

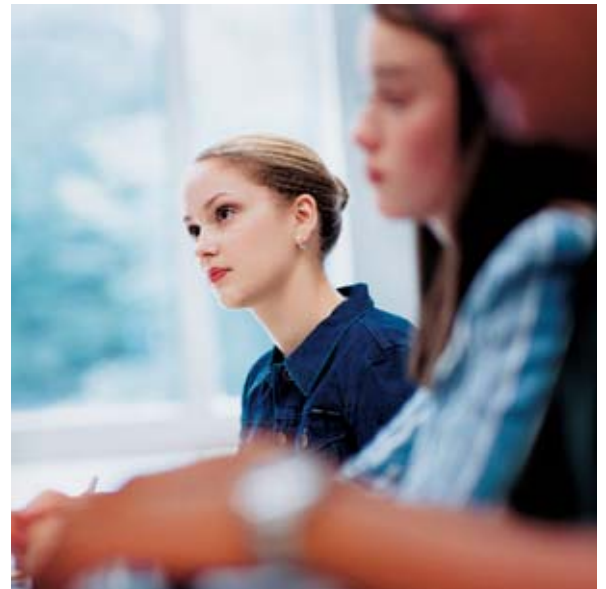
SPACI Success Story

Grid Computing



“HP has not only been actively involved in the SPACI consortium at the economic and technological sponsorship level, but it has played a strategic role as a ‘trait d’union’ with some players in the ICT world and major ones related to the industrial world. Through all its consortium activity, HP is a great resource in terms of expertise and know-how, helping to enhance the quality of the services SPACI provides”.

Giovanni Aloisio, Full Professor of Information Processing Systems at the University of Lecce and Chairman of SPACI





The information company has opened up new scale economies. The change has generated innovative means of approach to knowledge, with a view to sharing the ever-widening resources. Grid Computing represents the last frontier of an effective circle, capable of rationalising and optimising information systems by means of the virtual gathering together of computing and application resources. Italy is ahead of many other European countries and, surprisingly, the golden triangle lies in the south of Bel Paese. Here the SPACI consortium, a centre of competence in Grid Computing, has led the way. Involved in it are the University Centres of Lecce and Cosenza which, with HP Italia, have become promoters of a new technological and scientific culture, providing public and private research with the largest operating Grid infrastructure in Southern Italy.

The real technological revolution that took place at the beginning of last century was not the result of the invention of electricity, but the development of associated technologies for its distribution and transmission on a wide area. In fact, because of the development of these power grid technologies, today it is possible to have standardised, low-cost services that allow widespread and reliable access to electrical power.

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SPACI stands for Southern Partnership for Advanced Computational Infrastructures, a project created to promote applied research on Grid Computing and to help the transfer of technology from the academic and research world to the business world and that of Public Utility Companies. Presented to the Ministry of Education, University and Research (MIUR) by the ISUFI Centre For Advanced Computational Technologies of the University of Lecce, by the Center for Research on Parallel Computing and Supercomputers (CPS/CNR) of Naples, now ICAR-CNR, by the Center of Excellence MIUR for High Performance Computing (HPCC) of the University of Calabria, the project then led to a consortium, set up in 2004, that includes the Universities of Lecce and Calabria, Hewlett Packard Italia and the consortium company Spaci S.r.l., which has operating in it mainly young graduates from the Universities of Calabria, Campania and Puglia, with a particular qualification in the ICT area, distributed and parallel computing, and grid computing. The consortium is supported by some high-profile technological partners such as Intel, MSC Software and NICE, but it is HP Italia, as a strategic partner and among the founding partners of the project that, as well as promoting the development and support of Grid Computing technologies and their use in the most varied application situations, guarantees an added value from the operating point of view through support and system services in relation to the whole of SPACI's computer network, thanks to the EMEA structure known as HP Collaboration and Competency Network and to the HP Technical Computing Team (HPC).

It is Giovanni Aloisio, Full Professor of Information Processing Systems at the University of Lecce, and also Chairman of SPACI, who will explain the scenario.

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In fact, because of the development of these power grid technologies, today it is possible to have standardised, low-cost services that allow widespread and reliable access to electrical power. Today we are witnessing the same technological revolution with regard to calculation systems and, more generally, the large amount of data and information associated with scientific, economic and financial fields. Computing grids, or rather grid computing, as it is known, currently represent the most advanced point of research in the sector of heterogeneous systems, distributed on a vast geographical scale. SPACI's grid infrastructure, with a capacity of 1,837 Gflops, is a model of excellence in Southern Italy, and it is directed towards a national and international environment.”



The SPACI project's protocols in the most diversified application fields, from remote sensing (grids for dynamic acquisition, processing on demand and delivering images in relief) to medical imaging (grids for management, cataloguing, analysis and display in 2D/3D of biomedical images) with virtual reality application for surgical simulations, but the applied research fields in SPACI include specialised divisions as:

- Climatology and Atmosphere Physics (grids for applications of meteorology and dispersion of the uppermost atmospheric layer)
- Motor Industry (grids for fluidodynamic applications for flow simulations in combustion chambers, or internal combustion turbo-engine systems)
- Nanotechnology (grids for calculating structural, electronic and optical properties of organic molecules).

"HP has not only been actively involved in the SPACI consortium at the economic and technological sponsorship level", says Aloisio, "but it has played a strategic role as a 'trait d'union' with some players in the ICT world and major ones related to the industrial world. SPACI is strongly involved in the sectors of biomedicine, industry, finance and earth-observation, through projects carried out nationally and throughout the European Community. Through all its consortium activity, HP is a great resource in terms of expertise and know-how, helping to enhance the quality of the services SPACI provides"

Grid computing, when philosophy becomes technology

Grid computing can be seen as the technological approach of a precise cultural model. "As researchers, we have started from a simple premise", explains Aloisio, "we perform science, we carry out research and we have machines, why not share them? Unlike industry, in fact, in science we cannot have barriers because every result must be able to be shared. In a world which is already so competitive, scientists can exchange philosophy, promoting a free and useful exchange for the knowledge's sake. Our business is to do research and to bring innovation.

In order to get these results, it is necessary to get together and this is not easy, but the person who has the instruments cannot allow himself the luxury of keeping the exclusive right, also because the rapid obsolescence of machinery requires large investments, with an increasingly-lower ROI".

Grid computing is none other than the infrastructural application of that logic of sharing resources that, following the best criteria of rationalisation and optimisation of ICT, makes it possible to use the power of making a series of computers connected in a network via the Internet, and balancing the workload of processing units and memory according to new rules of distribution. Thanks to computing grids it is possible to reach very high power levels which can be accessed freely by those involved in a scientific or private community who otherwise would never be able to use them, unless by means of very substantial investments.



The need for strong powers of computing, in fact, derives from some processing peaks but, as sector workers know, for much of the time the machines are underused in relation to their actual capacity because they are used only for a minimal part of their real performance. The possibility of using, within complex environments, large networks comprising server subnetworks belonging to different companies and bodies allows all those involved to operate distributed processors together, both at cluster level, or a group of computers, and in a network, being able to rely on a larger number of system resources.

The advantages of a complete sharing of resources

In short, grid computing is a formula for reallocating resources and for making the most of them, and, for performing complex processes, also using those machines that by themselves would not have the necessary power. A cluster of computers physically close to each other and interconnected that divide up the tasks is, in fact, able to perform operations in parallel and in less time than a single computer equipped with a multiprocessor. Added to this is the fact that, under the banner of free exchange, other operating philosophies converge, such as the open Internet standards, Linux and the Open Source, that make it possible for engineers and scientists to have active access to widespread innovation in information architectures by means of osmosis and wide-ranging exchange.

“Another advantage of grid computing”, stresses Aloisio, “is the means of access to the resources. The connection to the machines distributed even in the remotest geographical areas does not require either a password, or identification codes or support in various accounts. In fact, on the grid there is a concept of transparency so that every time I connect to the grid I have a single account and, through all the relevant security protocols attached and connected, by means of very high-level interfaces, I can start the processing procedures as if all the machines were in one place”.

The researchers working with SPACI, in fact, are working on the development of user-friendly portals (OGSA compliant), for providing efficient and secure access to the grid environment, as well as acquisition, management and scheduling of resources, job submission and data staging, and for setting advanced grid information servers. Research activity aims at technological and training assessment and transfer in the areas of data bases and know-how, artificial intelligence, multimedia systems, mathematical software for constructing models and for simulation, artificial viewing in relation to high-performance computing systems, parallel calculation, advanced environments, protocols and technologies for networks of processors and for the Internet, as well as intelligent information systems and those with complex functional capacity.



HP Advanced Grid Strategy

“A very great advantage of HP’s active presence within the Consortium”, says Aloisio, “has been the possibility for the three University Centres to enter the HP Collaboration Competence Network, a situation aimed at exchanging skills and resolving a set of various different problems relating to software or to machine performance, in accordance with the development of a new generation of Grid Computing”.

In fact, HP, that has long worked on computing grids, has developed a virtual architecture that includes data protection services and their replication for servers and for storage and diverse utility software for automatic control and reconfiguration that enable the automatic partitioning of data center resources on the basis of the applications’ calculation and storage demands.

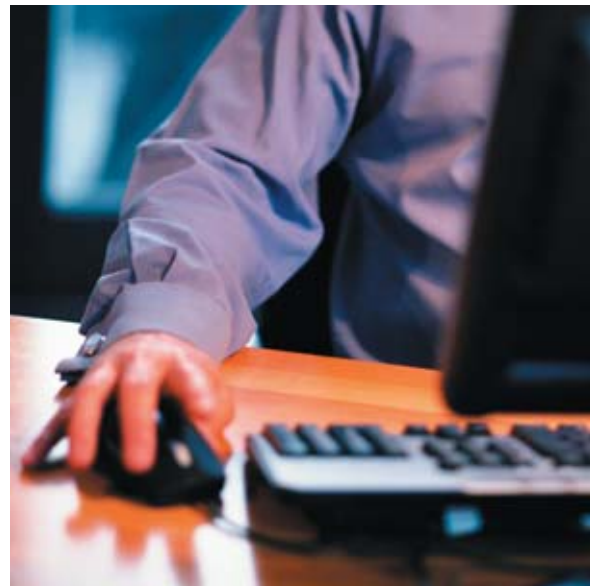
Taking the route of complete sharing of IT resources among the members of a virtual organisation under the banner of maximum security, HP has made an innovative software architecture, the Advanced Grid Strategy, equipping its own technological infrastructure with a Grid Computing code.

The shared resources become Grid Services, and the range of options includes computer processing capacity, memory space, data bases or applications, in a logic perfectly in line with the concept of Adaptive Enterprise, promoted by the company and that is put forward as a set of solutions and services suitable for supporting companies in the planning, development and management of change through a close connection between business processes and IT environment.

Once inserted into the architecture, these items can be managed according to different methods: recorded, automatically noted, accessed remotely, shared, updated or monitored. By means of the native use of standards for grid computing, HP aims to simplify the use and management of IT resources distributed in local clusters or over a geographical area, through the integration of already-existing industrial standards, among which are Global Toolkit and Open Grid Services Architecture (OGSA) in all its product lines for the enterprise range. The objective? To direct open solutions on the right path, by starting up new market standards in the service of innovation.

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Applied research for use in businesses

"At present, SPACI has several activities running", says Aloisio, "all aimed at helping the Italy system's innovation and competitiveness: computational astrophysics and fluid dynamics for the study of turbulence; molecular quantistic chemistry; cellular robots and their application to complex systems in the country such as volcanoes, landslides, pollution, etc.; stochastic models for financial market forecasts that meet the needs of quantitative finance; computational logistics for planning transport networks; algorithms and software for managing grid resources by means of scheduling techniques based on algorithms of optimisation on networks".

The research paradigms, the know-how of the partners involved and the computational and application resources made available by SPACI are a valuable opportunity for everyone in the company, regardless of their organisational and dimensional level.

An example of the opportunity for SPACI and HP to develop together new experiences and skills can be seen by the Cluster XC; a solution that is an advanced technological platform on which stand all the application developments of the SPACI researchers and developed by HP with advanced software methods that make it possible to operate in parallel and scalable ways, both in calculation operations and those of I/O and graphics.

"Pick demand computing is increasingly being used by the industrial world", concludes Aloisio, "but, in reality, the world of industry not only finds peak power useful, but also a substantial series of consultancy services on all the problems of process rationalisation and optimisation. SPACI's contribution on grid computing brings a significant change to those visions that exist in terms of access to machines or pre and post-implementation support. In fact, every company can choose to access our architecture directly in order to use top-of-the-range computing services and resources, according to a pay-per-use formula".

Company: SPACI Consortium

Sector: Research and Industry

Centres: Lecce, Cosenza, Naples

Personnel involved: among researchers from the consortium universities and from other conventional research bodies and spin-off companies, a total of around one hundred people are involved

Campus grid users: users of the grid campuses of the University of Lecce, Cosenza and Naples

Basics of the project

SPACI is the result of a project presented to MIUR (Ministry of Education, Universities and Research), by the ISUFI Center for Advanced Computational Technologies of the University of Lecce, headed by Professor Giovanni Aloisio, by the Parallel Calculation and Supercomputer Research Center (CPS/CNR) of Naples, headed by Professor Almerico Murli (now Naples Section of the ICAR-CNR), by the MIUR High Performance Calculation Research Centre of Excellence of the University of Calabria, headed by Professor Lucio Grandinetti. SPACI's infrastructure is based on the sharing of computing resources and scientific and technological skills available in the three centres, used in those application sectors that require the use of large computing capacities and the management of enormous amounts of data. SPACI's purpose is to stimulate and make productive, in social and industrial terms, interdisciplinary research in the sector of grid computing and its applications, deemed worldwide to be highly strategic for global socio-economic development. The actions planned refer to priority scientific and technological subjects in ICT according to the framework programmes of the EU that provide for specific actions in the field of grid technologies with relevant applications.

Architectural configuration

The SPACI architecture provides for Lecce a cluster of 68 HP integrity Rx2600 servers with an Itanium 2 1.4 GHz bi-processor; mass memory of 36 GB and 264 GB of RAM; SAN storage of 720 GB, 1 Quadrics Elan4 switch. Attached to this equipment is a Compaq Alphaserver SC with 4 quadriprocessor nodes and a Beowulf cluster made up of 5 ProLiant D1360 bi-processor nodes. In Naples, at the CNR, the 68 HP Integrity Rx2600 bi-processors and two Beowulf clusters are replicated. At the University of Calabria, in Cosenza, 13 HP Integrity Rx2600 Itanium 2 bi-processors are installed; one AlphaServer with 16 nodes (64 Cpu); four further clusters, one of 16 Pentium IV, one of 18 Pentium III, 8 MIPS R14000 processors of the SGI and another 3 Alphaservers and 2 SGI Origin.

HP, promoter of innovation

HP is one of the founding partners and promoters of the SPACI Consortium and contributes enthusiastically to the primary aim of promoting applied research through co-operation between Universities and Industry in order to help the Italy system's innovation and competitiveness. The company plays an active role within the SPACI Consortium, contributing in three essential ways:

- By guaranteeing skill from its widespread presence within the Research and Development departments of Italian industrial companies, brought to fruition through the supply of innovative Information Technology solutions.
- By ensuring inclusion of the experiences of the researchers themselves and of the largest international centres of competence, made available to the SPACI Consortium through the team that develops the HP Collaboration and Competency Network initiative and that operates on a continuous basis with SPACI's IT team, to explore and test cutting-edge technological solutions.
- By contributing to the consortium with the most innovative grid computing solutions that deliver calculation power in SPACI's three regional centres, gathering it and making it possible for all consortium researchers to use it as a single or global resource.

The co-operation between the SPACI Consortium's partners provides dynamic developments for the future, already offering from now on a valuable instrument for Italian companies, characterised by the highest parameters of skill and by a strong spirit of innovation.

For further information on HP solutions, visit www.hp.com/it

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