

Engineers propose method to eliminate wasted energy in computer processors

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In today's computer processors, much of the power put into running the processor is being wasted.

A research team at Case Western Reserve University came up with a novel idea called fine-grained [power](#) gating, which saves power and money in a couple of ways: less energy would be used, and less heat produced.

"Using less power produces less heat. Less heat means less cooling is needed," said Swarup Bhunia, professor of electrical engineering and [computer](#) science and an author of the research. "That can avoid the need for a big fan to cool off the processor, which saves a lot of money."

Processors are used in a variety of products, from computers to cell phones. Operational costs could be cut by more than one-third, the researchers say.

Bhunias, PhD student Lei Wang and PhD alumni Somnath Paul, whose work was funded by the Intel Corporation; presented their idea at the 25th International Conference on VLSI (Very-Large-Scale Integration) Design.

They received the award for best paper at the conference, held in Hyderabad, India Jan 7-11.

Bhunias explained that two parts of a processor consume power: the

datapath and memory. The datapath performs computations and takes control decisions, while memory stores data.

The waste is built-in. Computing rarely requires everything that a processor is capable of all the time, but all of the processor is fully powered just the same.

For example, while the processor might not always be doing addition, the component that performs addition is still being powered.

One attempt to improve [power dissipation](#) in processors is through something called coarse gating. It switches off an entire block of the processor that is not being used.

In the previous example, the coarse gating solution would be to just simply turn off the addition block when it is not doing addition.

The problem with this method is that most of the time, some part of every component is being used in a processor. Finding an entire block that is not being used at a given time is tough.

The Case Western Reserve team's fine-grained gating idea is to shut off only the parts of a component that are not being used at the time. While the addition component needs to be capable of adding extremely large numbers, it rarely needs to actually add large numbers. The processor might be using the addition block constantly, but the parts needed to add large numbers can be turned off most of the time.

Memory works the same way. A processor needs to be capable of storing large numbers, but seldom actually stores them.

This may not seem like much, but add everything up and it makes a big difference. The team calculated that the total power savings for a typical

processor in a high-performance system, such as a desktop computer, would be about 40%.

Bhunia explained that fine gating can't be applied to current processors, but could be used by companies to build next generation processors.

This new method does not only help corporations though. With fine-grained gating, a smart phone battery that lasted eight hours could now more than 11.

That's three more hours of Angry Birds and Words with Friends, which is a win for everyone.

Provided by Case Western Reserve University

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