EU's Action-Grid to Merge Nanoinformatics With Grid Computing, Biomedical Informatics

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Earlier this month, an international research consortium kicked off a new project called Action-Grid that aims to fuse the disparate fields of biomedical informatics, grid technologies, and nanoinformatics.

With €1 million ($ 1.56 million) in funding from the European Union over the next 18 months, Action-Grid partners will explore how to share resources, data, and research results in grid computing, biomedical informatics, and the emerging field of nanoinformatics.

The project partners, who comprise seven research institutes from Argentina, Chile, Croatia, France, and Greece, also plan to develop ways to transfer knowledge to labs and research groups in the Western Balkans, Northern Africa, and Latin America. Another goal of the project is to develop a so-called "Resourceome," which will collect comprehensive information on the available biomedical informatics resources among the project partners.

At the end of the project the group will present a white paper to the European Commission outlining a possible roadmap of future research projects in this area.

In addition to the Universidad Politecnica de Madrid in Spain, partners in the project include the Institute of Health Carlos III of Madrid; the Foundation for Research and Technology in Crete, Greece; France's HealthGrid; the University of Talca in Chile; the Hospital Italiano de Buenos Aires in Argentina; and the University of Zagreb Medical School in Croatia.

The project is also putting together an advisory board, which includes Casimir Kulikowski from Rutgers University and Joyce Mitchell from the University of Utah.

More information on Action-Grid can be found here.

Victor Maojo, project coordinator for Action-Grid, trained as a physician and a computer scientist at the Georgia Institute of Technology and Harvard University and is now a professor at the Universidad Politecnica de Madrid, Spain, where he directs the biomedical informatics group.

Maojo's team has worked on a number of grid-related projects, including Advancing Clinico-Genomic Trials on Cancer, or ACGT, a project funded by the European Commission to create a grid infrastructure and tools to integrate genomic and clinical data for future clinical trials.

BioInform recently spoke with Maojo about the goals and challenges of the Action-Grid project. The following is an edited transcript of that conversation.

Is Action-Grid a new physical grid?

There is no grid-related development in Action-Grid. A grid is a number of virtually interconnected, remote computers that perform some computing task and can be applied to computationally demanding applications, for example in biomedical research. … Researchers must design or reuse the middleware and all the software that controls all the operations of the grid.

In Action-Grid, we will reuse existing infrastructures and facilitate access, as much as possible, for external users from other geographical areas outside the EU.

How will the project unfold?

Right now we are working in three main directions, carrying out a survey of methods and tools in biomedical informatics, grid computing, and nanoinformatics in the various regions of the world in order to add them to the Resourceome tool. Once this pool of data is collected it will be made openly available to researchers.

Next we plan to deliver a white paper based on the work of the consortium and the advisory board. It will assist the European Commission in developing forthcoming Framework Programs at the intersections of these three new areas. We want to also design specific projects to link these three scientific areas for the first time.

This project builds on a similar project in which we forecast the future of biomedical informatics. We were quite successful in that [venture]. In 2001, we received €200,000 for a project called BioInfoMed, along with two other partners, and developed a white paper, which was published in the *Journal of Biomedical Informatics*, and through which we convinced the European Commission to invest what has now become over €100 million in biomedical informatics.

You are going to collaborate with researchers in the Western Balkans and Northern Africa, how wired are those countries?

We are not really sure yet. … First we are planning to find all the scientists in these regions who would like to work with the European Union. For Northern Africa those countries would be Tunisia, Morocco, Algeria, Libya, Egypt. The idea is to find out where the researchers [are] in these regions — also in Latin America and the Western Balkans, including Croatia, [and] Bosnia — who want to collaborate.

We are not trying to build a world-wide grid, that is not the mission of Action-Grid, but rather we want to detect the possibilities for exchange between scientists in these regions and EU-based scientists. We have experience in grid-building, for example, in creating the grid linking clinico-genomic data called Advancing Clinico-Genomic Trials on Cancer and for which we built the middleware to integrate databases that were both private and public.

In the course of these kinds of projects we have discovered that there are scientists working on similar topics, but [in] the EU there has not been a virtual meeting point where scientists can find tools built by other researchers or discover ways to increase data exchange. This is one of the main goals of Action-Grid: to integrate and enhance scientific exchange.

What kind of data will be linked, or is this about helping labs in more remote regions learn about what is going on in more active labs?

There are two levels: we would like to detect the needs of scientists in these underdeveloped regions where expertise may be lacking in many areas and also provide a list of open-source tools that could be shared across European laboratories. We are developing something called the Resourceome, a word that might sound a bit too big, but the idea is to collect information about many different tools that have been created in the EU.

Are you doing surveys to get the information from the different countries?

One way we are approaching this is by doing surveys of people working in this field and another method is to use text mining on papers and web pages. We have built a text-mining tool that has collected hundreds of [bioinformatics] tools just by extracting knowledge from papers and abstracts available through Medline and the ISI Web of Science. The tool is still in the prototype stage, but we hope to publish it soon.

Next, we plan to set up a web portal with this mined information where users can find open-source tools for bioinformatics, grid computing, biomedical informatics, and nanoinformatics.

Why is there a need to link biomedical informatics, grid technologies and nanoinformatics?

Ten years ago, medical informatics and bioinformatics were separate disciplines. But they had an enormous potential

for exchange and interaction. Now, biomedical informatics is maturing, facilitating translational research.

Grid technologies provide the technological infrastructure that biomedical research demands for many applications. At the same time, nanomedicine promises for the future to deliver many new approaches in diagnosis, therapies, and patient management.

As with the Human Genome Project, informatics methods and tools will accelerate the development of these nanotechnologies and their introduction into clinical practice and research. The differences between nanomedicine at the atomic level and public health at the populations level are enormous — as are the intermediate levels — but information can link all these levels. Informatics will help provide common research approaches at all these levels and the tools needed for this process.

What kind of informatics tools are needed to study nanoparticles in biomedicine?

The field of nanoinformatics is just starting and has the potential to grow to become a hot topic in research. We are not trying to define the area, because it has many meanings. For example, it refers to using quantum computing, developing computers from nano-components; another meaning implies extending the classical approaches in bioinformatics to the emerging area of nanomedicine. There is no one word that applies to the area or a common ground for everyone in this field.

Whereas public health informatics implies working with data on population groups, and medical informatics covers patient data, and bioinformatics is about data in reference to cells and molecules, nanomedicine makes up an additional realm, one between molecules and groups of atoms.

The informatics needs in nanomedicine will be varied, since you are going down to a lower level, a different scale. For instance, there will be databases of nanoparticles, modeling and simulation software tools, tools for clinical trials in nanomedicine, new imaging techniques, and so on. Other new applications will surely emerge in the coming years.

In past projects we have been involved in creating synergy between bioinformatics and medical informatics, integrating the data and ontologies from these two communities, in separate disciplines that were even hostile toward one another in some areas. But there is much room for synergy since bioinformaticians need clinical data to test their models. So we are forecasting a similar scenario for nanomedicine.

What is the Resourceome you are developing?

We adapted an early conceptual vision of a 'bioinformatics nation' for the US and the term 'Resourceome,' which is an inventory of bioinformatics resources. It will be based on a conceptual model to help users navigate and find the tool they need for their research. We have actually implemented a prototype of such a future vision, which is available through our group for research purposes.

In this case, there is a lack of awareness, even within the European Union, of the biomedical informatics tools that have been developed by EU researchers. What happens is that sometimes researchers develop a tool that was already available elsewhere. Thus, through surveys and our text mining-based tool … we are beginning to implement the idea of a Resourceome. Within Action-Grid this effort will be extended to the grid computing and nanomedicine areas, to help researchers from all the involved geographical regions learn about these tools and find out where to access them.

Can you offer examples of how work will change when the grid is in place?

I can give examples about how the work is actually changing now. For instance, in the ACGT project, 25 partners from 15 countries over the European Union and Japan are building common grid computing infrastructures for computationally demanding tasks such as simulation of cancer therapies and data grids for exchanging clinico-genomic data, from hospitals or public databases, for instance, all across Europe. This project promises to create the methods and tools to create virtual environments for developing new drugs in the context of genomic medicine.

One expected challenge in this regard is patient privacy. That is even more difficult in the EU than other countries, because the different countries each have their own rules and laws. It is difficult to bridge the different data types, but also the laws and rules in the countries differ, because there is no one common law in the EU.

We are trying to solve these issues that a single lab couldn't solve. Also for future clinical trials, including those in nano-medicine, there will be a need to merge data from different countries in Europe, so Action-Grid can help build the way to that.

Although current types of clinical trials and the future types are basically similar, we think the computing needs will differ, for simulations, for managing data. Agencies will have more and different oversight, too.