# Low-power operating system for many: Core LSI for embedded applications

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Toshiba Corporation today announced that it has developed an innovative, low power operating system (OS) for many-core processors, targeting application in embedded systems, including automotive products and digital consumer products. An evaluation of the OS on the company's own many-core processor recorded a 24.6% power reduction against the standard OS when running a super resolution program that scaled 1920×1080 pixel images to 3840×2160 resolutions. Details of the new OS were presented at "Design, Automation & Test in Europe (DATE 2013)" in Grenoble, France on March 20.

Recent multimedia processing, including video encoding and decoding and image recognition, requires high performance processors. Many-core processors, with up to dozens of cores, are finding an important role in running these applications. However, there is a problem: the higher the number of cores, the higher total power consumption. Manufactures want low power systems in order to maximize the battery life of mobile devices, and in consideration of the environment.

In current methodology, the OS controls power to the processor based on computation load history. However, this approach is not accurate enough to reduce power consumption and fails to manage abrupt fluctuations in computation load, and so more power than necessary is consumed.

Toshiba's many-core processor OS achieves low power consumption by using information inherent to parallel programs to control power supply. Parallel programs are run by a thread unit, and to run correctly the order

for executing the threads must be specified. Toshiba has developed and employed a technique for specifying the "number of dependence" among threads and controlling the execution order. This approach recognizes that the dependency number at any given time closely foreshadows the computation load in the near future, securing a more accurate prediction of power requirements. The new OS controls power supply and achieves a low power system without degradation in performance.

Toshiba plans to apply the low power OS to embedded systems for such applications as high resolution image processing and image recognition.

Provided by Toshiba