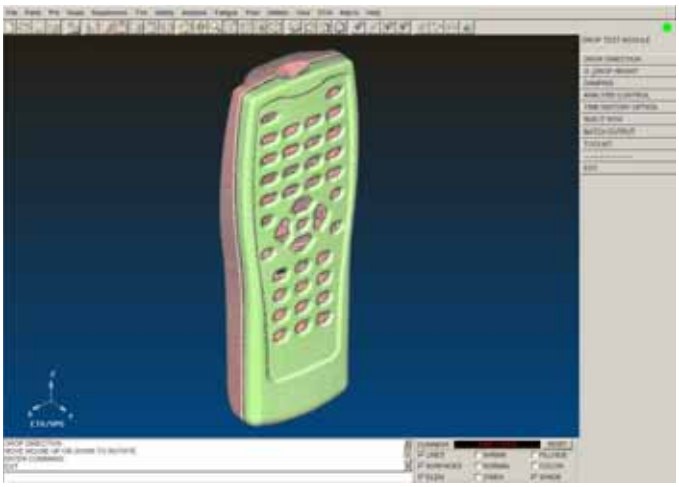
How will I get support and training for VPG?

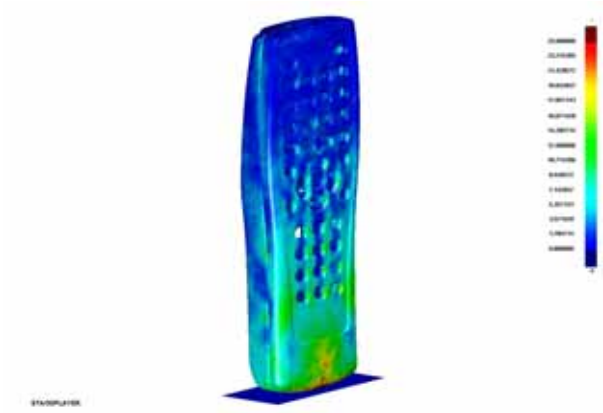
ETA provides email and telephone support from the offices in Troy, MI. Many VPG software distributors provide local support for VPG, as they did for FEMB. The first line of support will continue to be the local distributor with ETA always available for support. Training will be offered at ETA's Headquarters in Troy, MI on a monthly basis. Distributors may also offer training, based on your requests. Please let your local distributor know if you need training.

***What's happening to FEMB? Will** I be able to continue to use it?*

FEMB will still be available for those who wish to use it – contact ETA. Unfortunately, no product updates will be made and no bug fixes will be made after April 1, 2006. We intend on phasing out support for FEMB over the next 12 months, with ETA providing licenses for perpetual licensees for the foreseeable future.

After 10 years of bundling with LS-DYNA, ETA would like to retire FEMB and replace it with VPG. ETA is eternally grateful to those LS-DYNA PC based FEMB users and would like to assure them that this product evolution would add value to their own processes and development tasks. ETA is also grateful to the many distributors of the bundled software product and in particularly to the product integrator LSTC.





VPG User Interface for Drop Test Module & Simulation Results

Closing Notes

We look back on 10 years and see what great changes have occurred in the CAE world. Users of LS-DYNA PC and FEMB have created simulations that have saved lives through safer vehicles and products, allowed my boss hit a golf ball farther and straighter by designing better sports equipment, and saved many cell phones through drop test simulations.

With the latest pre-processing environment, and toolsets for the automation of simulation processes available in VPG, users will continue to innovate and deliver higher quality products to the marketplace.

ETA and LSTC will continue to collaborate into the future.

MD Nastran combines the best-in-class technology platforms including MSC Nastran, Marc, Dytran and LS-Dyna

MD Nastran is the world's most powerful enterprise simulation software solution. MD Nastran combines the best-in-class technology platforms including MSC Nastran, Marc, Dytran and LS-Dyna into one fully integrated multidiscipline solution for the enterprise. MD Nastran provides the broadest range of simulation and analysis capabilities available in the market today.

MD Nastran enables engineers to simulate how a design behaves under real-world conditions without having to solely rely on costly physical prototypes. MD Nastran's integrated and multidiscipline simulation capabilities gives engineers increased confidence by virtually testing a product's performance under all conceivable conditions. No other simulation solution in the market can boast the depth and breadth of capabilities that is the core of MD Nastran.

In addition to traditional linear structural analysis, MD Nastran has been revolutionized with integrated, multidiscipline simulation features that enable engineers to perform more accurate simulations faster, and more easily evaluate design decisions through nonlinear, vibration, heat transfer, motion and crash analysis all from within the MSC Nastran environment they have used for decades

MD NASTRAN BENEFITS

Accelerate time-to-manufacturing by leveraging MD Nastran's common data model to perform staggered, coupled, or discrete analysis across more new product development disciplines than any alternative offering
Drive manufacturing cost down by moving simulation technologies to the front of the new product development cycle

Explore more design alternatives, predict system-level functional performance, and accurately assess lifecycle service (safety, fatigue, durability) issues before making costly manufacturing commitments

Eliminate silos of expertise, reduce dependency on disconnected point solutions, and vastly improve analyst efficiency by managing all required simulations is a single, consistent usage environment

Save time, eliminate or reduce modeling idealization, and vastly improve real-world correlation by taking advantage of MD Nastran's high-performance computing, advance state-of-the-art solver technology, and special capabilities for large/complex simulations

MD NASTRAN APPLICATIONS

You can use MD Nastran to determine the following:

- Strength and fatigue of an aircraft fuselage, wings and flaps, and landing gear
- Strength durability and vibration of the various structures (body, chassis, suspension, steering, and wheels) of a car, a truck, or a train
- Effects of temperature fluctuations from convection, conduction, and radiation in consumer electronic devices, such as a television or a cell phone
- How a product holds up to a catastrophic event, such as dropping onto the floor, crashing into a brick wall, or falling from a crane

MD NASTRAN MODULES

- Nastran ACMS
- Nastran Acoustics
- Nastran Exterior Acoustics
- Nastran Aeroelasticity II
- Nastran Design Optimization
- Nastran Distributed Memory Parallel (DMP)
- Nastran Explicit Nonlinear (SOL 700)
- Nastran Krylov Solver
- Nastran Rotor Dynamics
- Nastran Superelements
- Nastran Topology Optimization
- Nastran Implicit Nonlinear Multi-Processor
- Nastran Explicit Nonlinear Multi-Processor

For More Information fill out the form on-line at:
http://www.mscsoftware.com/about/contact.cfm

MSC Software Corporation's 2006 Americas Virtual Product Development Conference

Huntington Beach, California - July 17-19, 2006
http://www.mscsoftware.com/events/vpd2006/na/index.cfm

MSC.Software's driving mission is to help you and your company improve your product development process. This conference is dedicated to providing you with the latest information on the strategies and technologies that you can use immediately to enhance concept development, design, simulation, testing, manufacturing, and business performance.

The MSC.Software Virtual Product Development Conference is the only industry event dedicated to exploring all aspects of Virtual Product Development (VPD). From pressing management issues to unique technical solutions, more than 700 engineering professionals in automotive, aerospace, bio-medical, civil engineering, defense, general machinery, and more will gather to share their knowledge, best practices and strategies for developing products that meet the ever-increasing pressures of time, cost, quality, and performance.

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Improve your knowledge and expertise in the application of MSC.Software VPD products. VPD enables companies to improve product development processes by enhancing their ability to make better decisions, explore innovative design alternatives and consistently "get products right".

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Build professionals in VPD and PLM processes by providing them exposure to other industry leaders.

Fujitsu Delivers PRIMERGY 8-socket Blade Server Powerhouse for Greater Scale-up, Scale-out Data Center Flexibility

PRIMERGY BX630 Featuring AMD Opteron Processors Offers Lower Power Consumption, Scales from 2 to 8 Processors

The PRIMERGY® BX600 blade server offers the full power of a rack server in a blade server form factor with 2-, 4-, or 8-processor server blades, each with dual hot-plug hard drive bays. Its flexible design allows the co-existence of PRIMERGY BX630 AMD Opteron™ and PRIMERGY BX620 S2 dual Intel® Xeon® server blades in the same chassis. Redundant chassis components including management blades, Ethernet switches, Fibre channel switches, power supplies and cooling provide excellent availability. This versatile system can be used for a wide variety of applications including complex Web services, terminal server farms, enterprise applications,

SUNNYVALE, CALIF.- Mar. 14, 2006—Fujitsu Computer Systems today announced the PRIMERGY® BX630 8-socket blade server powered by dual-core AMD Opteron™ processors, providing data-center administrators with maximum flexibility to scale up and scale out their infrastructures in a single chassis. Fujitsu is the first major vendor to deliver a standard-architecture 8-socket, dual-core blade server system, offering increased density and scalability with lower power and space requirements.

The 8-socket PRIMERGY blade server enables all components of an enterprise infrastructure—from network edge devices to backend databases—to be housed in a single blade server chassis. Individual blades can then be upgraded to more powerful servers as needed. The result is greater data-center design flexibility and lower total cost of ownership.

AMD Opteron-based PRIMERGY BX630 8-socket blade servers can be installed in the current PRIMERGY BX600 chassis and mixed with existing Intel® Xeon® based PRIMERGY BX620 S2 blade servers and PRIMERGY BX630 2-socket blade servers, enabling customers to select the best technology for specific businesses and applications.

The AMD Opteron architecture features AMD's HyperTransport™ interconnect, which is a critical component in the PRIMERGY BX630 blade server's modular design. This interconnect makes it possible to link two PRIMERGY BX630 2-socket blades into a single 4-socket blade, and then link two of these 4-socket blade into a single PRIMERGY BX630 8-socket blade. Packed with dual-core AMD Opteron processors, the system becomes a 16-core powerhouse, giving customers the flexibility to move high-end applications and da-

tabase processing to the PRIMERGY BX600 blade platform.

“The PRIMERGY BX630 8-socket server is another major step in Fujitsu’s ongoing commitment to offer our customers the power and flexibility they need to design and build out data centers that meet their current infrastructure needs while preparing them for the future,” said Richard McCormack, senior vice president of product and solutions marketing at Fujitsu Computer Systems. “With AMD Opteron-based PRIMERGY servers, our customers can achieve greater density and performance with lower power consumption and real estate requirements, resulting in lower total cost of ownership.”

Pricing and Availability

The PRIMERGY BX630 8-socket server will be available during the second quarter of 2006. The PRIMERGY BX630 blade pricing starts below $2250 in a 2-socket configuration. An 8-socket PRIMERGY BX630 blade is priced below $36,000.

Service and Support

Professional services from Fujitsu Computer Systems ensure successful implementation and support of the most complex operating environments. The PRIMERGY BX630 is certified with all of the major server operating systems: Microsoft Windows Server 2003 Enterprise, Microsoft Windows Server 2003 Enterprise x64 Edition, Red Hat Linux EL4 x86/AMD64, Novell SUSE Linux ES-9 x86/AMD64, and VMware ESX Server 2.5.x.

About Fujitsu Computer Systems Corporation

Headquartered in Sunnyvale, Calif., Fujitsu Computer Systems is a wholly owned subsidiary of Fujitsu Limited (TSE:6702) committed to the design, development and delivery of advanced computer systems and managed services for the business enterprise. The company offers a complete line of high-performance mobile and client computers, scalable and reliable servers as well as managed and professional services. Fujitsu Computer Systems emphasizes leading-edge technology, exceptional product quality, and productivity, as well as outstanding customer service. More information on Fujitsu Computer Systems is available at http://us.fujitsu.com/computers.

About Fujitsu

Fujitsu is a leading provider of customer-focused IT and communications solutions for the global marketplace. Pace-setting device technologies, highly reliable computing and communications products and a worldwide corps of systems and services experts uniquely position Fujitsu to deliver comprehensive solutions that open up infinite possibilities for its customers' success. Headquartered in Tokyo, Fujitsu Limited (TSE:6702) reported consolidated revenues of 4.7 trillion yen (US$44.5 billion) for the fiscal year ended March 31, 2005.

For more information, please see:

http://www.fujitsu.com.

Yahoo Group Yammerings

Jim Kennedy
KBS2 Inc.
jmk@kbs2.com

Len Schwer
Schwer Engineering & Consulting Services
Len@Schwer.net

This installment of "Yahoo Yammerings" features three questions, with responses, from the past month of postings to the LS-DYNA Yahoo Group:

1. *Failure Criterion in LS DYNA*
2. *Compression only Elements*
3. *The limitation of applying low strain rate tensile test data to impact problems?*

Question: Failure Criterion in LS- DYNA

I got struck in doing an analysis for finding the piercing force of a rubber material.

Here is a brief overview of simulation:

1) There is a silicon sheet for which I have defined the stress strain curve up to the breaking point (tensile test data). I am using Mat24 for the silicon/rubber sheet.
2) I have to pierce the silicon sheet with a flat faced tapered rod, modeled as rigid.
3) All the edge nodes (on periphery) of the silicon sheet are constrained in all DOF.
4) Displacement is given to the tapered rigid rod to pierce the sheet.

I have to find the force required for piercing the silicon sheet using a taper rod.

I got struck while prescribing the failure criterion for the silicon sheet elements. I am using EPPF, i.e. failure strain for defining the failure criterion. but experimental values are not matching the FEA results.

Can someone tell me how to define the EPPF value without affecting the results? Or is there any other options (apart from strain rate) available for defining the element failure criterion?

Response by James M. Kennedy

Are you sure you are using true stress and true strain input? LS-DYNA expects true stress-true strain input in most cases.

If you want EPPF not to effect your results, make it very large.

To be able to compare numerical and experimental values, and if you have failure in the experiment, you will need to model failure somehow in your simulation. You also might look at the MAT_ADD_EROSION option.

Follow-up Response by Conrad Izatt

James is correct in that you need to specify a true stress-true strain graph

in LS-DYNA and the failure strain will be a true strain.

However, there are many difficulties in matching experimental results for failure mechanisms. I imagine that the tensile test from which you have derived the stress-strain curve will give you an elongation to failure from which you can derive the failure strain. However, this is the failure strain of the whole test specimen, rather than the strain in the 'necking' region at the point of failure. If your mesh in your model is sufficiently fine, then you will need to use the necking strain as the failure strain.

To cut a long story short, the failure strain that you put into LS-DYNA will depend on the material behavior and the mesh density.

I believe there was discussion on this subject in this forum that appeared in FEA Information November 2005. However, I can't seem to find it on the internet.

There is also a keyword *MAT_NONLOCAL which aims to tackle this mesh dependency.

Question: Compression only Elements?

I am a new bee to this group and would appreciate any help in trying to set up a model. I am trying to represent a collar sitting around a tube, but I wanted to avoid using contacts if possible. The collar has a moment applied it which is transmitted to the tube. I have modeled the tube as a beam and the collar as a mid surface shell, I thought about using a set of compression only links between the shell and beam but I am not sure if this type of link is available in LS DYNA. Can anyone let me know the best method to represent this type of model, and if a compression only element is available? I would appreciate any help. I am using LS DYNA 970 v5434a

Response by Denis Corkery

A spring element definition with MAT_SPRING_GENERAL_NONLINEAR will allow you to define a force displacement stiffness characteristic. The stiffness characteristic can then be defined such that the spring element can only act in compression?

Question: The limitation of applying low strain rate tensile test data to impact problems?

I am curious about impact simulations, usually we use Mat_24 as our material model and we get this data curve from a “low strain rate tensile test,” for example 50mm/min tensile speed. Although we can use a table to describe different strain rate behavior form 50mm/min to 500mm/min, I think for most impact problems, these strain rates are still too low to apply to impact simulations, am I right? Can we use the semi-static tensile data curve for impact problem? Or we must get a high-strain rate tensile data curve. Please give me some high-strain rate test method and application.

Response by Ashim Ghosh

LS-DYNA offers 3 different ways to model the rate effect.
1. Use test values of True stress-strain data in a tabular format: For this you need to test the sample at different speeds.

2. Use a single data curve and use a table to suitably scale the curve with respect to strain rates.
3. Use Cowper Symonds rule. You need to determine/search values of C & P parameters.

The rates depend on impact speed, geometry etc. You need to know what strain rate range covers your specific case and do the tests accordingly.

Response by Jim Kennedy

On December 30, 2005, Message 7665, I posted a note that you might find of interest in which I provided some information with respect to rate effects, e.g., Cowper Symonds parameters, data structure for general strain rate input, and viscoplastic rate effects.

Follow-up by Nick Harle

Further to Mr. Kennedy's comments, you may find this published conference paper from Corus's R & D department in IJmulden to be of interest.

The paper covers, in an automotive crash context, the effects of strain rate and yield surface effects in component simulations and stripped down body-in-white (BIW) simulations.

Strain rate effects are important in automotive crash analysis, with this paper stating that strain rate effects up to 200/s should be included. But how should these effects be included?

Basically both Cowper-Symonds (CS) and Johnson-Cook (JC) strain rate approximations have the limitations that the strain rate factor (applied to a quasi-static tensile test derived curve) is independent of the plastic strain. This is not true for steels in general. What you have to do with JC or CS is to either "average out" the strain rate magnification factor across the plastic strain range, or choose where you want to be most accurate, e.g. near the yield point or at large plastic strains. Using MAT24 allows the actual strain rate curves from different strain rate tests to be input and hence the true strain rate effect is applied at the given strain rate level. The only thing to watch here, is that you need true-stress versus true-plastic-strain values for enough strain rate values to stop any errors from LS-DYNA interpolating between strain rate curves and potentially giving less accurate results. Again this is mentioned in the paper.

Okay, so strain rate effects can be caught to differing degrees of accuracy - does it actually matter? Well in automotive terms, for components that have a clearly defined collapse mode (usually from geometry) the effects of incorrectly capturing strain rate will be minimized. However, it is when you get to complex geometry of car components (such as tapering longitudinal) that the choice of strain rate approximation can determine your collapse mode and the resulting energy absorption. The paper has further details.

Finally, what our forming colleagues have known for a long time, is that the isotropic material behavior behind the Von Mises yield surface used in say MAT 3, 12, 24 of LS-DYNA is not true for a thin steel sheet produced by being rolled from a 6inch thick ingot - they use Hill48 , Hill90, etc yield criterion. The paper also covers the effect of changing yield surface in components and BIW simulations. Again, where the collapse mode is clearly defined the effect of changing yield surface is minimized.

LS-DYNA Yahoo Groups

There are over 1650 subscribers from all over the world, and this list seems to grow by a hundred new subscribers ever few months; no small testament to the rapidly growing popularity of LS-DYNA. The group currently averages over 250 message per month, i.e. about 10 message per work day.

You can subscribe to the group by sending an email request to:
LS-DYNA-subscribe@yahoogroups.com

or by visiting the Yahoo Groups web site

http://groups.yahoo.com

Generally the quickest/best responses are to those questions posed with the most specifics. General questions such as “How do I use XXX feature?” either go unanswered, or are answered by Jim Kennedy with links to appropriate references in the growing LS-DYNA related literature, e.g. see the archive of LS-DYNA Conference proceedings at www.dynalook.com .

TOP CRUNCH NEWS – Benchmarks Online
Dr. David Benson – www.topcrunch.org

03/07/06

FILE DESCRIPTION

File Name: car2car

Code Version: LS-DYNA

Creator: Dr. Makino

Description:

This model is based on NCAC minivan model and created by Dr. Makino. Supplied by Dr. Tsay, LSTC, on Feb. 13, 2006 Termination time modified per John Hallquist to .120 on March 7, 2006

results to be posted shortly

02/16/06

FILE DESCRIPTION

File Name: Parallel_Implicit

Code Version: ANSYS, Inc.

Creator: Yong-Cheng Liu, ANSYS, Inc.

Description:

To run Distributed Ansys in parallel, you may use our launcher (GUI) To selection # of processors and machine names in the network. We also have simple script command line to do so, e.g. Ansys90 -dis -pp -np 10 < input_deck > output_deck & Where flag -dis---> run distributed parallel, -pp ---> It is a parallel version of Ansys -np ---> number of processors == 10.

results to be posted shortly

The 2006 Annual Korea LS-DYNA Users' Conference Organized by KOSTECH

The Conference will take place in Chuncheon-si. Doosan Resort is an excellent membership resort located at the Gangchon. It is famous for travelers visiting Korea and is a popular attraction during all seasons.

This conference provides a unique forum for LS-DYNA users to learn how experts in engineering and academia are applying the latest simulation technology and methods to accelerate and improve product development.

The conference is an ideal forum for LS-DYNA users to share and discuss experiences, to obtain information on up-coming features of LS-DYNA and to learn more about new application areas. The conference will be accompanied by an exhibition featuring the latest software and hardware developments related to LS-DYNA.

We strongly encourage you to participate in the conference either as speaker presenting your paper, attendee, exhibitor or sponsor. You should not miss this event!
In addition, our attendees can relax and enjoy our evening garden receptions. This year our Closing Banquet will be held at the Uiamho Lakeside, where you can enjoy breathtaking views of the island from the resort.

Accompanying LS-DYNA Classes
April 18-19th

- Contact in LS-DYNA
  Ala Tabiei
- Advanced Impact Analysis
  Paul Du Bois

Nearby Attractions

- Soyangho Lake
- Cheongpyeongsa Temple
- Jungdo Island
- Chuncheon's Dakgalbi

Information Contact:
E-mail : young@kostech.co.kr
http://www.kostech.co.kr
KOSTECH
B-1303, Kolon Lakepolis 2, 749,
Janghang-dong, Ilsan-gu Goyang-si
Gyeonggi-do, S.KOREA

Technology Day 2006 - June 7, 2006

http://www.engin.umd.umich.edu/ceep.

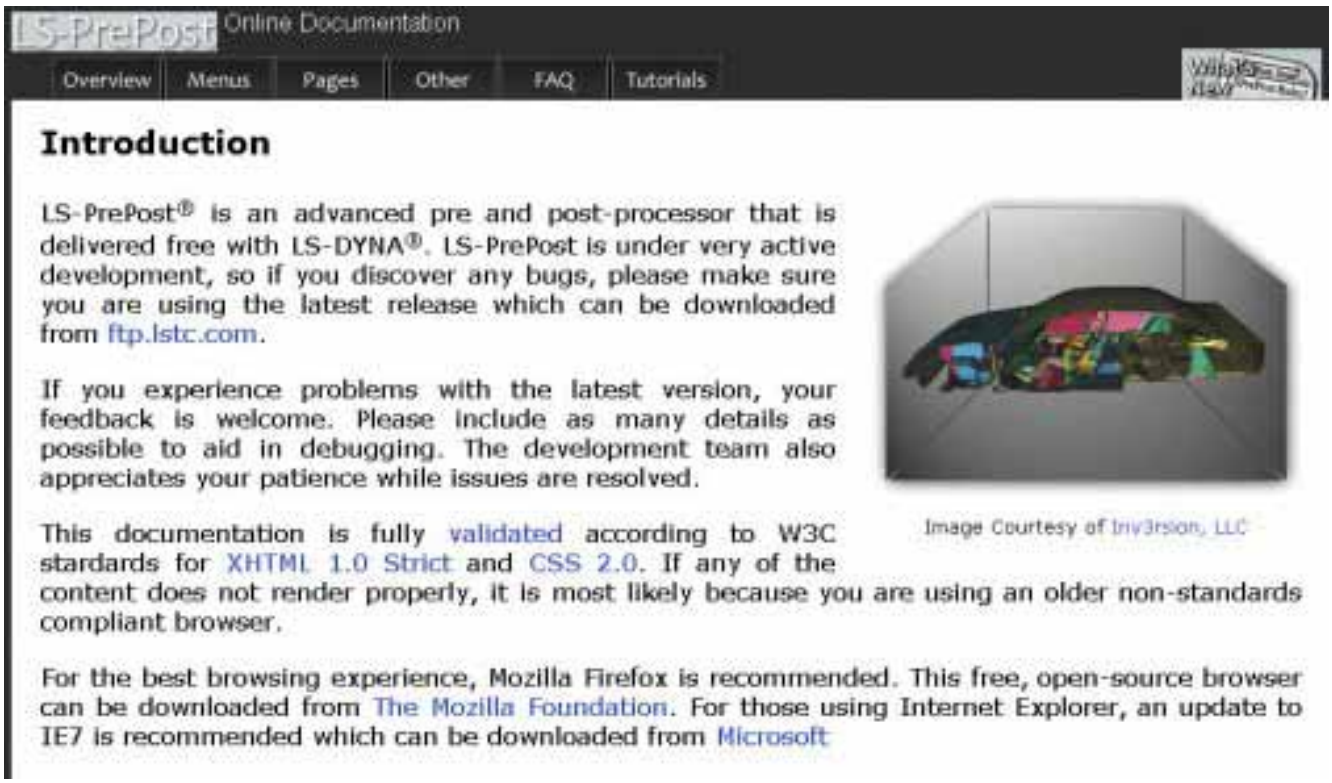
The Center for Engineering Education and Practice (CEEP) supports relevant collaborative projects of faculty and industrial partners. Technology Day is an annual event sponsored by CEEP to provide an update of the University's collaborations with industry.

For Information Visit http://www.engin.umd.umich.edu/ceep.
Or contact:
Donna Goddard, Administrative Assistant
Center for Engineering Education and Practice
E-Mail: dgoddard@engin.umd.umich.edu
Telephone: (313) 593-3403

Seminars from the 9th Int'l LS-DYNA Users Conference will be held at the University of Michigan-Dearborn June 7-8.

LS-PrePost Support Site Online

Official Open date April 1st, with continued upgrading
www.lstc.com/lspp



LS-PrePost On Line Support Site is brought to you by LSTC's LS-PrePost Development Team in California and Michigan.

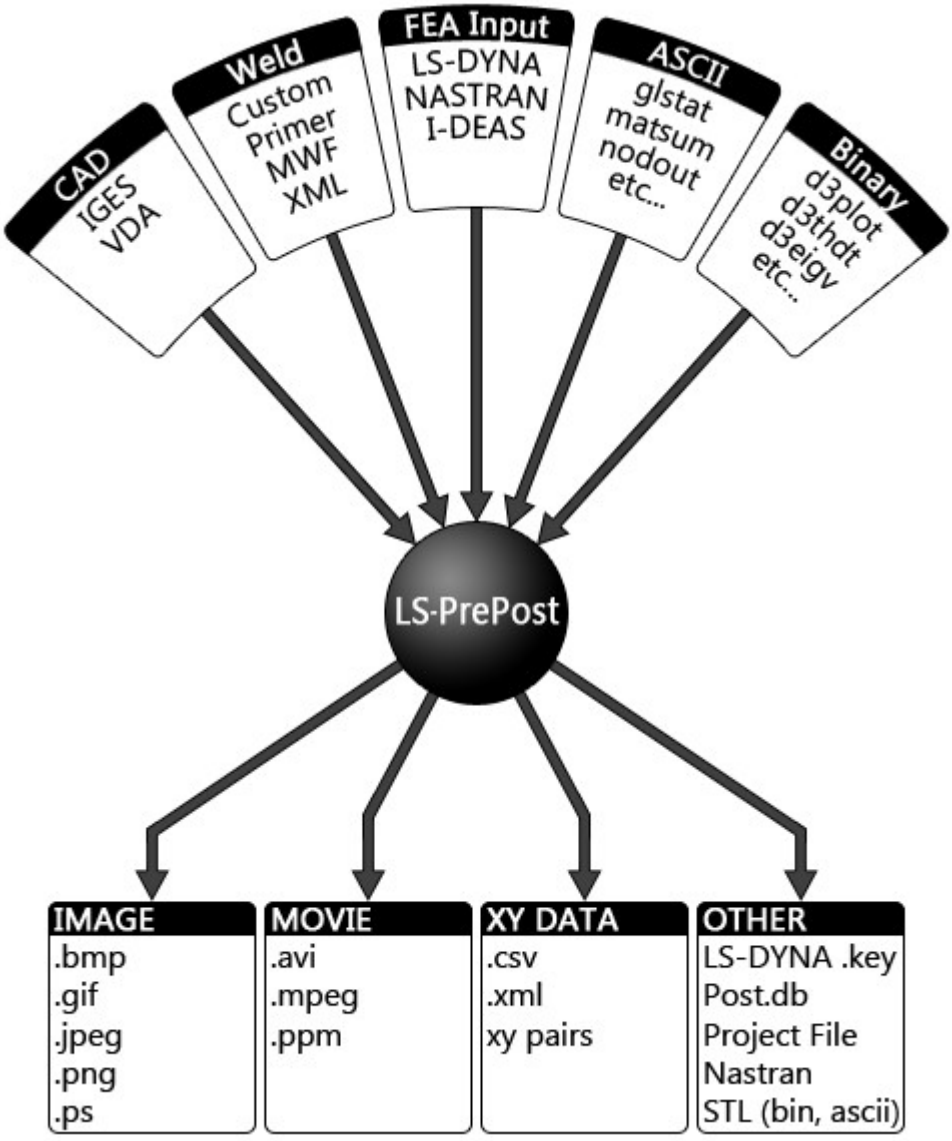
General Overview

LS-PrePost® was designed to provide the following core functionalities:

- Full LS-DYNA® keyword support
- LS-DYNA model visualization
- LS-DYNA model creation and editing
- Advanced post-processing

LS-PrePost's main post-processing capabilities include states result animation, fringe component plotting, and XY history plotting.

LS-PrePost is also capable of importing and exporting data in a number of common formats. The figure on the right illustrates a sampling of those that a typical user might find most useful.



9th Int'l LS-DYNA Users Conference

Rouge Factory Tour Sunday, June 4, 2006:

We hope you can join us for the 2006 Conference Outing

The Henry Ford: Museum and Greenfield Village

- Reserved 1:00 p.m. tour - all 75 seats
- Tour takes about 2-1/2 hours
- Arrive 1/2 hour earlier (12:30 p.m.) to check in.
- LSTC will provide transportation from conference venue (Hyatt Regency Dearborn) to The Henry Ford (and return).
- We will contact participants to confirm attendance and shuttle seat in mid-May.

The Henry Ford (all attractions) opens at 9:30 a.m. and closes at 5:00 p.m., Sunday thru Saturday

It's possible to upgrade to 1-day Fun Pack which adds the Museum or Village to the outing. Upgrade cost would be at the participant's expense. Transportation other than round trip from Hyatt Regency for the tour is participant's responsibility.

IMAX Theatre shows also available; see http://www.thehenryford.org/imax for shows and times.

For information contact Cathie Walton (cathie@lstc.com; 248-649-4728).

Cathie Walton
LSTC Michigan
1740 W. Big Beaver Road, Suite 100, Troy, MI 48084 USA
voice: 248-649-4728; mobile: 313-790-9040; fax: 248-649-6328

The Ford Rouge Factory Tour Website : http://www.hfmgv.org/rouge/

9th Int'l LS-DYNA Users Conference

Sunday, June 4, 2006

- Event: Henry Ford: Museum and Greenfield Village

  1:00 p.m. about 2-1/2 hours

- Conference Registration 5:00 p.m. - 8:00 p.m.
- Exhibition Hall 5:00 p.m. - 8:00 p.m
- Welcome Reception 6:00 p.m. - 8:00 p.m

Monday, June 5, 2006

- Registration 7:30 a.m. - 4:00 p.m.
- Keynote speakers 8:30 a.m. - noon
- Technical Sessions 1:00 p.m. - 6:00 p.m.
- Exhibition Hall 8:00 a.m. - 6:00 p.m.
- Banquet 7:00 p.m. - 9:00 p.m.
  (complete with entertainment)

Tuesday, June 6, 2006

- Registration 7:30 a.m. - noon
- Technical Sessions 8:30 a.m. - 5:00 p.m.
- Exhibition Hall 8:00 a.m. - 5:00 p.m.

Wednesday, June 7-8, 2006
Training Seminars (2 days) 8:30 a.m - 6:00 p.m.

- Registration 8:00 a.m.
- Continental Breakfast and lunch both days

Register For The Conference:

www.ls-dynaconferences.com

A short course taught by Ted Belytschko and Thomas J. R. Hughes

NONLINEAR FINITE ELEMENT ANALYSIS May 22-26, 2006 Austin TX

PURPOSE

To provide engineers, scientists, and researchers with a background in the fundamentals of nonlinear finite element methods and a critical survey of the state-of-the-art. It covers solids, structures, and fluids, with an emphasis on methodologies and applications for non-linear problems. The theoretical background, implementations of various techniques, and modeling strategies will be treated. Advantages and shortcomings of alternative methods and the practical implications of recent research developments will be stressed. The course has been offered for the past 20 years and has been taken by about 2,000 engineers, scientists, faculty members, and graduate students. A synopsis of the topics covered can be found at http://www.zace.com

Registration Fee For This Short Course:

Prior to, or on April 21, 2006	$2,175
After April 21, 2006,	$2,375

Daily Schedule

Registration begins at 8:00 a.m. on Monday. The lectures will start at 9 a.m. and end at 5:30 p.m., Monday-Thursday, and 9 a.m.-12:00 p.m. on Friday.

For additional information:

Contact: Ted Belytschko Inc. TBINC18@aol.com or visit http://www.zace.com

LSTC Training Classes – 2006

Jane Hallquist
Training Coordinator
LSTC California & Michigan
Email: ***jane@lstc.com***
Tel: ***925-449-2500***

California Location

LSTC California
7374 Las Positas Road
Livermore, CA 94551

Michigan Location

LSTC Michigan
1740 W. Big Beaver Rd
Suite 100
Troy , MI 48084

Training Class	US $	Livermore, CA	Detroit, MI
Introduction to LS-DYNA **1. J. Reid** **2. A. Tabiei**	$750	Feb. 07-10 May 02-05 Aug. 01-04 Nov. 14-17	Jan. 16-19 April 25-28 July 25-28 Oct 16-19 Dec. 11-14
Advanced LS-DYNA for Impact Analysis	$950	June 27-30 Sept 26-29	Not Scheduled
Advanced Options in LS-DYNA	$750	Not Scheduled	Feb 21 - 22
Material Modeling Using LS-DYNA User Defined Options	$750	June 13-14	Not Scheduled
LS-DYNA Implicit	$750	June 15-16	Sept. 07-08
Introduction to LS-OPT	$750	May 16-19 Nov. 07-10	Not Scheduled
ALE/Eulerian & Fluid/Structure Interaction in LS-DYNA	$750	Feb. 15-17	Not Scheduled
Concrete and Geomaterial Modeling with LS-DYNA	$750	Oct 24-25	Not Scheduled

LSTC Training Classes – 2006 (cont'd)

Training Class	US $	Livermore, CA	Detroit, MI
MESH Free Methods in LS-DYNA (SPH and EFG)	$750	Feb. 01-03	Not Scheduled
LS-DYNA Composite Materials	$750	March 30-31 Sept. 14-15	Not Scheduled
LS-DYNA for Heat Transfer & Thermal-Stress Problems	$500	Not Scheduled	Not Scheduled
Contact in LS-DYNA	$750	March 28-29 Sept. 12-13	June 22-23

Participant Distribution & Consulting Channels

Sales – Support –Training – Benchmark – Consulting.
Listed are only a few of their many services

	**DYNA*more*** uli.franz@dynamore.de

Italy 	**Numerica Srl** www.numerica-srl.it info@numerica-srl.it

Japan 	**The Japan Research Institute, Ltd** (JRI) cae-info@sci.jri.co.jp

Netherlands 	**Infinite Simulation Systems B.V.e** **Jurgen Mathijssen**

Sweden 	**Engineering Research AB** sales@erab.se

Taiwan 	**Flotrend Corporation** Contact: gary@flotrend.com.tw

EVENTS – 2006

If you want your event listed please send the information to:
mv@feainformation.com

2006	
April 20-21	**Korean LS-DYNA CONFERENCE in Chun-Cheon City, Hosted by Korean Simulation Technologies**
April 24-26	**MSC.Software 2006 Americas VPD Conference,** Detroit, MI - US
May 02-04	**2006 International ANSYS Conference** Pittsburgh, PA - US
June 04-06	**9th International LS-DYNA Users Conference** Dearborn, MI - US -**Registration and Hotel available on line**
July 02-06	**ICSV13 Vienna** Vienna, Austria
July 5-7	**HEAT TRANSFER 2006** Ninth International Conference on Advanced Computational Methods and Experimental Measurements in Heat and Mass Transfer The New Forest, UK
Sept 19-20	**JAPAN LS-DYNA Users Conference 2006** Tokyo, Japan Hosted by JRI
Sept 25	**11th Korea LS-DYNA Users Conference 2006, Seoul, Korea Hosted by Theme Engineering Inc.**
Oct 12-13	**LS-DYNA Users Meeting in Ulm.** Hosted by DYNAmore
Oct 25-27	**2006 CADFEM Users Meeting** International Congress on FEM Technology Stuttgart area - Germany
Nov 14- 16	**Aerospace Design Expo 06** Anaheim, CA - US

LS-DYNA Resource Page

Interface - Hardware - OS And General Information

Participant Hardware/OS that run LS-DYNA (alphabetical order).

LS-DYNA has been fully QA'd by Livermore Software Technology Corporation for All Hardware and OS listed below.

TABLE 1: SMP
TABLE 2: MPP Interconnect and MPI

TABLE 1: SMP - Fully QA'd by LSTC	
AMD Opteron	Linux
CRAY XD1	Linux
FUJITSU Prime Power	SUN OS 5.8
FUJITSU VPP	Unix_System_V
HP PA-8x00	HP-UX 11.11 and above
HP IA-64	HP-UX 11.22 and above
HP Opteron	Linux CP4000/XC
HP Alpha	True 64
IBM Power 4/5	AIX 5.1, 5.2, 5.3
IBM Power 5	SUSE 9.0
INTEL IA32	Linux, Windows
INTEL IA64	Linux
INTEL Xeon EMT64	Linux
NEC SX6	Super-UX
SGI Mips	IRIX 6.5 X
SGI IA64	SUSE 9 with ProPack 4 Red Hat 3 with ProPack 3

LS-DYNA Resource Page

MPP Interconnect and MPI

FEA Information Inc. Participant's (alphabetical order)

Fully QA'd by Livermore Software Technology Corporation

Vendor	O/S	HPC Interconnect	MPI Software
AMD Opteron	Linux	InfiniBand (SilverStorm), MyriCom	LAM/MPI, MPICH, HP MPI, SCALI
CRAY XD1	Linux		
FUJITSU Prime Power	SUN OS 5.8		
FUJITSU VPP	Unix_System_V		
HP PA8000	HPUX		
HPIA64	HPUX		
HP Alpha	True 64		
IBM Power 4/5	AIX 5.1, 5.2, 5.3		
IBM Power 5	SUSE 9.0		LAM/MPI
INTEL IA32	Linux, Windows	InfiniBand (Voltaire), MyriCom	LAM/MPI, MPICH, HP MPI, SCALI
INTEL IA64	Linux		LAM/MPI, MPICH, HP MPI
INTEL Xeon EMT64	Linux	InfiniBand (Topspin, Voltaire), MyriCom	LAM/MPI, MPICH, HP MPI, INTEL MPI, SCALI
NEC SX6	Super-UX		
SGI Mips	IRIX6.5		
SGI IA64	Altix/Prism		

LS-DYNA Resource Page

Participant Software Interfacing or Embedding LS-DYNA

Each software program can interface to all, or a very specific and limited segment of the other software program. The following list are software programs interfacing to or having the LS-DYNA solver embedded within their product. For complete information on the software products visit the corporate website.

ANSYS - ANSYS/LS-DYNA
www.ansys.com/products/environment.asp

ANSYS/LS-DYNA - Built upon the successful ANSYS interface, ANSYS/LS-DYNA is an integrated pre and postprocessor for the worlds most respected explicit dynamics solver, LS-DYNA. The combination makes it possible to solve combined explicit/implicit simulations in a very efficient manner, as well as perform extensive coupled simulations in Robust Design by using mature structural, thermal, electromagnetic and CFD technologies.

AI*Environment: A high end pre and post processor for LS-DYNA, AI*Environment is a powerful tool for advanced modeling of complex structures found in automotive, aerospace, electronic and medical fields. Solid, Shell, Beam, Fluid and Electromagnetic meshing and mesh editing tools are included under a single interface, making AI*Environement highly capable, yet easy to use for advanced modeling needs.

ETA – DYNAFORM
www.eta.com

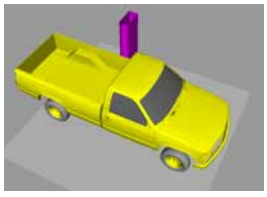
Includes a complete CAD interface capable of importing, modeling and analyzing, any die design. Available for PC, LINUX and UNIX, DYNAFORM couples affordable software with today's high-end, low-cost hardware for a complete and affordable metal forming solution.

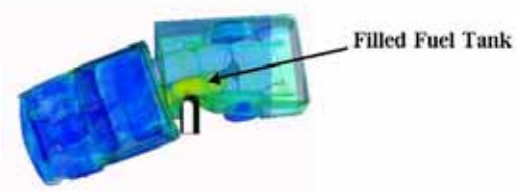
ETA – VPG
www.eta.com

Streamlined CAE software package provides an event-based simulation solution of nonlinear, dynamic problems. eta/VPG's single software package overcomes the limitations of existing CAE analysis methods. It is designed to analyze the behavior of mechanical and structural systems as simple as linkages, and as complex as full vehicles

MSC.Software "MSC.Dytran LS-DYNA"
www.msc.software.com

Tightly-integrated solution that combines MSC.Dytran's advanced fluid-structure interaction capabilities with LS-DYNA's high-performance structural DMP within a common simulation environment. Innovative explicit nonlinear technology enables extreme, short-duration dynamic events to be simulated for a variety of industrial and commercial applications on UNIX, Linux, and Windows platforms. Joint solution can also be used in conjunction with a full suite of Virtual Product Development tools via a flexible, cost-effective MSC.MasterKey License System.





Side Impact With Fuel Oil Inside

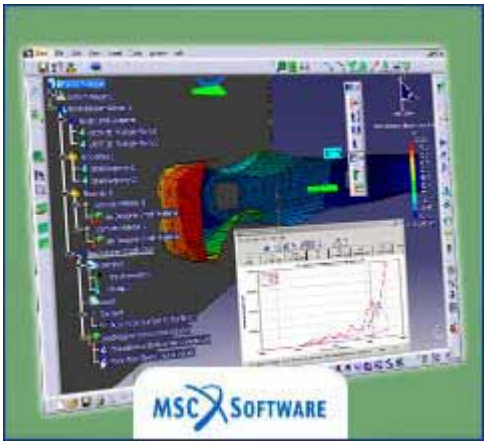
MSC.Software - MSC.Nastran/SOL 700

The MSC.Nastran™ Explicit Nonlinear product module (SOL 700) provides MSC.Nastran users the ability access the explicit nonlinear structural simulation capabilities of the MSC.Dytran LS-DYNA solver using the MSC.Nastran Bulk Data input format. This product module offers unprecedented capabilities to analyze a variety of problems involving short duration, highly dynamic events with severe geometric and material nonlinearities.

MSC.Nastran Explicit Nonlinear will allow users to work within one common modeling environment using the same Bulk Data interface. NVH, linear, and nonlinear models can be used for explicit applications such as crash, crush, and drop test simulations. This reduces the time required to build additional models for another analysis programs, lowers risk due to information transfer or translation issues, and eliminates the need for additional software training.

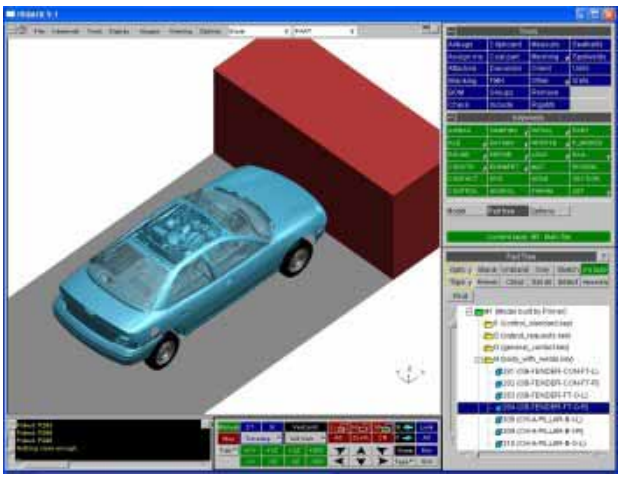
MSC.Software – Gateway for LS-DYNA

Gateway for LS-DYNA provides you with the ability to access basic LS-DYNA simulation capabilities in a fully integrated and generative way. Accessed via a specific Crash workbench on the GPS workspace, the application enhances CATIA V5 to allow finite element analysis models to be output to LS-DYNA and then results to be displayed back in CATIA. Gateway for LS-DYNA supports explicit nonlinear analysis such as crash, drop test, and rigid wall analysis.



Gateway products provide CATIA V5 users with the ability to directly interface with their existing corporate simulation resources, and exchange and archive associated simulation data.

Oasys software for LS-DYNA
www.arup.com/dyna



Oasys software is custom-written for 100% compatibility with LS-DYNA. Oasys PRIMER offers model creation, editing and error removal, together with many specialist functions for rapid generation of error-free models. Oasys also offer post-processing software for in-depth analysis of results and automatic report generation.

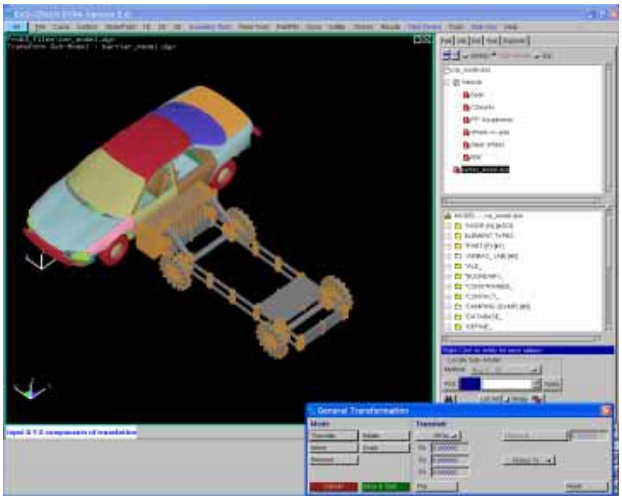
EASi-CRASH DYNA
http://www.esi-group.com/SimulationSoftware/EASi_CRASH-DYNA/

EASi-CRASH DYNA is the first fully integrated environment for crashworthiness and occupant safety simulations with LS-DYNA, and covers the complete CAE-process from model building and dataset preparation to result evaluation and design comparisons.

EASi-CRASH DYNA can be used for concept crash, FE crash and coupled rigid body/FE crash simulations in conjunction with MADYMO.

EASi-CRASH DYNA's main features include:

- Support of all keywords of LS-DYNA 970/971
- Powerful mesh editing features, such as automesh and remesh
- LS-DYNA/MADYMO coupling capabilities for pre- and post processing (support of MADYMO format till version 6.2.2)
- Model Assembler for organizing the model through sub assembly/sub models and included files
- Enhanced Weld tools for manipulation of connections and Weld comparison
- Simple dummy positing and seat belt routing
- Pre and Post processing in same environment
- Superpose and merge multiple models
- Animation and plotting
- Process compatible
- Full capability to handle IGES, CATIA V4, CATIA V5, UG and NASTRAN files



Hardware & Computing and Communication Products

www.amd.com

www.fujitsu.com

www.hp.com

www-1.ibm.com/servers/deepcomputing

www.intel.com

www.nec.com

www.sgi.com

Software Distributors

Alphabetical order by Country

Australia	**Leading Engineering Analysis Providers** www.leapaust.com.au
Canada	**Metal Forming Analysis Corporation** www.mfac.com
China	**ANSYS China** www.ansys.cn
China	**MSC. Software – China** www.mscsoftware.com.cn
Germany	**CAD-FEM** www.cadfem.de
Germany	**Dyna*More*** www.dynamore.de
India	**GissETA** www.gisseta.com
India	**Altair Engineering India** www.altair-india.com
Italy	**Altair Engineering Italy** www.altairtorino.it
Italy	**Numerica SRL** www.numerica-srl.it
Japan	**Fujitsu Limited** www.fujitsu.com
Japan	**The Japan Research Institute** www.jri.co.jp
Japan	**CRC Solutions Corp.** www.engineering-eye.com
Korea	**Korean Simulation Technologies** www.kostech.co.kr
Korea	**Theme Engineering** www.lsdyna.co.kr

Software Distributors (cont.)

Alphabetical order by Country

Netherlands	**Infinite Simulation Systems B.V** www.infinite.nl
Russia	**Strela, LLC** www.ls-dynarussia.com
Sweden	**Engineering Research AB** www.erab.se
Taiwan	**Flotrend** www.flotrend.com.tw
USA	**Engineering Technology Associates** www.eta.com
USA	**Dynamax** www.dynamax-inc.com
USA	**Livermore Software Technology Corp.** www.lstc.com
USA	**ANSYS Inc.** www.ansys.com
UK	**Oasys, LTD** www.arup.com/dyna/

Consulting and Engineering Services
Alphabetical Order By Country

Australia Manly, NSW www.leapaust.com.au	**Leading Engineering Analysis Providers** Greg Horner info@leapaust.com.au 02 8966 7888
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USA Windsor, CA www.schwer.net/SECS	**SE&CS** Len Schwer len@schwer.net (707) 837-0559
USA Corvallis, OR www.predictiveengineering.com	**Predictive Engineering** George Laird (1-800) 345-4671 george.laird@predictiveengineering.com
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Informational Websites

The LSTC LS-DYNA Support site: www.dynasupport.com

LSTC LS-DYNA Support Site	**www.dynasupport.com**
FEA Informationwebsites	**www.feainformation.com**
TopCrunch – Benchmarks	**www.topcrunch.org**
LS-DYNA Examples (more than 100 Examples)	**www.dynaexamples.com**
LS-DYNA Conference Site	**www.ls-dynaconferences.com**
LS-DYNA Publications to Download On Line	**www.dynalook.com**
LS-DYNA Publications	**www.feapublications.com**
LS-DYNA CADFEM Portal	**www.lsdyna-portal.com.**

Feb Highlights from FEA Information Inc.

Website: www.feainformation.com

Pathscale:

Provides software and hardware products that reduce the most critical impediments to application performance scalability on Linux clusters.

The Japan Research Institute, Ltd :

Specializing in Research & Consulting; System Consulting, Frontier Business, System Integration and Science Consulting.

Hewlett Packard:

HP's utility computing solutions address this dilemma by making infrastructure and applications available as "services" that let you dynamically dial up or dial down capacity to meet your changing business needs. We offer a diverse range of utility-based solutions including cost-saving PC, server, storage, mail and messaging, and print utilities; centralized data center infrastructure provisioning; and state-of-the-art distributed grid technologies.

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