Chameleon-Chip Adapts Itself and Stays Cool

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A microprocessor adapting itself to the actual use and environment. That's the way to keep the energy consumption of future 'mobile companions' within limits and be flexible at the same time. Paul Heysters, who finishes his PhD-research at the University of Twente on September 24, developed a new type of processor. His 'Montium' is **a reconfigurable processor adapting itself towards low energy consumption**. It is possible to get **ten times better performance, with ten times lower energy consumption at the same time**, according to Heysters. He did his research at the Centre for Telematics and Information Technology of the University of Twente in The Netherlands.

Without energy-saving measures, they get real miniature stoves in your pocket, the mobile equipment of the future. They will be packed with a lot of functions, for which users need separate devices now. Including broadband mobile communication, GPS, navigation, camera, audio and video, ranging to full electronic driving license and passport. Fully profit from all these features means using a lot of energy. An application-specific chip (ASIC) would be the most energy-economic solution, but it is not flexible at all. That's why Heysters chooses reconfigurability: he lets the hardware adapt itself to the use that's made of it. The Montium – in animal world a rare chameleon species- is a processor that is capable of this. And it consumes far less power.

Tiles
Future mobile equipment has to, for example, be able to adapt to the

network environment it is currently working is. Do you prefer a broadband connection and do you happen to be in a WiFi environment, than the chip will enable a WiFi connection. Is it just GSM/GPRS you can rely on at the moment, it chooses this connection. Without having fixed chips for all these standards onboard. Or: when you are just looking into your electronic diary, you don't need sophisticated video functions.

The approach Heysters chooses is a 'tiled' one. His processor is not a huge generic one, capable of every possible task, but it consists of tiles that can be switched on or off depending on the desired function. Tiles are available for digital signal processing (DSP), for specific tasks and small general purpose processors. Every type of tiles is available in a repeated pattern.

This approach is really different from developing an 'economic' or 'mobile' version of a regular processor, Heysters states. In those cases, usually some adjustments are made to the power supply voltage or clock frequency. But in essence, the processor still is highly overdimensioned for the tasks it has to perform. What Heysters proposes is changing the hardware architecture based on the algorithm. This works: in a complex task like calculating a fast Fourier Transform, the Montium performs ten times better than a generic processor for mobile use, while it consumes ten times less energy. It would consume hundreds of times less than a Pentium, but this comparison is not fair: a Pentium would never be economic enough for a handheld device and get far to warm.

Worldwide, there are efforts going on for these energy-saving strategies. The Montium approach can be succesful in this, according to Heysters. One of the true success factors is that good design tools become available: designers have to be able to do their work on a high level of abstraction, without having to bother about the hardware underneath. Promising steps have been made in the group Heysters is working in.

Industry is interested in his approach, and in fabricating a prototype chameleon-chip consisting of nine Montium tiles.

Source: University of Twente