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## **Multimillion project for optical chips to open door to multibillion market**

**Last week Eindhoven saw the kick-off of the international R&D project PARADIGM. This project, which is led by Eindhoven University of Technology, is intended to standardize the development and production of optical chips, making them much cheaper and bringing all kinds of new products within arm's reach. The costs of the project amount to 13 million euros, of which the EU will contribute the lion's share. It is a big promise indeed: the project is to open the door to a new market, potentially worth tens of billions of euros.**

Optical chips, chips that work with light signals instead of electronic signals, are in great demand to process the ever-growing Internet traffic flows, but also have the potential to impact many other application areas. The increasingly larger data flows in computers and in processors with dozens of arithmetic cores require optical components as well. Whereas the voluminous internet traffic is already running via light signals - in glass fibers -, in these processing nodes the signal processing still takes place electronically. Those nodes are reaching their limits presenting an opportunity for Optical switches, also known as photonic devices, to provide the solution to this problem.

### **A few cents**

The PARADIGM project (Photonic Advanced Research and Development for Integrated Generic Manufacturing) is to ensure that this solution is affordable. Sixteen parties have joined forces in the project, including leading European enterprises, universities and knowledge institutes: Oclaro, Alcatel-Thales III-V Lab, two Fraunhofer Institutes (HHI and IZM), Philips Miplaza, CIP, Gooch&Housego, Linkra, Willow Photonics, the universities of Cambridge, Chalmers, Milano and Eindhoven, and three design software companies: Phoenix, Photon Design and Filarete. The COBRA Institute of Eindhoven University of Technology is the project coordinator.

At present the toughest bottleneck for large-scale application of optical chips is the price level for the development and manufacture. It is high in comparison with commonplace electronic chips. Professor of Optical Communication Technology, Meint Smit, at the department of Electrical Engineering, commented that "Microelectronics cost a few cents per square millimeter of chip, as the technology is mature and highly standardized. In addition, its development costs are low because we have sophisticated software for the fast and accurate design of the chips. We should also like to attain that capacity with photonic devices." It is particularly products that are not currently made in large volumes which the project aims to make more than ten times cheaper, as a result of standardization of the design methods and the production techniques involved. Moreover, companies will be able to make prototypes and put products on the market much faster. Smit expects that within six years a large portion of all optical chips can be made in this standardized manner.

### **Tens of billions**

Cheaper production methods will also make new products viable. An example is the fiber sensor, which can be used to measure all sorts of things, such as tensions in bridges, airplanes or windmill blades, and can give off timely warnings against overload. As the technology currently stands, the most expensive item is the optical readout unit, the price of which is expected to drop considerably through integration. Researchers also envisage other applications in medical instruments and in computers. All in all this is a market that may ultimately achieve ten percent of the scope of the microelectronics market, as professor Meint Smit estimates. This implies revenues of billions of euros. Smit believes that the technology being developed in PARADIGM will be commercially available by 2016.

**Technological edge**

Now, Europe has a technological edge on the rest of the world, according to Smit, and the new project must strengthen this position. This edge is the result of current European projects for the standardization of optical integration technology. In total there are projects running in Europe now amounting to over fifty million euro, most of which revolve around two technologies (Indium Phosphide and Silicon technology) which jointly cover a large part of existing as well as future applications.

Less than a year ago the EUROPIC project was started, which focuses on the standardization of existing Indium Phosphide chip fabrication technology. PARADIGM concentrates on developing an improved technology, thanks to which the performance of standardized chips will before long be able to compete with components which are currently far more expensive. PARADIGM will also tackle the 'packaging' of the optical chips, facilitating connection with one or more glass fibers. Today that packaging is as expensive as the chips themselves, so it must also become cheaper. PARADIGM technology will enhance the economic viability of these standardized chips still further, so that this technology will become the dominant one for optical chips.