Viewpoints

By Jack McCredie

Build It and They Will Come—Although You May Wish They Had Not

For approximately the past four years, thousands of dedicated individuals from hundreds of colleges and universities around the world have been working hard to design, build, and operate Internet2 (I2). (In this column, the term I2 implies the full range of advanced higher education networking activities—campus, regional, national, and international—not just specific infrastructure projects.) Some hearty souls are now even working on Internet3. However, these investments do not receive universal support. Among other arguments, detractors claim that there are few, if any, applications that need, or can effectively use, I2 features. Indeed, the perception of a lack of applications led Blaise Zerega to label high-bandwidth networks "highways to nowhere." In a recent *Forbes* magazine article, Zerega wrote: "Without killer apps, there is no reason to hop on broadband."[1]

Yet sometimes hopping on the wagon requires a leap of faith. I have described UC Berkeley's advanced networking strategy as a "build it and they will come" philosophy. At times computer users are very vocal in their requests (demands) for services like more free modems, more free software, more computer-equipped classrooms and laboratories, more, more, more. . . At other times, planners simply must start developing and building an advanced part of the IT infrastructure *before* users begin clamoring for it. This is a risky business because the clamor may never be heard. What if the new information highway, as Zerega has claimed, does lead to nowhere?

Many IT professionals nevertheless believed, based on years of experience, that there were plenty of reasons to start building. They feel that there is no such thing as too much processor speed or memory, secondary storage, or network bandwidth. It takes a long time, large investments, and technical innovation to deliver advanced quality-of-service features, high-bandwidth networks, and advanced applications. The judgment of the early participants in I2 was that a coordinated, worldwide effort to build an advanced academic networking infrastructure was needed. It may have been a risky decision, but late in 1996 the project began, with great fanfare.

From the beginning of I2, the planners sketched a clear map for where the highway would lead. There was a strong emphasis on encouraging new education and research applications. I2 meetings highlighted demonstrations of emerging applications in addition to new technical features and the latest in gigapop architecture. For example, there was excellent press coverage of the fall 1999 demonstration of the transmission of high-definition TV signals between Stanford and the University of Washington over the network.

But at the I2 conferences, and at meetings of CalREN-2, California's regional higher education network, there was an undercurrent of concern about what the next really big networked "killer application" would be and how best to encourage its development. Several universities provided budgetary and staff support to help faculty members develop I2 applications, and some offered prizes for innovative collaborations. We were looking for the kind of impact for I2 that we saw from Mosaic and early Web applications a few years ago. What would surprise the community as the next big winner, and who would emerge as the next set of dedicated users? As Zerega asked in his magazine article: "What will be the must-have killer applications? The revolution is waiting."

Did anyone forecast Napster, the phenomenally popular application that enables individuals throughout the world to find and share online music? Certainly I did not. Instead, given the well-known fact that pornography is a huge and expanding cyberspace business, I expected that it would not be long before reporters and friends of the university would be calling my office with concerns about inappropriate materials accessible by our network. As reported recently in *U.S. News & World Report*, "Adult material accounts for 69 percent of the $1.4 billion pay-to-view online-content market, far outpacing video games (4 percent) and sports (less than 2 percent)."[2] We have had a few such inquiries, but nothing like the flap that many universities have experienced over the Napster issue. The press is full of accounts of legal actions by rock groups, attempts to block the application, student protests, clogging of networks due to high music-related traffic, and unexpected and large bills from Internet Service Providers (ISPs) for traffic that has exploded in just a few months. Napster, which came out of nowhere, may now be one of the most popular destinations on the information highway, and it has nothing to do with the goals of I2.

This application is probably just the tip of the iceberg. For example, if only one thousand people on your campus decide to use their desktop computers to connect to a favorite remote radio station using the network, your infrastructure would experience a sustained traffic rate in excess of 30 Mbps. You would probably receive an increased ISP bill of more than $150,000 per year just for this use. Streaming audio is only a drop in the bucket compared with video. Like using Napster, listening to recreational music on the net has little to do with the goals of I2.

Meanwhile, at Berkeley's Space Sciences Laboratory (SSL), the SETI@Homeproject (http://setiathome.ssl.berkeley.edu/) has enlisted almost two million volunteers from around the world to process data, using spare cycles on their home and office computers. In the last nine months, the traffic to and from the campus network generated from this ingenious project has grown from an insignificant amount to a level approximately equal to the combined usage from all other academic and administrative applications in our campus community. The bad news is that most of the two million volunteers from around the world do not have access to the international capacity in which we have invested. They reach our regional I2 network via the commodity Internet. Once again, ISPs are sending us bills for hundreds of thousands of dollars for unbudgeted and unplanned expenses. This innovative application certainly has a great deal to do with the goals of both the university and I2, but the users are not where we thought they would be.

The current networking situation on most campuses is similar to giving students, faculty, and staff unconstrained access to the university phone system to make unlimited free long-distance calls throughout the world. We have built an advanced technical infrastructure and encouraged high-bandwidth applications, but we have not put in place the policy and financial infrastructure to manage it correctly.

Clearly a long-term solution to these issues must include ways of charging users for unusually high network volume. Such a plan should also allow users who want to download personal files to do so, but they should pay the marginal costs of this usage and not disrupt the academic uses that are the raison d'être for implementing our campus networks. These users must also be educated about their legal liabilities when dealing with copyrighted material.

Often the unintended consequences of new technologies are the ones that will bite us. What we need to do now is to complete workable acceptable-use policies, charging mechanisms, intellectual property policies about ownership of online course materials, and user educational materials. All of these new and revised policies need to be consistent with the new technologies we have delivered and those we are planning. Once again we have forgotten that often the technology itself is the easy part.

As a native of Pittsburgh, Pennsylvania, I am familiar with the building of the infamous "Bridge to Nowhere," the Fort Duquesne Bridge. Just a little ahead of its time in the 1960s, it is a splendid structure that had just one major planning problem. Although the bridge was completed on time, there was no space available on the north side of the Allegheny River to build the required connectors from the bridge to the Interstate system. So this important part of the city's infrastructure remained unused for several years, with the exception of the occasional late-night reveler who would drive off the end of the span into the water.

We have built Internet2, and the users are beginning to come in droves. Unlike the Fort Duquesne Bridge, I2 is certainly not a bridge to nowhere. The problem is that many potential travelers want to go to different destinations. And many others who want to go where the bridge leads are unable to connect to it. Users are not necessarily going where we had expected, taking the routes we had planned, or using the network the way we had thought they would. But isn't that what exploring the revolutionary impacts of information technologies on higher education is all about?

Notes

1. Blaise Zerega, "Highway to Nowhere," *Forbes*, February 21, 2000.
2. Brendan Koerner, "A Lust for Profits," *U.S. News & World Report*, March 27, 2000, 38.

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