Efficient computer network on a chip

October 19 2010

Satellite TV without having to set up a receiver dish. Digital radio on your mobile phone without your batteries quickly running flat. The advanced calculations needed for these future applications are made possible by a microchip with relatively simple processors that can interact and communicate flexibly. These are among the findings of research at the Centre for Telematics and Information Technology of the University of Twente carried out by Marcel van de Burgwal, who obtained his PhD on 15 October.

Soon it will be possible to receive satellite signals not only with a satellite dish, but also using stationary antennae arrays made up of grids of simple, fixed, almost flat antennae that can fit on the roof of a car, for example. The antennae then no longer need to be carefully aimed: the grid of antennae forms a 'virtual dish'. That is a great advantage, especially for mobile applications such as satellite TV on the move. The aiming of the virtual dish is actually carried out by the entire grid. It is comparable with the LOFAR project, in which countless simple antennae laid out on the heathland of Drenthe in the north east Netherlands together form a huge dish for radiotelescopy. This too calls for large numbers of calculations and fast communications.

Computing power replaces analogue components

Conventional microprocessors are less suitable for these calculations, because they are highly overdimensioned and use large amounts of energy. The remedy is a combination of smaller, simple processors on a single microchip that can carry out tasks flexibly and be switched off

when they are not needed. In this way a complete computer network can be constructed that takes up just a few square millimetres. To achieve this, Van de Burgwal makes use of an efficient infrastructure based on a miniature network, where a TV or radio receiver is defined by software instead of the classic coils and crystals. "Software-defined radio may seem much more complex, but we can pack so much computing power into the space taken up by, for example, a coil that it more than repays the effort", says Van de Burgwal.

Chameleon

The same type of microchip also turns out to be suitable for a completely different application: digital radio reception on a smartphone, where the main criterion is minimizing energy use. In his doctoral thesis Van de Burgwal shows that major gains can also be made here by using new methods of communication between the different processors. The multi-processor chip that he uses is based on the Montium processor - appropriately named after a chameleon - that was developed at the University of Twente. The processor is being further developed and marketed by the spinoff business Recore Systems.

Provided by University of Twente