

“Large scale networks of computing resources in the service of the most computationally intensive problems of the future” is one vision of the Grid, being developed by computer scientists and physicists around the globe. But what else is the Grid and how is it different from other ways of computing? What are its challenges and promises?

*symmetry* listened in as Vicky White, head of Fermilab’s Computing Division, and Miron Livny, professor of Computer Sciences at the University of Wisconsin, discussed Grid computing. This is an extract of their conversation.

For the full discussion visit [www.symmetrymagazine.org](http://www.symmetrymagazine.org).

## What is the Grid?

Vicky White: The literature says the Grid is a set of parallel computers and interconnected devices that are all heterogeneous, but they are all going to look homogenous from a user’s point of view. But I think the Grid is shorthand for a way of working together in which we actually exploit the synergies between things, rather than just a physical infrastructure. It is a shorthand for us expressing this vision that we can all do better together by sharing and cooperating and leveraging off of the different interests that we have.

Miron Livny: For me the Grid is a concept, or if you want, a movement, rather than a system and I think that the term “The Grid” enables us to come together and start doing certain things in a certain way that is much more sociological or cultural within the scientific community than technical. But the technology is gaining strength now because of progress on the hardware side.

## How is the Grid related to the Web?

VW: I think the Web is a really important precursor because people have actually watched the progression of the Web from something scientists

started off with as a way to share their documents and their information into a general way of sharing information that a lot of people could benefit from, into the very basics and the engine of all e-commerce that affects everybody’s lives. I think it’s extremely important to be able to sell to people a vision. And that is the salt of funding agencies: the ability to invest in this technology and invest in making this come together and that’s why this has become so important to all of us because you can’t do much of all of this without the funding behind you.

ML: So I think that the big question out there is, “Will computing become an integral part of the life of every citizen in the same way that data is today?” The Web is a data delivery system and most citizens or most people don’t use computing—they use the Web to book a ticket or to figure out a route from point A to point B, but it doesn’t involve a complex simulation to pick the optimal route. Science is depending more and more on computing to make any kind of decision, and I believe that this will become part of our daily lives so that we will ask computers to make decisions for us, by using

simulations and solving models that affect our lives. I think that when we start using computers to make decisions, we are starting to really use computational power.

## How critical is Grid security, based on our Web experiences?

VW: I think you have to work on these issues technologically, with computer scientists, who have a great part to play. We’re really at the beginning of security. And we’re going to work on this federation, the sociological issues and how we together decide: How do we track down bad guys? What’s the punishment? What are we going to do with them? What is an imprisonment equivalent of the violator in the Grid world? What do you do? We’re not going to get the FBI on every single case. So it’s part of the process of building this vision. And it’s not easy. It’s a challenge.

ML: I think that the concept of the Grid has a lot to do with sociology, and common benefit in changing the way we do science and hopefully the way that we live. But then, by definition it will build more opportunities for the bad people. And we’ll have to deal with it with the same mechanism

that we have now: we'll have to lock our cars, put more security on our homes. But we will have to also change the police and the laws, in order to deal with the people who break in, because there is no way to build something that is not breakable.

### Can the Grid achieve a true global outlook?

ML: Technology is viewed as an element in the economy of a country. Countries feel that if they are leading the Grid, they want to feel ownership of some of it to show that they are players. So because of the sociology you have to accept that, and you cannot say that the Grid technology is American, even if it were true. And you cannot say that all the Grid technology is IBM, or HP. Everyone wants to feel that they have an element in it. And I think that they will. At some point someone will make an innovation in one place, and then we'll have to move in that direction. Heterogeneity is in the foundation of everything that we are doing. It's cultural, it's political, it's economic, it's conceptual, and it will all

move forward, I believe. So I think that the point that we have many Grids is a very straightforward conclusion.

VW: In physics we have pressing needs to interoperate together. We're working very closely in the US and moving outwards to work on the LHC Computing Grid. And the Europeans are doing a very similar thing—they are working on a European Grid, which is the center for LHC computing. The key is that all of these self-interests have to push together and interoperate. And one of the driving forces is the physics of the LHC actually demands that we have movement towards an interoperating economy.

### What role does physics play?

ML: Physics is the most mature science in terms of large-scale collaboration. I don't think that there is any other science that's getting even close to it. We have to work in larger groups toward solving the problems that we are facing; we have to share...I think biology is coming pretty fast to join this. Their problems are

not as clearly defined as in physics, though. But sharing data, and bringing the community in, and figuring out what it means, is all part of this... We are ahead not in what we are using for our physics, but in what we are doing as a science that other sciences can follow.

VW: Being narrow is not going to help us in the end. So I'd like to leave with that message, that just as we have to embrace technology to do our science, we really have to embrace this concept of fitting into a bigger ecosystem, not just high energy physics. If we do that, I think we'll be successful. Our science will be better, and we will actually share with other people and have this impact on society, which I think everyone hopes and dreams for.

Photos: Deborah Guzman Meyer/Fermilab

