Engineering professor suggests standards for next-generation fiberoptic metro networks

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Connect computers in an office, and you've got a local area network (LAN). Connect them on larger scales, such as the United States-wide or global Internet, and you've got a wide area network (WAN). Connect them at a scale in between the local and the global, and you've got a metropolitan area network (MAN), such as that linking San Jose, San Francisco and other Bay Area cities or such as that providing access to a service such as DSL.

"Metro and access networks represent the weak link in the telecom universe today, as both larger networks—that is, WANs—and smaller networks—that is, home nets—are currently much more powerful and less expensive," said Stanford electrical engineering Professor Leonid Kazovsky, whose current research is funded by Fujitsu, the National Science Foundation, the Stanford Networking Research Center, KDDI (a Japanese company) and ITRI (a Taiwanese organization that serves as a facilitator between government and industry). "Serious R&D effort is required to research, develop and deploy next-generation metro and access nets."

For more than a decade, Kazovsky has focused his research efforts on next-generation broadband metropolitan networks—their architectural design, analysis, theoretical performance assessment, experimental implementation and experimental investigation. In March, he delivered the keynote address at the International Workshop on Optical Networking in Italy, where he is on sabbatical this year.

He and his graduate students Yu-Li Hsueh and Jaedon Kim wrote a paper for the Optical Fiber Communication Conference this March with researchers Ching-Fong Su and Richard Rabbat and director of Internet protocol networking Takeo Hamada of Fujitsu Labs of America. In the paper, they proposed a way to deal with bursts of Internet traffic that periodically clog networks with packets of data from web and e-mail applications. They advocate efficiently transporting burst-prone optical data using wavelength division multiplexing, or WDM, which employs a single fiberoptic cable to send, say, tens to hundreds of different wavelengths of light—meaning hundreds of different light-encoded messages can sprint down the same cable at the same time.

Fiberoptic networks solve a big problem. With the promise of connectivity anytime, anywhere, the roads on which data travel are getting more crowded. Up to this point, traffic on circuit-based networks was managed by building bigger roads (that is, creating more bandwidth with more wires) or directing traffic (via routers, such as Ethernet switches).

But if fiberoptic cables are to be the workhorses of next-generation networks, hardware standards need to support packet-optimized WDM technology. Currently, they don't.

Kazovsky and others would like to stimulate a global debate among leaders in industry, academia and government akin to the discussions you'd see at the United Nations. The development of various MANs is leading to deployment of multiple systems with different hardware that limits their interoperability. And like the different tongues produced after the fall of the Tower of Babel in the Bible story impeded communication, so too can the lack of uniformity in network systems. So MANs, though not as far-flung as WANs, really are a global problem and have attracted the attention of global companies such as Fujitsu, the world's third-largest provider of information technology services.

"Industry and academia have strengths complementary to each other, and to understand the working mode of the joint team was a part of the engineering process itself," said Fujitsu's Hamada. "We at industry have probably more knowledge on product-related technologies and better perspectives on technology development. On the other hand, we have constantly been impressed by the creativity and the engineering talent at Stanford. In the end, this is at the heart of Silicon Valley, where good things mix and match."

Collaborations are especially important in this research area, where "things are seldom black and white," said Kazovsky, whose prior MAN research was sponsored by Sprint and the Defense Advanced Research Projects Agency. "Things are much more complex. We need to understand and refine features and move the technology toward standardization."

Kazovsky hopes the debate encouraged by Stanford and Fujitsu will encourage industry players, including such key companies as Cisco and Nortel, to discuss standards over the next couple of years and that those discussions will ultimately lead to compatible network components for new fiberoptic metro networks. He envisions a standards committee established by an entity such as the Institute of Electrical and Electronics Engineers, a nonprofit technical professional association of more than 360,000 individual members in approximately 175 countries.

"How do you get a standard adopted by everyone?" Kazovsky asked. "In the old days, there'd be patent-grabbing to protect an idea. Today, that may be counterproductive because most service providers don't want to deploy proprietary networks." Nowadays, he said, while patents still protect some technologies, most deployed networks are based on agreed-upon standards.

"To be successful, next-generation metro nets must be standards-based, which in turn requires building a consensus among all key players—equipment vendors, network operators and customers," he said.

Source: Stanford University