Managing research instruments on the Web

Telescopes, supercomputers or microscopes can cost millions of dollars. The research institutions which bought them often try to share the costs with other laboratories. And they're also tempted to use Internet to allow remote control of their expensive systems. But Internet traffic is not reliable enough to control a multi-million-dollar experiment in real time. So, Ohio State University (OSU) researchers have developed RICE (Remote Instrumentation Collaboration Environment) to do a better job. The software has already been successfully tested by various research institutes in Columbus, Ohio. And it will soon become publicly available.

You can see above a screenshot of an active session of the RICE software (Credit: OSU). “On the surface, RICE would look very familiar to anyone who’s used Internet videoconferencing software, or even an Internet chat program. There’s a window that lists the names of researchers who are logged in, and another window for text messaging. A third window shows a video feed of the object being studied, along with buttons to control the instrument. One primary user — presumably, the lead researcher on an experiment — can transfer control of the instrument from one remote researcher in one location to another.”

Because large research instruments are expensive and universities have a limited budget, “the need for such remote operation is growing, and it’s driven by the costs of doing research, explained Prasad Calyam, a doctoral student in electrical and computer engineering at Ohio State. Calyam is a senior systems developer at the Ohio Supercomputer Center (OSC), where he and other researchers are developing the software in collaboration with materials scientists at Ohio State’s Center for the Accelerated Maturation of Materials (CAMM).

So how did they test RICE? “The CAMM engineers and their students used RICE to operate a microscope from different locations — first, directly at the microscope, then elsewhere inside the laboratory, then at another location inside the same building. Finally, they operated the microscope
from two miles away at the OSC offices on Ohio State’s west campus in Columbus. Each test utilized a
different kind of network setup; the test at OSC was performed over the public Internet.”

Obviously, using the public Internet is taking some bandwidth from other OSU users. How did it
work? “Calyam was also pleased to note that the experiment at OSC didn’t affect the network
performance of the center’s employees, despite the fact that the software’s video feed requires 10-30
megabytes per second of bandwidth. “The first question a system administrator in a campus
environment has to ask before installing this kind of software is, ‘If we use this in the laboratory, how
will it affect all my other users in the building?’” Calyam said. “Now we know, if the lab has a
well-designed network, RICE won’t affect them — they can go about business as usual.””

The RICE software will be presented at the ACM Immersive Telecommunication conference
(IMMERSCOM 2007) conference in Verona, Italy, on October 11, 2007. For more information, you
can read the technical paper that will be discussed at this conference, “User and Network Interplay in
Internet Telemicroscopy” (PDF format, 7 pages, 390 KB). The above illustration has been extracted
from this paper.

Sources: Ohio State University news release, October 10, 2007; and various websites

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Roland Piquepaille lives in Paris, France, and he spent most of his career in software, mainly for high
performance computing and visualization companies. For disclosures on Roland’s industry affiliations, click
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