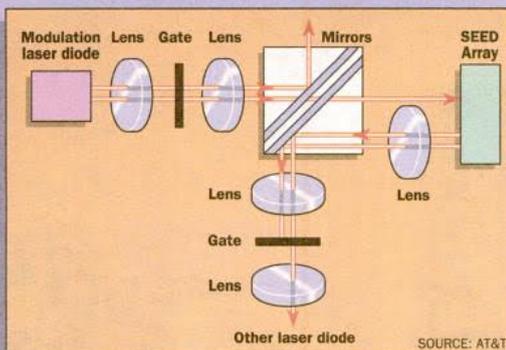


# HARDWARE

## Digital Optical Processor



Each array contains two modulated laser diodes divided into separate beams that provide communications between arrays.

## AT&T Launches Optical Processing Prototype

### Lasers, Lenses, Mirrors Replace Electronics

BY RON COPELAND

Predicting its potential use as a parallel processing engine capable of dealing with 1,000 times more information than conventional chip designs can handle, AT&T's Bell Laboratories demonstrated last week a revolutionary digital optical processor.

The prototype optical device replaces electronic components with optics, using lasers, lenses, and mirrors in place of electronic switches.

"This wireless process uses lasers to transmit information internally and employs optical devices to process the information," explained William Ninke, director of information systems research at Bell Labs.

Characterizing the five-year development effort as "the culmination of fundamental advances in computing theory and optical devices," Alan Huang, head of the optical computing research department, also credited the laser optics found in the now-ubiquitous compact disc player as a necessary component of the Bell Labs implementation.

While admitting that the one-million-cycle-per-second device is only a crude example of what the technology is capable of achieving, AT&T scientists predicted that a device capable of delivering several hundred million cycles per second would be possible in the near future.

The processor is comprised of optical transistors called Symmetric Self-Electro-Optic-Effect Devices (S-SEEDs). These optical switches fulfill all logical functions within the processor. They also store information, in the form of ones or zeros, changing state only after the data has been processed.

The optical processor carries

out calculations by changing the on-off status of switches on successive arrays, with an "on" representing a one and an "off" representing a zero.

The prototype design contains 32 S-SEEDs on each of four arrays. Each S-SEED, measuring 5 microns square, contains two mirrors that have controllable reflectivity. Two outputs can be driven by each S-SEED.

Each array contains two 10-milliwatt modulated laser diodes. The laser operates in the infrared (850-nanometer) range. The light beams, which can be divided into several beams, provide communication among the arrays.

The four arrays are separated by lenses and masks that serve as connective wiring, either allowing light to pass or blocking its passage.

By changing the on-off status of optical switches on successive arrays and by switching the lasers on and off, the device is able to perform binary calculations.

Input/output functions via optical fibers or even through free space are also possible, according to AT&T.

The switching on and off of the laser beams, combined with the activities of other arrays, allows the device to perform simple addition and subtraction functions.

"Although the digital optical processor is an important accomplishment, significant research must be done before the new technology can be turned into commercial products," Huang cautioned.

AT&T includes speech and vision recognition, switching, and general computing as promising areas for the future application of the optical processing technology.

## Intel Identifies Bug in 486 Systems

Company Proposes a Fix for the Bug, Found in Early EISA Designs

BY RON COPELAND  
AND MARTIN MARSHALL

In an errata sheet released to OEM customers earlier this month, Intel revealed that a bug in the i486 microprocessor could, under the right circumstances, cause EISA-based systems to hang.

At the same time, Intel announced a fix for the problem that requires changing a PAL (Programmable Array Logic) device in the EISA design and inserting two jumpers, according to Intel.

The problem is limited to some early designs of EISA systems and shouldn't delay system availability, Intel said.

"It did cause some problems with EISA systems, but we have not seen it cause any problems with Micro Channel or AT sys-

tems," said Jacque Jarve, Intel public relations manager for microprocessor architectures. "No shipments, to our knowledge, have been made to customers," Jarve said.

A system implementation with multiple i486s on the motherboard would also see the errata, Jarve said. However, processor add-in boards like the Systempro would not see this, nor would an implementation like the Wizard Card, she added.

A collision between a bug in the Intel 486 processor and a bug work-around for the interrupt controller in the Intel EISA chip set is what causes the system to hang in 486/EISA machines, according to system developers.

"The 486 chip sends two consecutive interrupt acknowledgments to accomplish an interrupt

acknowledge," said Michael Slater, editor and publisher of *Microprocessor Report*. "However, there's an optimizing algorithm that sometimes separates those two interrupt acknowledgments."

"Normally this wouldn't matter, but there's a bug-fix work-around on the EISA interrupt controller chip that depends upon seeing the two interrupt acknowledge signals in a row," Slater said.

The insertion of any other signal between the two interrupt acknowledge signals, however, defeats the work-around on the EISA chip, according to Slater.

Intel accidentally raised system vendors' hackles by announcing that no EISA/486 systems, other than loaner prototypes, had been shipped to customers anyway, Slater said.

## MCA Clone Market Is Increasing Steadily

BY PAUL WORTHINGTON

Vendors vying for non-IBM Micro Channel PC buyers are enjoying healthy, if nonspectacular, sales as the market of MCA-based machines slowly increases.

Despite often lower-than-expected initial sales, business for makers of MCA clones is profitable, and no one is even considering leaving the market at this time. "They're not doing as well as AT units, which is still the standard," said Shawn Leuthold, marketing manager at

American Mitac. "We're in a good position as we offer both."

Sales have increased every month since the August introduction of Mitac's machine, according to Leuthold, although not by as much as initially projected. Overall, interest in Micro Channel has tapered off, he added. "We're looking for slow growth," he said.

First Class Systems, having tied their fortunes to Micro Channel's success by committing to an MCA-only product strategy, has found a good market reception for their products

and good public reception to "Micro Channel as a technology," said Cappy Frederick, vice president of marketing. "I can't see any reason for anybody to think of getting out of the market," he said.

"It is a good market, but nowhere near that of the AT bus," said Ed Juge, Tandy's director of market planning.

"For us it's fairly small; quite frankly, 85 percent of the people who are buying machines don't need to buy either Micro Channel or EISA," Juge said.

At least one company sees today's Micro Channel market as only the first ripple of a giant wave to follow. Advanced Logic Research (ALR) is poised to dominate the non-IBM Micro Channel market, according to Dave Kirkey, ALR's vice president of marketing and sales. ALR has made major investments in the Micro Channel Architecture, including joint designs with NCR and source-code purchases from Phoenix, according to Kirkey. "We want to be the Compaq of the Micro Channel market," Kirkey said. "Given that sales for ALR machines are on the rise, we can't build them fast enough."

IBM still dominates the MCA field, according to vendors. "In comparison to IBM we're not on the charts," said First Class Systems' Frederick.

IBM MCA buyers "will not mess around with non-IBM machines," said Rick Rose, president of the New York/New Jersey-area dealer Dataflex Corp. "They refuse to take any chance of some BIOS incompatibility problem down the line," said Rose.

## U.S., Japanese Vendors Ready PC Card Standard

BY PATRICK DRYDEN

U.S. and Japanese developers with a stake in the laptop market hope to release next month a PC card standard that will let users access software or storage from any machine, currently impossible due to incompatible connectors and formats used by the credit-card size memory devices.

Hardware and software vendors anticipate that this standardization will open the door to specially designed programs for portables and further reduce the size of all PCs, from desktop to laptop, notebook, hand-held, and even smaller units.

PCs will get cheaper as they get smaller, yielding hand-held XT-class boxes in the \$500 range within a year, predicted

Jim Prelack, president of the PC Memory Card International Association (PCMCIA) and OEM marketing manager for Lotus Development Corp.

Peripatetic PC users will enjoy extended battery life with portables based on the low-power storage technology, according to PCMCIA chairman John Reimer, manager of microcomputer and communication products at Fujitsu Microelectronics. "One goal is to let laptop users totally forget about the battery, like calculator users," he said.

**ANARCHY REIGNS.** Two weeks ago in Dallas, representatives of the Japan Electronic Industries Design Assoc. (JEIDA) met with PCMCIA members for the first time to work out a satisfactory

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