



DEISA Training session in Jülich, Germany



The next DEISA training session will be organised in Jülich, Germany, on October 23rd - 25th, 2006.

The 2nd DEISA training session will be organized at Forschungszentrum Jülich GmbH, in Jülich, Germany on October 23rd - 25th, 2006. Scientists from all European countries and members of industrial organizations involved in high performance computing are invited to attend. The attendance is limited to 30 participants. DEISA will take charge of the travel and living expenses of up to 15 participants arriving outside Germany. The registration will close on October 13th .

The purpose of the training is to enable fast development of user skills and know-how needed for the efficient utilisation of the DEISA infrastructure. The first part of the training will give a global description and introduction to the DEISA infrastructure and will describe the general middleware services, the usage of the DEISA Common Production Environment and the detailed utilisation of UNICORE. The second part of the training will be dedicated to the topic of performance and portability.

The registration for this training session is open. The program is available at www.deisa.org/training.

DESHL v3 released!

Version 3 of the DEISA Services for the Heterogeneous management Layer, better known as the DESHL, is now available from <http://deisa-jra7.forge.nesc.ac.uk/>.

DESHL allows users and their applications to manage batch jobs and data across a computing grid in a uniform manner regardless of the underlying hardware and software on the various nodes of the grid. The DESHL employs emerging grid standards so that a user and their applications are not affected by the differences or changes in the hardware and software configuration on the grid nodes.

The DESHL software has been developed by DEISA's seventh Joint Research Activity (JRA7). EPCC and ECMWF from the UK, FZJ from Germany and CINECA from Italy are the participants in this research activity.

The DEISA JRA7 activity is using modern Grid standards to develop a means for coordinating and integrating services for distributed resource management in a heterogeneous supercomputing environment. Figure 1 illustrates how the DESHL can be used to access the DEISA heterogeneous supercomputing infrastructure.

The DESHL provides users and their applications with a command line tool and application programming interfaces for job and data management in a UNICORE-based grid such as the DEISA heterogeneous supercomputing infrastructure. The DESHL employs emerging Grid

standards like the SAGA (Simple API for Grid Applications) and JSDL (Job Submission Description Language) emerging grid standards as well as the Open Group Batch Environment Services specifications. Reliance on well established Grid standards is of course the best way to enable interoperability with other Grid environments.

The DESHL v3 command line tool provides the following job management and file transfer capabilities.

- determine the DEISA sites to which a user can submit a batch job to
- submit a batch job to a DEISA site
- terminate a batch job at a DEISA site
- view the status of a batch job on a DEISA site
- upload a file to a DEISA site
- download a file from a DEISA site
- delete a file from a DEISA site
- determine if a file exists on a DEISA site
- list the contents of a directory on a DEISA site
- rename a file on a DEISA site
- copy/move a file between DEISA sites

The latest release of the DESHL also includes a GUI-based installer, an installation and user manual, a design description, and API documentation for the DESHL Client and Grid Access libraries.

Finally, it is worth noting that the DESHL Client library was the first publicly-available Java-based implementation of file and job management services using the proposed SAGA grid standard. More importantly, it is the first SAGA implementation to be actively deployed, tested against and used with a production-level, continental grid infrastructure and thus represents an important contribution to global Grid computing.

For more information on the DESHL please access the DEISA JRA7 web-site at <http://deisa-jra7.forge.nesc.ac.uk/> or contact the DEISA JRA7 Task Leader, Mr Terry Sloan (t.sloan@epcc.ed.ac.uk).

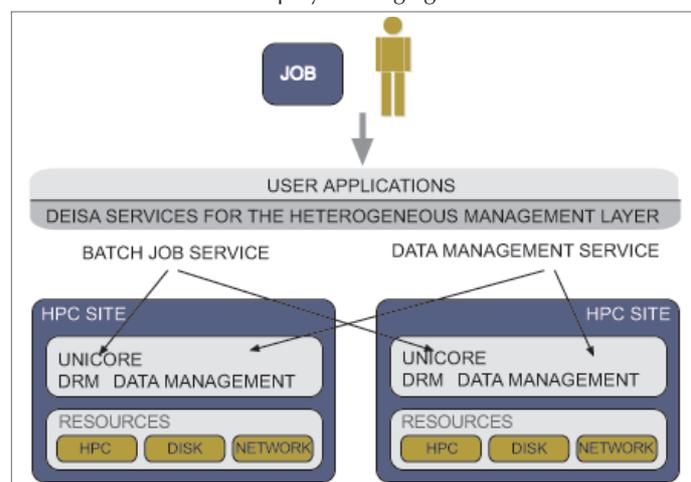


Figure 1: Using the DESHL (DEISA Services for the Heterogeneous management Layer) to access the DEISA heterogeneous supercomputing infrastructure

Simulating Type Ia Supernovae on DEISA

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Only about once in a century, a “new star” might appear on the night sky, visible to the naked eye, which fades away over some weeks. A sub-group of these events – classified as Type Ia supernovae (SNe Ia) – are among the most energetic explosions in the universe. Being rare in single galaxies such as the Milky Way, the majority of SNe Ia occurs far away. Due to their enormous intrinsic brightness, outshining billions of stars, large telescopes facilitate the observation of supernovae that went off when the universe was only about half its present age. Therefore, they can be used as “lighthouses” and “standard candles” to determine the geometry and the expansion rate of the universe. Here, one exploits the fact that SNe Ia are (at least by astronomical standards) remarkably uniform. Knowing the intrinsic luminosity, their apparent brightness tells us their distance. These measurements indicated that the universe undergoes an accelerated expansion at present – a result which fits into the theoretical framework of General Relativity, given that a yet unknown form of “dark” energy is assumed to dominate the universe today. Thus, SNe Ia may have given birth to a major revision of our understanding of physics and of the universe.

However, a close look to the sample of well-observed nearby SNe Ia reveals an intrinsic scatter in their brightnesses which is evidently connected to other properties. Such correlations are used to calibrate the cosmological distance determinations. But, as yet, these are established only empirically. A sound theoretical understanding of the explosion mechanism is therefore one of the great challenges of astrophysics. Only models that tackle the underlying physics in a self-consistent way are predictive enough to provide answers concerning the reliability of SNe Ia as cosmic distance indicators. A promising approach is pursued at the Max Planck Institute for Astrophysics. By constructing numerical models of SN Ia explosions [2][4] and by comparing the results with detailed observations of nearby Type Ia supernovae, new insights into the explosion mechanism are gained.

Although there exists consensus about the astrophysical scenario [1], the exact explosion mechanism is unclear. SNe Ia are attributed to the thermonuclear explosion of White Dwarf stars, of about 1.4 solar masses, which consist of carbon and oxygen. The behavior of such a final event of the star life implies a very complex variety of phenomena that make SN Ia

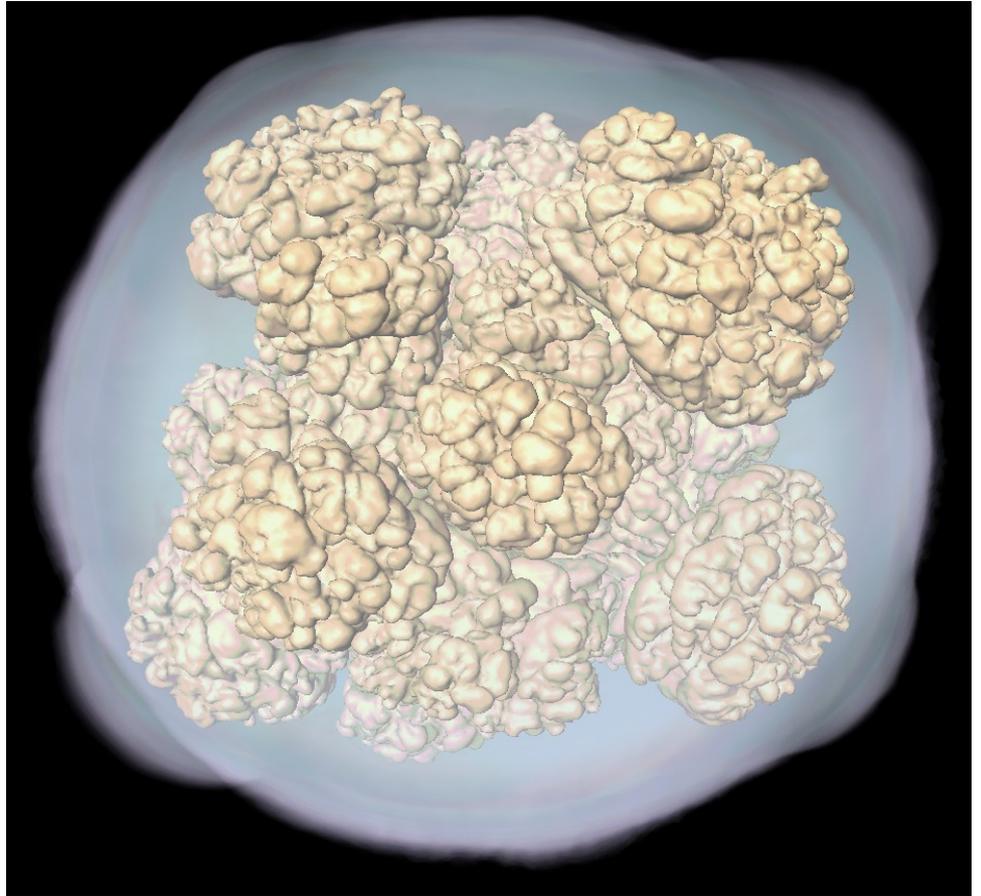


Figure 1: Snapshot from a Type Ia supernova explosion simulation on DEISA. The largest near-spherical shape is the volume rendering of the logarithm of the density which indicates the White Dwarf star, and the inner isosurface represents the thermonuclear flame. Its complex structure results from instabilities and turbulent nature of the flow as the flame progresses from its ignition, near the star's center, towards the surface.

explosions a problem of turbulent combustion much like the burning of fuel in car engines.

The challenge of implementing this scenario into numerical simulations lies in the vast range of relevant length scales. While the radius of the exploding White Dwarf star amounts to ~ 2000 km, the width of a flame typically is less than a millimeter. In order to model turbulence effects consistently, three-dimensional simulations are inevitable, and it is impossible to resolve the full range of scales with a brute approach. Thus different correlated methods and models have been used to code the solution and the resultant simulation was carried out within the DEISA framework on HPCx, the IBM cluster in the UK using 512 processors. The evolution of the explosion process was obtained using 6403 cells. The results are illustrated in Figure 1.

Based on this simulation, observables can be predicted and these will then be compared with actual observations to assess the validity of the SN Ia model. This pipeline of post-processing

steps is a pan-European effort including research groups from Germany, Italy, Sweden, and Russia. The distributed DEISA infrastructure will continue to provide the resources for this task. Indeed, DEISA is proud to host this project, particularly since its relevance in Cosmology is documented by the choice of the Scientific American newsletter to use its results as the cover story (“How to Blow Up a Star”) for the October 2006 issue.

References:

- [1] Hillebrandt, W. & Niemeyer, J. C., 2000, ARA&A, 38, 191.
- [2] Reinecke, M., Hillebrandt, W. & Niemeyer, J. C., 2002, A&A, 391, 1167.
- [3] Reinecke, M., Hillebrandt, W., Niemeyer, J. C., Klein, R. & Gröbl, A., 1999, A&A, 347, 724.
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- [5] Schmidt, W., Niemeyer, J. C., Hillebrandt, W. & Röpke, F. K., 2006, A&A, 450, 283.
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