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# Google and I.B.M. Join in 'Cloud Computing' Research

**By STEVE LOHR**

Even the nation's elite universities do not provide the technical training needed for the kind of powerful and highly complex computing Google is famous for, say computer scientists. So Google and I.B.M. are announcing today a major research initiative to address that shortcoming.

The two companies are investing to build large data centers that students can tap into over the Internet to program and research remotely, which is called "cloud computing."

Both companies have a deep business interest in this new model in which computing chores increasingly move off individual desktops and out of corporate computer centers to be handled as services over the Internet.

Google, the Internet search giant, is the leader in this technology. But companies like Yahoo, Amazon, eBay and Microsoft have built Internet consumer services like search, social networking, Web e-mail and online commerce that use cloud computing. In the corporate market, I.B.M. and others have built Internet services to predict market trends, tailor pricing and optimize procurement and manufacturing.

Behind these services are data centers that typically use thousands of processors, store countless libraries of data and engage specialized software to tackle what scientists call Internet-scale computing challenges. This new kind of data-intensive supercomputing often involves scouring the Web and other data sources in seconds or minutes for patterns and insights.

Most of the innovation in cloud computing has been led by corporations, but industry executives and computer scientists say a shortage of skills and talent could limit future growth.

"We in academia and the government labs have not kept up with the times," said Randal E. Bryant, dean of the computer science school at Carnegie Mellon University. "Universities really need to get on board."

Six universities will be involved in the initiative. They are Carnegie Mellon, Massachusetts Institute of Technology, Stanford University, the University of California, Berkeley, the University of Maryland and the University of Washington.

Google is building a data center, at an undisclosed location, that will contain more than 1,600 processors by the end of the year. I.B.M. is also setting up a data center for the initiative.

The centers will run an open-source version of Google's data center software, and I.B.M. is contributing open-source tools to help students write Internet programs and data center management software.

The data centers under way have a small fraction of the computing firepower behind Google's Internet

search service. But they will be big enough, scientists say, to do ambitious Internet research. Setting up and running such centers, including providing the electricity and technical staff, is difficult and expensive. The two companies, a person who was told of their plans said, have committed a total of $30 million over two years for the project.

"This is a huge contribution because it allows for a type of education and research that we can't do today," said Edward Lazowska, a computer science professor at the University of Washington.

The companies' and academics' long-term goal is to expand the data-center clusters so students from many schools can participate and to enlist the support of other companies and the federal government.

The companies and university scientists involved in the initiative have talked to the National Science Foundation and other agencies.

The collaboration began after a meeting in December between Eric E. Schmidt, chief executive of Google, and Samuel J. Palmisano, I.B.M.'s chief executive, at Google's headquarters in Mountain View, Calif.

In an interview on Friday, Mr. Schmidt recalled that he had sketched out his vision of cloud computing on a whiteboard, emphasizing its potential economic and social importance, and urged the I.B.M. chief to cooperate to build the skills needed.

At the time, Mr. Palmisano said, he had just come out of a day of technology briefings at I.B.M., and his company is doing a lot of research in the same field. I.B.M. also has deep knowledge and experience in building and managing complex data centers.

Mr. Schmidt said, "I.B.M. has some of the best technology in the industry, and we couldn't have done this without them."

Mr. Palmisano noted that cooperation between the two companies was easier because Google is mainly a consumer company, while I.B.M. concentrates on the corporate market. "We're more complementary than anything else," Mr. Palmisano said. "We don't really collide in the marketplace."

And by helping university students, I.B.M. and Google hope to help themselves in the marketplace.

"We're trying to create the easiest possible on-ramp for universities into this world of cloud computing," said Stuart I. Feldman, a vice president of engineering at Google and a former senior researcher at I.B.M. "But yes, this kind of computing is core value to Google and I.B.M. We have an interest, no doubt."