Cloud computing—delivering software and services from a central computer to desktop terminals—is arguably the hottest topic in computing today. The reasons are economic. PC hardware prices continue to fall, but maintenance costs continue to rise.

“If you’re a large corporation with 50,000 or 100,000 desktops, you’re fixing broken hardware, guarding against viruses, and patching and upgrading software for each one of them. The costs are astronomical,” explained Jason Nieh.

If the PC-on-a-desktop paradigm is broken, what will replace it? “Most analysts believe we are moving to cloud computing, where corporate computers run only in secure data centers where they are protected, secure, and easier to manage and service. If a desktop fails, it doesn’t matter because all the memory and files actually reside in the data center,” said Nieh.

But cloud computing has a weakness: speed. Centralized applications run slower than the same program on a local PC. This is especially true for programs with graphical displays.

“A modest display has 1024 x 768 pixels, and each pixel has 32 bits of data,” added Nieh. “Displays update 30 to 60 times per second or more, so you’re potentially sending a gigabyte or more of data per second to each PC on the network, and that can slow response times.”

Computer scientists have tried to compress data to reduce the load. This helps, but it requires additional computing power and fails to handle gracefully today’s complex graphical interfaces.

Nieh uses intelligent software to reduce data flows and response times from the cloud. In Nieh’s scheme, the application draws the screen on a virtual display. Then his program analyzes what is on the display, and sends commands to the desktop terminal, instructing it on how to redraw the screen. Many of the most common commands are embedded in the graphics card’s hardware, so they operate very fast. The system updates the terminal by sending only those portions of the display that change, enabling very fast response times.

The big payoff comes when connecting to the Internet. Data centers almost always have the fastest Internet connections. “They update web pages much faster than local desktops, laptops, or smartphones,” Nieh said. “If a carrier uses this technique, you don’t have to settle for the limited functionality of smartphones that run some software but not others.

“You get improved functionality and improved performance that makes you feel like you’re right there, and you get it on your smartphones, desktops, and laptops.”

B.S., Massachusetts Institute of Technology, 1989; M.S., Stanford, 1990; Ph.D., Stanford, 1999