Mission

Computer science today is driven by two main trends: the use of computing resources on demand (outsourced computing) and the need of processing a huge amount of data coming from different sources (data-centric computing). The effects of these two trends will lead the future computing platforms towards hybrid systems composed of distributed specialized subsystems with specific and complementary features that operate synergistically. These systems will interact with the users by means of multiple devices (desktops, smartphones, embedded systems), will use sensors and actuators networks to interact with the environment and will use remote computing and storage resources. Such systems will be used in multiple application domains, either on an individual scale as on a collective scale: from personalized medicine to complex systems analysis like biologic or social economics systems, from environmental monitoring for the civil defence or the eco-sustainable growth to the various domain of the smart platforms.

The aim of the (DS)2 laboratory is focused on the implementation, integration and the management of applications and services for distributed computing systems and/or their components. It provides support and technology transfer services to the other labs as well as to external organizations. The support services will include activities on system administration, design and development of secure software, and implementation, benchmarking and tuning of HPC and distributed computing applications.

Fields of application

More and more accurate and efficient computational simulations are needed to analyze complex systems and to tackle problems of applied sciences with complexity and scale larger than ever before. These simulations require the development and use of methods and technologies that rely on HPC and distributed computing. The computational kernels used in scientific applications are grouped in appropriate classes of algorithms, including the Spectral Methods,

the Dense and Sparse Linear Algebra and the more recently introduced Algorithms on Graphs.

These classes don’t specify a determined strategy for introducing the parallelism, as matter of fact the distributed computing environment leads every computational kernel to different algorithms , based on different approaches to computation and communication. Many complex systems act as intermediaries between the computing capacity, the communication infrastructure and the physical world: computing systems, computer and communication systems, interact continuously and dynamically with the surrounding world through a distributed processing capacity. The different resources of a distributed system must be integrated in order to guarantee a unique system view that hides the presence of heterogeneous architectures and different levels of parallelism. The recent use of distributed systems based on Cloud technologies in science is characterized by a number of open issues subjects of fervent research such as data privacy, security, interoperability between different systems and sustainability of these platforms. The issues related to the data privacy and to the threats of cyber-terrorism are of utmost importance due to the complexity of these systems in terms of components and mutual interactions and due to their functionalities that must be available in a pervasive way, ie with a close interaction with the surrounding environment.

Research themes

In computer science area, researchers study methodologies for the characterization and prediction of biological phenomena, through optimization algorithms and machine learning. The analysis of data coming from high throughput experiments integrates a priori knowledge generated from secondary ontologies and databases, containing information on biologic mmolecules iteration. Determination of new prognostic targets is based on selection techniques of the charactirstics obtained from sperimental data. The study is dedicated to the detection of new characteristics and new methods that allow to find these target accurately.

Transient time-varing phenomena, such as stem cell differentiation and vitality of cells that undergo to certain treatements, are going to be studied and characterized starting from electronic microscopy video, using segmentation technologies and pursuit of variable shapes over time.

Photorealistic rendering techniques will be used for the analysis of tridimensional models of secondary and tertiary interesting biological molecules. New algorithms for photorealistic rendering of scenes and ambience.