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Smartphone chips may power servers, researchers say

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Looking at historical trends and performance benchmarks, a team of researchers in Spain have concluded that smartphone chips could one day replace the more expensive and power-hungry x86 processors used in most of the world's top supercomputers.

"History may be about to repeat itself," researchers at the Barcelona Supercomputing Center wrote in a paper (http://www.montblanc-project.eu/sites/default/files/publications/Are%20mobile%20processors%20ready%20for%20HPC.pdf) titled "Are mobile processors ready for HPC?" The paper was presented at the EDAworkshop13 in Dresden, Germany, this month.

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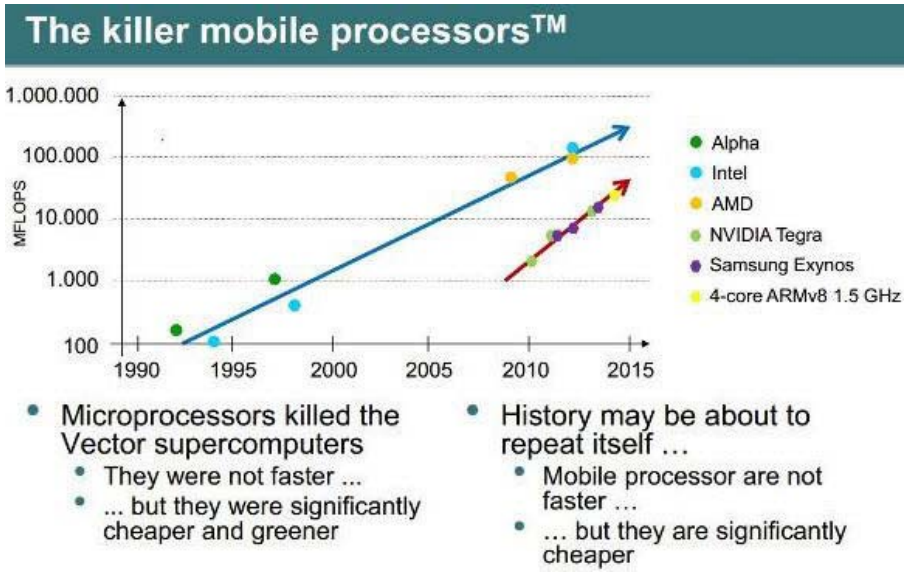
The researchers point to the history of less expensive chips bumping out faster but higher-priced processors in high-performance systems. In 1993, the list of the world's fastest supercomputers, known as the Top500, was dominated by systems based on vector processors. They were nudged out by less expensive RISC processors like IBM's Power chip, whose use in supercomputers peaked early in the past decade. The RISC chips in turn were eventually replaced by cheaper commodity processors like Intel's Xeon and Advanced Micro Devices' Opteron, which today are used in more than 400 supercomputers on the Top500 list.

The transitions had a common thread, the researchers wrote: Microprocessors killed the vector supercomputers because they were "significantly cheaper and greener," they said.

"Mobile processors are not faster ... but they are significantly cheaper," the researchers wrote.



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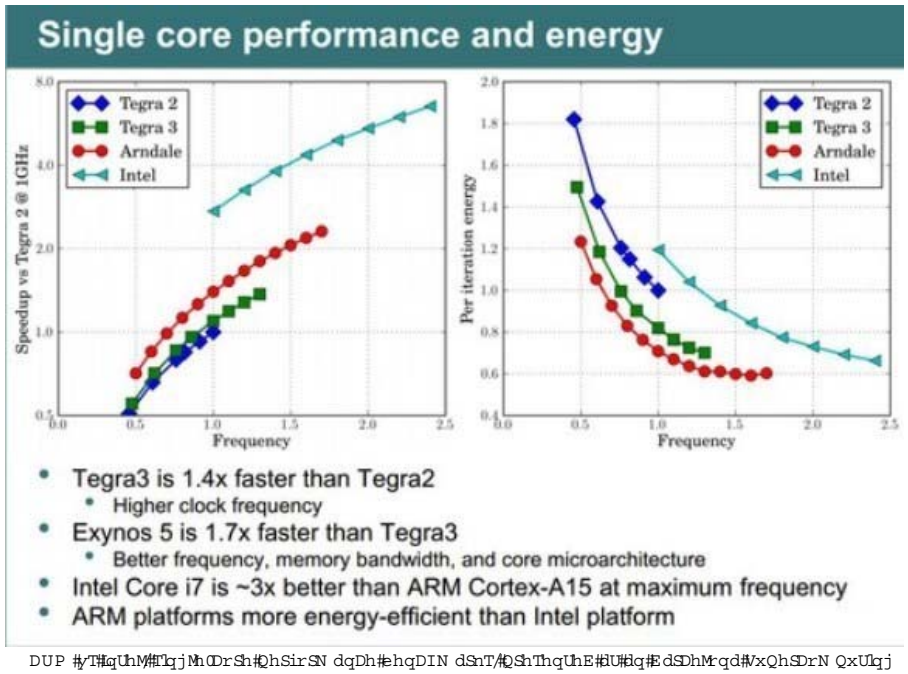
Low-power chips based on designs from U.K. chip company ARM are used in most smartphones and tablets sold today. Intel has found some limited success with its Atom processor, which was originally designed for netbooks and is still based on its x86 architecture.

Interest in using mobile processors in servers is mounting as companies look to reduce data-center power bills. Smartphone chips are seen by some as well-suited for workloads that involve high volumes of small transactions, like dishing up search results and processing "likes" on social networks. Beefier chips like the Xeon and Opteron are seen as best for software that requires more performance, such as large database applications and ERP (enterprise resource planning) systems.

One of the goals at the Barcelona Supercomputing Center (BSC) is to build prototype systems that help improve performance-per-watt. The organization, funded by the Spanish government and the European Union, has built servers based on Nvidia's quad-core Tegra 3 chip, which uses an ARM Cortex-A9 processor design, and another on Samsung's dual-core Exynos 5, based on the faster Cortex-A15.

As well as looking at history, their prediction about smartphones chips is based on benchmark results. They compared Samsung's 1.7GHz dual-core Exynos 5250, Nvidia's 1.3GHz quad-core Tegra 3 and Intel's 2.4GHz quad-core Core i7-2760QM -- which is a desktop chip, rather than a server chip.



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The researchers said they found that ARM processors were more power-efficient on single-core performance than the Intel processor, and that ARM chips can scale effectively in HPC environments. On a multi-core basis, the ARM chips were as efficient as Intel x86 chips at the same clock frequency, but Intel was more efficient at the highest performance level, the researchers said..

In a battle between two ARM chips, the Nvidia Tegra 3 (http://www.pcworld.com/article/243453/article.html?tk=rel_news) chip was compared to Samsung's Exynos 5250. The Exynos 5250 was 1.7 times faster than the Tegra 3 on single-core performance.

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Hewlett-Packard recently launched its Moonshot server, (http://www.pcworld.com/article/2033434/hps-first-moonshot-server-with-atom-processors-priced-at-61875.html?tk=rel_news) which is based on Intel's low-power Atom server chip. ARM processors from Calxeda and Texas Instruments are expected to be used in future Moonshot systems. Dell has also built prototype ARM servers and is contemplating use of the low-power chips in supercomputers.

The BSC researchers point to weaknesses in ARM designs that may hold up their use in servers. Today's ARM chips are 32-bit designs, meaning the amount of memory they can address is limited. They also lack error correction technologies, have no network off-load chip, and do not use standard I/O interfaces.

ARM has announced a 64-bit design, however, and Calxeda, AMD, and AppliedMicro are among the chip makers expected to ship 64-bit ARM chipsets with an array of I/O and networking features.

As the ARM server market evolves, the technical challenges will be resolved, according to the researchers, and increased competition could further drive down prices.

"Mobile processors have qualities that make them interesting for HPC," the researchers wrote, advising readers to "get ready for the change, before it happens."

BSC is also involved in Project Mont-Blanc (http://www.montblanc-project.eu/publications) and the Axle Project (http://axleproject.eu/), which are efforts to develop supercomputers that combine the processing power of CPUs, graphics processors and other computing resources.

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