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Solving the Internet gridlock

UW-Madison

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November 13, 2008 12:00 am • [Nick Dmytrenko](#)

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During high school, my home computer was so mind-numbingly slow that I would

click on AOL, go downstairs, make a sandwich, eat it and return just as it asked me to log in. I did this until I could no longer stomach the thought of using it again and bought a Mac. Less than two years later, my new computer feels just as slow. The problem isn't my computer though; it's me.

As computer programs evolve and students carry out more complicated tasks like editing movies, burning CDs and producing music, computers are struggling to run these operations

without slowing down.

This dilemma especially affects scientists who rely heavily on computing. The Large Hadron Collider (LHC), for example, as the world's largest particle accelerator, will require billions of calculations in order to effectively interpret and store its results next year.

However, to perform these types of experiments, scientists need computers to process, record and analyze astronomical amounts of data. Without purchasing millions of dollars worth of computer equipment, this would require more than what modern technology has to offer.

Enter The Grid,"" an experimental form of computer technology over 30 years in the making. ""Grid computing"" employs the Internet to link computers together and share the work, accomplishing more tasks, faster. With software developed by UW-Madison scientists, the Grid not only promises to solve the data crisis but revolutionize the way we conduct science.

What is the Grid?

""What people call the Grid, I view as more of a movement than a technology or a thing,"" said Miron Livny, UW-Madison professor of computer sciences.

""What we're doing is using the Internet to create more sophisticated services,"" Livny said. ""You submit your jobs here and through the Internet we can find other places to run your jobs.""

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The Grid is not a computer, but how scientists are connecting computers together to form a web, or a "grid."

Once these computers are connected, they share resources which improves speed and processing power. This connection allows information to be more readily accessible and increases the amount of tasks that can be performed.

It's a lot like building a house. The more people who lend a hand, the faster it gets done. By not linking computers together, they sit idle, wasting energy and not contributing to anything.

"Some might argue, 'You should turn off that computer if you're not using it.' I say you got a lot of energy that was spent making that machine, you want to use it for all it's worth," Ken Hahn, systems administrator of the Grid, said.

UW involvement

With many projects hungry to utilize the processing power of the Grid, it can be a hassle to figure out which ones have the greatest priority.

To decide who has precedence, UW programmers have developed a program called CONDOR that serves to allocate tasks. The CONDOR Project, led by Livny, has been in development for 25 years on campus and employs 20 programmers to

help update and maintain the software.

All of the money to run CONDOR comes from federal funding, just like the Internet when it was being developed.

"Wisconsin is in the spotlight for science and computers and I think the University gets a lot of points for it," UW-Madison physics professor Bruce Mellado said. "Our participation in this project helps establish the department and creates higher standards."

CONDOR is an open-source program, meaning anyone can download it for free and implement it however they choose. All this data is sent back to UW programmers who look at how their

program is being put into action.

"Everyone wants to know how other people are using CONDOR for their project and we want to hear what they need that we don't do," Hahn said.

Scientists working on the Grid also provide students with the opportunity to get involved with the project.

"Besides just professors, we have a number of graduate students who come up with small projects through their own research, and we apply it to CONDOR; so there's research as well as development," Hahn said.

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Because CONDOR is a UW-Madison based program, students involved with the project are on the cutting-edge of technological development. Mengmeng Chen is one of these graduate students and assists Hahn in monitoring the Grid.

""Working here is great because you're doing something no one else in the world is doing,"" Chen said.

Who is using it?

Currently, the new particle accelerator - the LHC - is operating under a section of the Grid, located in the Computer Sciences building on Dayton Street, to calculate and store data from the particle collisions.

The UW physics department has strong involvement in the particle accelerator's two main experiments: CMS and ATLAS. Both experiments have developed large Grid facilities on campus. When CMS and ATLAS aren't taking up all the Grid's resources, other departments on campus can utilize their section of it or use the UW's own version of the Grid.

The main departments whose projects run on the Grid are computer science, physics, chemical engineering, medical physics and biotechnology.

""Physics has become very needy in terms of computer resource,"" Mellado said. ""We basically have to harness huge amounts of CPU on disks.""

Businesses are also jumping at the prospect of grid computing. Many have begun building grids for their own advanced computations or to rent them out to businesses whose computing needs have exceeded their means.

""Now Microsoft and IBM are saying, 'We will create, for you, computing capacity where you can come use our computers to run your projects,'""" Livny said. ""If you think of the services you're getting, such as Google running your calendar, they run it in a distributed environment. Amazon already has a service where you can run computing data there for you, too.""

According to Oracle, a database company, major companies such as Hewlett-Packard and insurance giant Hartford Life have gotten into grid computing as well.

""Businesses are using it internally,"" Livny said. ""If you're looking at what we have on the campus, we have 5,000 computers that we share between different groups. There are a lot of companies out there that are now doing it within their own company.""

Where to next?

As our personal computing needs increase, grid computing may work its way from strictly businesses and universities into our home.



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""If you wake up in the morning and need to run a complex simulation or you need to do risk analysis of your portfolio ... your computing needs are more than what you have on your desk,"" Livny said.

The future of home grid computing seems hazy, however, as the average family does not need to run complex calculations like many physicists and companies do.

""Will people need more computing? I don't know,"" Livny said. ""Science definitely needs it today and I would say that science has been a very good predictor of what people and businesses need.

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