

## PIE

Performance and Introspection at Exascale

Leading Principal Investigator		Project data
Gabrielle Dawn Allen (Louisiana State University (LSU))		Project begin: 01.04.2011
		Duration: 3 years
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Dieter Kranzmueller, Ludwig-Maximilians-Universitaet...		
Luciano Rezzolla, Albert Einstein Institute, Max Planck In...		
Ian Hinder, Albert Einstein Institute, Max Planck Institut...		
David Skinner, Lawrence Berkeley Laboratory (LBL)		
Karl Fuerlinger, Lawrence Berkeley Laboratory (LBL)		
Joan Masso, University of the Balearic Islands (UIB) (n...		
Sascha Husa, University of the Balearic Islands (UIB) (...)		
Jesus Labarta, Barcelona Supercomputing Center (BSC)...		
Summary		

Simulation supported science is of increasing importance for many global-scale grand challenge problems such as understanding climate change, efficiently modeling nuclear fusion, predicting the effects of coastal processes such as hurricanes or oil spills, or investigating the origins of our universe. At the same time, the accessibility and utility of the ultrascale HPC systems that drive simulation science are in danger of eroding. The usefulness of petascale resources is already limited to science teams who can both deal with the complexities of expressing their science goals in HPC form and deal with complex performance optimization scenarios which vary across architectures and across runs. As we move toward exascale, without research and development effort applied to these two issues the utility of exascale systems will be of increasingly limited scientific and social relevance.

We propose a program of research that will make it easier for scientists to express their problems in programmatic form suitable for HPC and also to make performance optimization more accessible and productive. These two efforts respectively form the HPC entry points and outputs that are growing steadily more complex.

We will then apply these methods to driver problems in coastal modeling and general relativistic astrophysics, aiding ongoing research in our collaboration, which will ensure that our methods will in the

end be practically applicable. Our program of research will bring automatic code generation and scalable performance introspection to exascale.

Signature

Baton Rouge, 07.05.2010

Allen

Provisional Financial Summary

Principal Investigator	First Name	Last Name	Institution	City	Country	Estimated Costs (EUR)	Estimated Funding requested (EUR)
Leading PI	Gabrielle Dawn	Allen	Louisiana State University (LSU)	Baton Rouge	USA	300.000	300.000
Partner PI 1	Erik	Schneider	Louisiana State University (LSU)	Baton Rouge	USA	0	0
Partner PI 2	Ian	Hawke	University of Southampton (SOTON), School of Mathematics	Southampton	UK	250.000	250.000
Partner PI 3	Dieter	Kranzmueller	Ludwig-Maximilians-Universität München (LMU)	Munich	Germany	250.000	250.000
Partner PI 4	Luciano	Rezzolla	Albert Einstein Institute, Max Planck Institute for Gravitational Physics (AEI)	Potsdam	Germany	250.000	250.000
Partner PI 5	Ian	Hinder	Albert Einstein Institute, Max Planck Institute for Gravitational Physics (AEI)	Potsdam	Germany	0	0
Partner PI 6	David	Skinner	Lawrence Berkeley Laboratory (LBL)	Berkeley	USA	275.000	0
Partner PI 7	Karl	Fuehringer	Lawrence Berkeley Laboratory (LBL)	Berkeley	USA	0	0
						1.325.000	1.050.000

**Leading Principal Investigator**

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Highest academic qualification	PhD
Principal Investigator details	<p>Gabrielle Allen is Associate Professor in Computer Science at Louisiana State University, and a faculty member at the Center for Computation &amp; Technology. Gabrielle obtained a PhD in computational astrophysics from Cardiff University in 1993. Before moving to LSU in 2003, Gabrielle led the computer science area of the Max Planck Institute for Gravitational Physics (AEI) where she led of the Cactus Code project and was a PI for the European GridLab project. At LSU, Gabrielle leads the Computational Frameworks group which develops and supports Cactus, and leads the cyberinfrastructure component of the statewide NSF research infrastructure improvement award. She is involved in a number of large, collaborative projects involving computer science, scientific computing and the computational sciences, in diverse fields including petroleum engineering, coastal modeling, computational fluid dynamics, numerical relativity and computational chemistry. In particular, Gabrielle leads the NSF funded Einstein Toolkit Consortium developing open software for relativistic astrophysics.</p>

Cactus Framework: Black Holes to Gamma Ray Bursts, E. Schnetter, C. Ott, G. Allen et al, in Petascale Computing: Algorithms and Applications, Ed. D. Bader, CRC Press LLC (2007).

The Grid Application Toolkit: Toward Generic and Easy Application Programming Interfaces for the Grid, G. Allen et al, Proceedings of the IEEE, 93(3), (2005).

The Cactus Framework and Toolkit: Design and Applications, T. Goodale, G. Allen, G. Lanfermann, J. Masso et al, in Vector and Parallel Processing - VECPAR 2002, 5th International Conference, LNCS, Springer, (2003).

Supporting Efficient Execution in Heterogeneous Distributed Computing Environments with Cactus and Globus, G. Allen et al, proceedings of SC2001 Conference, (2001)

The Cactus Worm: Experiments with Dynamic Resource Discovery and Allocation in a Grid Environment, G. Allen et al, Int. Journal of High Performance Computing Applications, 15(4), (2001).

Estimated costs	300.000
Estimated funding requested	300.000

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Erik Schnetter is an assistant research professor at the Center for Computation & Technology and the Department of Physics & Astronomy at Louisiana State University. His research interests combine computational relativistic astrophysics and scientific computing. He leads LSU's numerical relativity group that investigates astrophysical systems such as black holes, neutron stars, and stellar core collapse where general relativity plays a key role, and which emit gravitational waves that are expected to soon be observed.

Schnetter is also software architect of the Cactus framework, and original author and project lead of the parallel adaptive mesh refinement infrastructure "Carpet" which are publicly available and which are used in several other relativistic astrophysics research groups.

Schnetter is currently focussing on understanding and modelling Gamma-Ray Bursts, in particular investigating the effect of neutrino

	radiation in large-scale numerical simulations.
	E.Schnetter, C. D. Ott, P. Diener, C. Reisswig. Astrophysical applications of numerical relativity - from TeraGrid to Petascale. The 3rd annual TeraGrid Conference, TeraGrid '08, 2008.
	C. D. Ott, H. Dimmelmeier, A. Marek, H. Janka, I. Hawke, B. Zink, E. Schnetter. 3D collapse of rotating stellar iron cores in general relativity including deleptonization and a nuclear equation of state. Phys. Rev. Lett. 98:261101, 2007.
	P. Diener, F. Herrmann, D. Pollney, E. Schnetter, E. Seidel, R. Takahashi, J. Thornburg, and J. Ventrella. Accurate evolution of orbiting binary black holes. Phys. Rev. Lett. 96:121101, 2006.
	L. Baiotti, I. Hawke, L. Rezzolla, E. Schnetter. Gravitational-wave emission from rotating gravitational collapse in three dimensions. Phys. Rev. Lett. 94:131101, 2005.
	E. Schnetter, S. H. Hawley, and I. Hawke. Evolutions in 3D numerical relativity using fixed mesh refinement. Class. Quantum Grav. 21: 1465-1488, 2004.
Estimated costs	0
Estimated funding requested	0

**Principal Investigator 2**

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Principal Investigator  
 details

Ian Hawke is a Lecturer in Applied Mathematics at the University of Southampton and a member of the largest classical general relativity group in Europe. Having completed a PhD in computational methods in cosmology at the University of Cambridge in 2001, Ian worked at the Max Planck Institute for Gravitational Physics (AEI) in Potsdam, Germany where he was lead author on the "Whisky" code for relativistic hydrodynamics. This project, which relies on the Cactus framework and is developed within an EU Research Training Network, is ongoing and drives an international collaboration applying the code to astrophysical problems such as binary neutron star merger. Since moving to Southampton in 2004 Ian has focused on improving the algorithms used in large scale relativistic hydrodynamics simulations, and on improving the physical model used, particularly by the inclusion of interfaces, elasticity and multi-fluids.

Millmore, S. and Hawke, I. (2010) Numerical simulations of interfaces in relativistic hydrodynamics. *Classical and Quantum Gravity*, 27, (1),



	015007-[23pp].
	Saijo, M. and Hawke, I. (2009) Collapse of differentially rotating supermassive stars: post black hole formation. Phys. Rev. D, 80, 064001-[17 pp].
	Ott, C.D., Dimmelmeier, H., Marek, A., Janka, H.-T., Hawke, I., Zink, B. and Schnetter, E. (2007) 3D collapse of rotating stellar iron cores in general relativity with microphysics. Physical Review Letters, 98, (26), 261101-[4pp].
	Baiotti, L., Hawke, I., Montero, P., Loeffler, F., Rezzolla, L., Stergioulas, N., Font, Jose A. and Seidel, E. (2005) Three-dimensional relativistic simulations of rotating neutron star collapse to a Kerr black hole. Phys. Rev. D, 71, (2), 024035-[30pp].
	Schnetter, E., Hawley, S. and Hawke, I. (2004) Evolutions in 3D numerical relativity using fixed mesh refinement. Classical and Quantum Gravity, 21, (6), 1465-1488.
Estimated costs	250.000
Estimated funding requested	250.000

**Principal Investigator 3**

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Habilitation

Principal Investigator  
 details

Prof. Dieter Kranzlmüller is a professor at Ludwig-Maximilians-Universität (LMU) and member of the board of directors of the Leibniz Supercomputing Centre (LRZ) of the Bavarian Academy of Sciences and Humanities. He has worked in parallel computing and computer graphics since 1993, with special focus on parallel programming and debugging, cluster and especially grid computing. He has participated in several national and international research projects, including leading roles in the EU Projects EGEE, EGEE-2 and EGI\_DS, has been acting as reviewer and international expert for several countries and research programs, and has co-authored more than 150 scientific papers in journals, and conference proceedings. He serves as Area Director Applications of the Open Grid Forum (OGF) and as Scientific Director of the Center for Digital Technology & Management (CDTM). He is also the German representative of the EGI Council.

	M. Ronsse, D. KranzlmProgram Executions., Communications of the ACM, Vol. 46, No. 9, pp. 62-67 (Sept. 2003).
	R. Mahajan, D. KranzlmChemical Physics (PCCP), Vol. 8, No. 47, pp. 5515-5521, (December 2006).
	D. KranzlmPrograms., in: .Parallel Computing: Software Technology, Algorithms, Architectures, and Applications., Elsevier Science (September 2003).
	D. KranzlmGVK/glogin Approach., Engineering the Grid: Status and Perspective., American Scientific Publishers (January 2006).
	R. Preissl, D. KranzlmCommunication Patterns., Future Generation Computer Systems, Vol. 16, No. 1, pp. 147-154 (2010).
Estimated costs	250.000
Estimated funding requested	250.000

**Principal Investigator 4**

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Rezzolla

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Highest academic  
 qualification

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Principal Investigator  
 details

Luciano Rezzolla is the head of the numerical relativity group at the Albert Einstein Institute, MPI for Gravitational Physics. Rezzolla obtained his PhD in Relativistic Astrophysics from SISSA, Trieste, Italy in 1995. He then moved as postdoctoral fellow at the University of Illinois at Urbana-Champaign and at NCSA, Illinois. After returning to Italy in 1999 first as an assistant professor and then as an associate one, he has been involved in the developments of numerical codes for the simulation of astrophysical scenarios in nonlinear regimes and in spacetimes with strong curvature. The Whisky code, now widely used in general-relativistic astrophysics, was developed under his coordination in SISSA and at the AEI. At SISSA he was also appointed as Director of the Computing Centre. Since 2006 he leads the group simulating sources of gravitational waves at the AEI which now counts about 20 scientists among postdoc and students. Besides his interests in numerical relativity and in the development of codes for parallel supercomputers, his research covers the oscillation modes of neutron stars and black holes, as well as the physics

	of compact objects.
	Predicting the direction of the final spin from the coalescence of two black holes, E. Barausse , L. Rezzolla, Astrophys. J. Lett. 704 L40-L44, 2009
	Challenging the paradigm of singularity excision in gravitational collapse L. Baiotti, L. Rezzolla Phys. Rev. Lett., 97, 141101 (2006)
	r-mode Oscillations in Rotating Magnetic Neutron Stars L. Rezzolla, F.K. Lamb, and S. L. Shapiro, Astroph. Journ. Letters 531, L141-144 (2000)
	A New ,Simple Model for High Frequency Quasi Periodic Oscillations in X-Ray Binaries containing a black hole L. Rezzolla, T. W. Maccarone, S'i. Yoshida and O. Zanotti Mon. Not. Roy. Ast. Soc. 344, L37 (2003)
	New Relativistic Effects in the Dynamics of Nonlinear Hydrodynamical Waves L. Rezzolla and O. Zanotti, Phys. Rev. Lett. 89, 114501 (2002)
Estimated costs	250.000
Estimated funding requested	250.000

**Principal Investigator 5**

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 Cooperation Partners

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Highest academic  
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Principal Investigator  
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Ian Hinder is a postdoc at the Albert Einstein Institute in Germany. He obtained his PhD from the University of Southampton in 2005 where he worked on mathematical formulations of the Einstein equations and automated code generation. He then moved to a postdoc at Penn State University where his automatically generated code became the group code used in production simulations of binary black hole mergers. He specialized in simulations of BBH systems with eccentricity and comparisons of these with post-Newtonian approximations. In his second postdoc, at the AEI, he is currently the senior member of the binary black hole group, and is working in international collaborations involving simulations to systematically span the BBH parameter space as well as test gravitational wave detection algorithms using simulation data.

I. Hinder, F. Herrmann, P. Laguna, D. M. Shoemaker, Comparisons of eccentric binary black hole simulations with post-Newtonian models}, Submitted to Phys.Rev.D

M. C. Washik, J. Healy, F. Herrmann, I. Hinder, D. M. Shoemaker, P. Laguna, R. A. Matzner, {em Binary Black Hole Encounters, Gravitational Bursts and Maximum Final Spin}. Phys.Rev.Lett.101:061102, 2008.

I. Hinder, B. Vaishnav, F. Herrmann, D. M. Shoemaker, P. Laguna, Circularization and Final Spin in Eccentric Binary Black Hole Inspirals. Phys.Rev.D77:081502, 2008

F. Herrmann, I. Hinder, D. Shoemaker, P. Laguna, R. Matzner, Gravitational recoil from spinning binary black hole mergers, ApJ, 661, 430, 2007.

S. Husa, I. Hinder, C. Lechner. {em Kranc: a Mathematica application to generate numerical codes for tensorial evolution equations}. Comp. Phys. Comm 174:983--104, 2006

Estimated costs

0

Estimated funding  
requested

0

**Principal Investigator 6**

non G8-Partner -  
 Cooperation Partners

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Highest academic  
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Principal Investigator  
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David Skinner is Principle Investigator for the DOE SciDAC Outreach Center, which assists scientists in sharing their advances with other scientists and with the public. The center provides tutorials on scientific computing topics, fields inquiries from the public and industry, as well as improving and disseminating scientific computing technologies. David is the primary author and developer of the Integrated Performance Monitoring (IPM) open source framework for performance profiling of parallel applications and workloads. This work grew out of the need to profile large numbers of different codes that make up the diverse workloads at HPC centers. Improving application performance, characterizing scientific workloads, and analysis of emerging architectures are the core activities of David's present HPC research.

On the Importance of End-to-end Application Performance Monitoring and Workload Analysis at the Exascale, D. Skinner and A. Choudry, International Journal of High Performance Computing,, Nov 2009; vol. 23:



pp. 357 - 360.

Consistent Application Performance at Exascale, D. Skinner and W. Kramer, International Journal of High Performance Computing, Nov 2009; vol. 23: pp. 392 - 394.

Integrated Performance Monitoring of a Cosmology Application on Leading HEC Platforms, International Conference on Parallel Processing: ICPP 2005., Nominated: Best paper award L. Oliker, J. Borrill, J. Carter, D. Skinner, R. Biswas

Software Roadmap to Plug and Play Petaflops, W. Kramer, J. Carter, D. Skinner, L. Oliker, P. Husbands, P. Hargrove, J. Shalf, O. Marques, E. Ng, L. Drummond, and K. Yelick, LBNL Technical Report, LBNL-59999, July 2006.

Understanding the Causes of Performance Variability in HPC Workloads, IEEE International Symposium on Workload Characterization, IISWC05, D. Skinner and W. Kramer

Estimated costs

275,000

Estimated funding  
requested

0

**Principal Investigator 7**

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 Cooperation Partners

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Principal Investigator  
 details

Karl Fuerlinger received his PhD summa cum laude from the Technical University Of Munich in 2006. His dissertation work was concerned with automated techniques for performance diagnosis for large scale supercomputers. Karl is the main developer of ompP (<http://www.ompp-tool.com>), a portable performance profiling tool for OpenMP applications. In 2007 Karl accepted a position as a senior research associate at the Innovative Computing Laboratory at the University Of Tennessee. Having been offered a position at UC Berkeley a year later, he expanded his areas of expertise into HPC workload analysis and application characterization and the monitoring and analysis of data intensive applications. At UC Berkeley he is also an associated researcher at Par Lab, and has expanded his research interests into auto-tuning of numerical algorithms, multicore operating systems, parallel programming patterns and hardware performance counter design for next generation architectures.

K. Fuerlinger, N. J. Wright, D. Skinner, C. Klausecker and D. Kranzmueller. Effective Holistic Performance Measurement at Petascale Using IPM. CiHPC Status Conference of the Gauss-Allianz, Schwetzingen Germany. 2010. To appear.

K. Fuerlinger, N. J. Wright, and D. Skinner. Performance Analysis and Workload Characterization with IPM. 3rd Parallel Tools Workshop, Dresden Germany.

K. Fuerlinger and S. Moore. Recording the Control Flow of Parallel Applications to Determine Iterative and Phase-Based Behavior. Future Generation Computing Systems (FGCS), volume 26, pages 162-166, 2009.

M. Gerndt and K. Fuerlinger. Highly Scalable Performance Analysis Tools. In Petascale Computing: Algorithms and Applications. CRC Press, 2007.

K. Fuerlinger and J. Dongarra. On Using Incremental Profiling for the Performance Analysis of Shared Memory Parallel Applications. In Proceedings of the 13th International Euro-Par Conference on Parallel Processing (Euro-Par '07), pages 62-71, August 2007.

Estimated costs

0

Estimated funding  
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Highest academic qualification	PhD
Principal Investigator details	<p>Dr. Joan Massó is Associate Professor of Theoretical Physics at the University of the Balearic Islands (UIB) since 1998. During 1993-1996 he worked at the National Center for Supercomputing Applications, and from 1996 to 1999 in the Max Plank Institut für Computationphysik. He is one of the original authors of the Cactus code (<a href="http://www.cactuscode.org">www.cactuscode.org</a>). During the decade 2000-2009, Joan founded and directed GridSystems (<a href="http://www.gridsystems.com">www.gridsystems.com</a>), which was one of the leading European private companies in the development and commercialization of Grid Computing middleware (<a href="http://fura.sourceforge.net">fura.sourceforge.net</a>) with applications in finance, health, telecommunications and many other industries. As CEO of GridSystems, he has participated in 6 European Projects and 3 Spanish National projects with a total budget of over 200M Euros. Joan has a wide experience in many areas of high performance computing, grid and cloud computing and has also acted as an advisor to many international boards, public and private. In 2010, Joan is back full time to Academia and is now participating actively in the development of the Institute of Advanced</p>

	computing and Community Code ( <a href="http://www.iac3.eu">www.iac3.eu</a> ) at the UIB.
	C. Bona, J. Massó, "Hyperbolic system for Numerical Relativity", Phys. Rev. Letters 68, 1097 (1992)
	C. Bona, J. Massó, E. Seidel, J. Stela, "A New Formalism for Numerical Relativity", Phys. Rev. Letters 75, 600 (1995)
	P. Anninos, K. Camarda, J. Massó, E. Seidel, W.-M. Suen, and J. Towns, "Three dimensional numerical relativity: the evolution of black holes", Phys. Rev.D, 52 2052 (1995)
	T. Goodale, G. Allen, G. Lantermann, Joan Massó, T. Radke, E. Seidel, J. Shalf: The Cactus Framework and Toolkit: Design and Applications VECAR 2002, 197 Springer Verlag (2002)
	M. Laucelli, J. Massó, "Grids in the Telecommunication Sector" in book "Grid Computing: A practical guide to technology and applications" Ed. A. Agha, Charles River Media (2003)
Estimated costs	139.000
Estimated funding requested	0

**Principal Investigator 9**

non G8-Partner - Cooperation Partners	Yes
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Highest academic qualification	PhD
Principal Investigator details	<p>Sascha Husa is assistant professor in the gravitational theory group at the University of the Balearic Islands, and works on the numerical solution of the Einstein equations. After obtaining his PhD at the University of Vienna, he held postoc positions at the University of Pittsburgh, MPI for Gravitational Physics and the University of Jena (where he has also held a lecturer position). Sascha Husa has made key contributions to the state of the art of numerical evolutiouns of black hole binaries and the interface to gravitational wave detection, and has co-developed (with Ian Hinder) the Kranc software for automatic code generation.</p> <p>S. Husa, I. Hinder, C. Lechner. Kranc: a Mathematica application to generate numerical codes for tensorial evolution equations}. Comp. Phys. Comm. 174, 983--104, 2006.</p> <p>P. Ajith, et al., "A Template bank for gravitational waveforms from coalescing binary black holes. I. Non-spinning binaries", Phys. Rev. D77,</p>

	104017 (2008).
	M. Hannam, S. Husa, D. Pollney, B. Bruegmann, N. O' Murchadha, "Geometry and regularity of moving punctures", Phys. Rev. Lett. 99 241102 (2007).
	J. Gonzalez, U. Sperhake, B. Bruegmann, M. Hannam, S. Husa, "The maximum kick from nonspinning black-hole binary inspiral", Phys. Rev. Lett. 98 091101 (2007).
	J. Gonzalez, M. Hannam, U. Sperhake, B. Bruegmann, S. Husa, "Supermassive recoil velocities for binary black-hole mergers with antialigned spins", Phys. Rev. Lett. 98 231101 (2007).
Estimated costs	0
Estimated funding requested	0

**Principal Investigator 10**

non G8-Partner - Cooperation Partners	Yes
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Highest academic qualification	PhD
Principal Investigator details	<p>Jesus Labarta is full professor on Computer Architecture at the Technical University of Catalonia (UPC) since 1990. Since 1981 he has been lecturing on computer architecture, operating systems, computer networks and performance evaluation. His research interest has been centered on parallel computing, covering areas from multiprocessor architecture, memory hierarchy, parallelizing compilers, operating systems, parallelization of numerical kernels, performance analysis and prediction tools.</p> <p>Since 2005 he is responsible for Computer Science research within the Barcelona Supercomputing Center. His major directions of current work relate to performance analysis tools, programming models, in particular developing the StarSs model (with implementations for different multicore and accelerator nodes such as Cells, GPUs, SMP), interconnection networks, node architecture and resource management. All these topics are being researched in the holistic framework of the MareIncognito</p>



project, a BSC R&D cooperation with IBM.

A. Snively, L. Carrington, N. Wolter, J. Labarta, R. Badia and A. Purkayastha (2002). A Framework for Performance Modeling and Prediction Supercomputing 2002 (SC.02)

X. Martorell, N. Smeds, R. Walkup, J. R. Brunheroto, C. Almasi, J. A. Gunnels, L. DeRose, J. Labarta et al (2003). Blue Gene/L performance tools IEEE Transactions on Parallel and Distributed Systems. vol. 49, no2-3, pp. 407-424

J. Labarta, J. Gimenez, Performance Analysis: From Till when an Art in Frontiers of Scientific Computing. M.A. Herroux, P. Raghavan and Horst Simon (Eds.). 2006.

M. Casas, R. Badia, J. Labarta, Automatic Extraction of Structure of MPI Applications Tracefiles, Proceedings of the European Conference on Parallel Computing (Euro-Par), pages 3-12, 2007.

M. Casas, R. Badia, J. Labarta, Automatic analysis of speedup of MPI applications", Proceedings of the 22nd ACM International Conference on Supercomputing (ICS), pages 349-358, 2008.

Estimated costs 100.000

Estimated funding requested 0