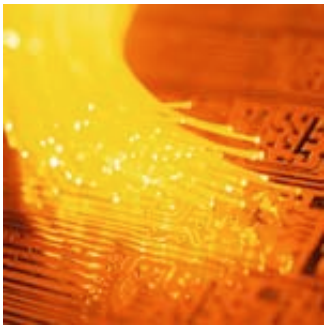
Optoelectronic integration overcoming processor bottlenecks

August 2 2005



One of the biggest obstacles facing computer systems today is the problem of memory latency, the time a computer must wait to access the data stored in memory despite faster processor speeds. Two demonstrators reveal that optoelectronics may offer solutions.

“Your domestic PC these days can have a processor of two GHz and faster – this is quite common – but the processor power will often be wasted because the real bottleneck in computer processing is the memory.” That is John Snowdon of Heriot-Watt University in Edinburgh, speaking about the objectives of the HOLMS project.

“Optoelectronic technologies are the only way to bridge the present gap between processor speed and memory bandwidth,” says John Snowdon of Heriot-Watt University in Edinburgh, of the HOLMS IST project.

“This has been documented by the SIA, the Semiconductor Industry Association in the US.”

“Your domestic PC these days can have a processor of two GHz and faster – this is quite common – but the processor power will often be wasted because the real bottleneck in computer processing is the memory,” he says.

As a result participants in HOLMS set out to make the use of board-level optical interconnection in information systems practical and economical. They aimed to develop optoelectronic technology to the point where it would be compatible with standard electronic assembly processes. HOLMS focused on two key areas of optical technology: a seamless opto-mechanical interface to commercial parallel-fibre arrays, and low-cost optical waveguides that could be easily integrated into conventional printed circuit boards (PCBs).

“What is key about HOLMS is our work on optoelectronic packaging – how to make optoelectronic technologies more compatible with market and industry needs,” he continues. “We were able to take the signals from a fibre and push them into a high-bandwidth free-space optical connection, one which is capable of addressing many electronic processors simultaneously. So the latency is as low as you can get – essentially we’re working at light speed with many thousands of channels.”

The key achievement of HOLMS, believes Snowdon, was the project’s success in integrating fibre-optics with free-space technologies and optical PCBs – to form a powerful three-part optoelectronic interface. “We started from a pioneering research point-of-view, but with a commercial goal – that’s why we have so many industrial partners. This level of integration has not been achieved before outside the laboratory.”

HOLMS ends in September 2005, and the participants have developed two working demonstrators to show the functional aspects of the technology. The two main university partners, Hagen University (Germany) and Heriot-Watt, are both integrating the knowledge gained into their academic research.

Several of the industrial partners, including ILFA (PCB manufacturer) and Siemens of Germany, and Thales in France, have incorporated the results into their product development. Thales is investigating the potential of HOLMS' optoelectronics technology for use in very-high-speed embedded systems in defence applications, while Siemens is believed to be developing a high-bandwidth optical waveguide PCB that could be on the market in as little as two years.

"It is the potential of this technology for the domestic markets that is so exciting," says Snowdon. "This kind of technology could be built into the everyday PC within just two generations of development, which is no time at all."

Source: IST Results