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New Device Could Boost Data Speed

■ Technology: The development of 'opto-chips' represents the Holy Grail of the fiber-optics business, one of the researchers says.

By CHARLES PILLER, Times Staff Writer

SAN FRANCISCO--Goodbye, world wide wait.

An optical-technology breakthrough announced Thursday could dramatically enlarge the capacity for data networks to provide high-speed Internet access to a nearly endless number of customers.

This new "electro-optic modulator" can pump data in the form of light signals through fiber-optic networks--the backbone of the Internet as well as telephone and cable TV systems--at 10 or more times the rate possible today but using only a tiny fraction of the power now required.

The device represents "the Holy Grail the people in the fiber-optic business have been looking for," said USC electrical engineer William Steier, co-author of a study in the journal Science that describes the development. Steier collaborated with Larry Dalton, a chemist at the University of Washington and USC, as well as other researchers.

If the technology proves reliable in long-term testing, products based on the new "opto-chips" could appear within two years.

Network titans such as Lucent Technologies Inc., Nortel Networks Corp. and Cisco Systems Inc. can be expected to adopt the technology as soon as it becomes commercially available, according to Charles Willhoit, an analyst with the investment bank J.P. Morgan & Co. in San Francisco.

At the moment, high-speed Internet access over cable modems and phone-line-based DSL systems are gradually overtaking standard computer modems as the primary connections to the Internet. And the new opto-chips may ensure that the fiber-optic networks providing data to businesses and homes using those methods will be able to add many millions of new customers without creating a data bottleneck.

And in the long run, the opto-chips could help customers download movies or large music files in the blink of an eye.

But such improvements will require a range of other technologies--including components that manage and decode the high-speed optical signals--that are still under development, said Charles Cox, a fiber-optic researcher at MIT.

And for instantaneous downloads, each computer will need its own optical-fiber connection, something that won't be common for years.

But most industry watchers view the march toward ultra-high bandwidth, industry parlance for fat data pipes, as inevitable. And the new opto-chip looks like a key technology to help popularize this faster transmission of data.

Current electro-optic modulators are grown as crystals from a chemical compound called lithium niobate.

But that technology has key limitations: It typically requires 5 or more volts to operate, generating substantial heat, and suffers from a loss of signal that can disrupt data streams. For data transmission rates to rise dramatically, voltage must drop.

The new technology creates modulators out of polymers--plastics--that require as little as 0.8 volts to operate, generate much less heat and suffer little signal loss, according to the researchers.

Polymer-based modulators also may offer manufacturing advantages. Unlike crystal-based products, the new modulators are created using a process akin to those used in semiconductor manufacturing, said Susan Ermer, a researcher with Lockheed Martin in Palo Alto.

Polymers are also easier to package than today's products, offering the potential for cost savings, according to James Bechtel, a co-author of the Science study and an engineer with Ipitek Group in Carlsbad, Calif., a company working to commercialize the technology.

"The knock on polymers has been data loss and manufacturability," said Willhoit. "My guess is that if something like this actually works, [companies that develop it] will be phenomenal acquisition fodder for JDS Uniphase or Corning," leaders in the optical-component market.

But Ermer cautioned that opto-chips have a long way to go before they replace existing technologies.

"Until you try to commercialize something and get it out into the environment you're going to use it [in], you don't know how it will respond to things like humidity, or say, radiation," she said.

The first wave of commercialization may come this summer. Los Angeles-based Pacific Wave Industries intends to release an opto-chip that can support data transmission at eight times the speed of today's standard and operates on 4 volts of power--an intermediate step to the very-low power, higher-speed devices described in Science, but still a vast improvement over current devices.

USC's Steier predicted that the opto-chips could also lead to super-accurate "phased-array radar" systems for aircraft and satellite guidance.

Current phased-array systems, which consolidate data from up to thousands of small antennas, can be prohibitively expensive and bulky.

Those problems could be solved by the new modulators--lighter, faster units that do not suffer the kind of data loss experienced by today's optical systems.

"In the long run," Steier added, "some kind of a small, cheap phased array on your cellular telephone" could greatly enhance sound quality by always locating the strongest available signal.

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