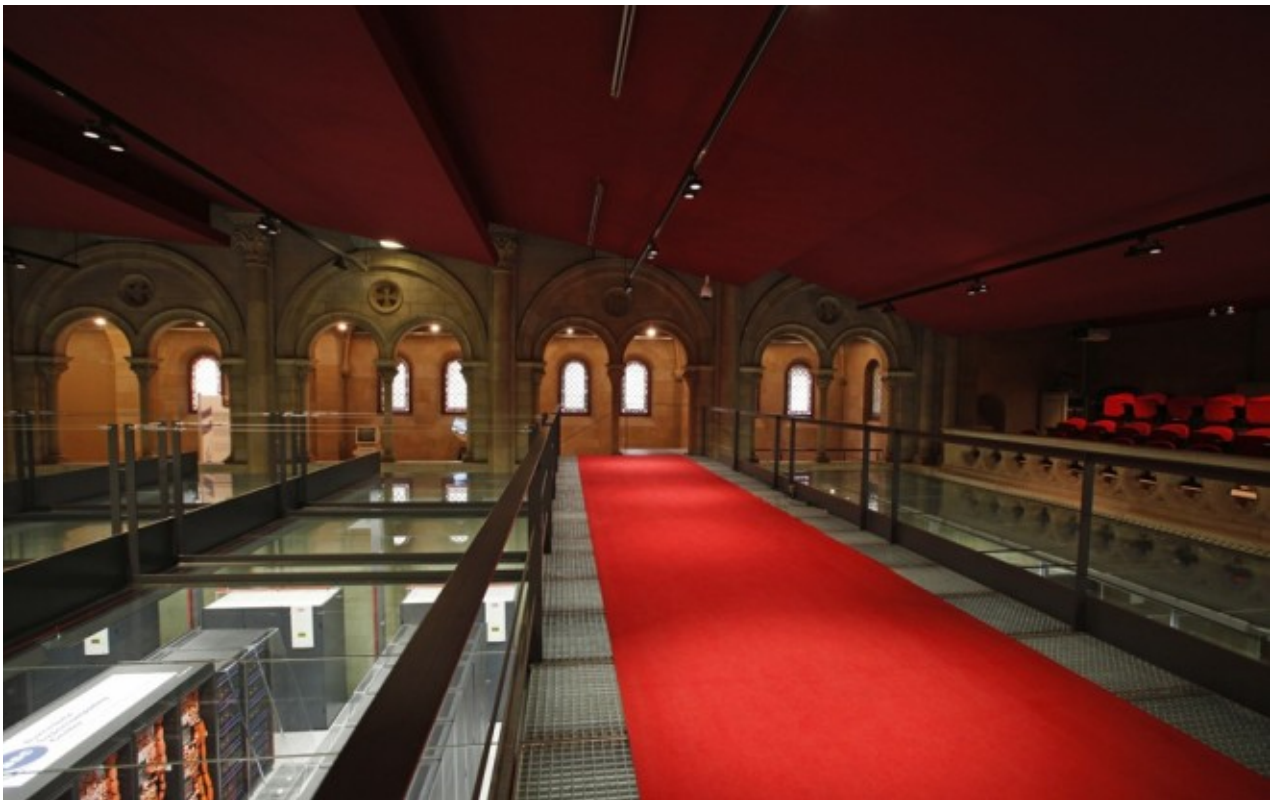
Alex Ramirez wants to build a supercomputer that's six times as powerful as Tianhe-2, the Chinese machine that's ranked as the world's most powerful. That's an incredibly ambitious goal, but here's the surprising part: He wants to build it using ...

One Man's Dream to Build a Supercomputer From Cellphone Chips

By Robert McMillan
11.15.13
6:30 AM



The Barcelona Supercomputing Center's MareNostrum supercomputer. *Photo: Barcelona Supercomputing Center*

Alex Ramirez wants to build a supercomputer that's six times as powerful as Tianhe-2, the Chinese machine that's ranked as the world's most powerful. That's an incredibly ambitious goal, but here's the surprising part: He wants to build it using the sort of chips you typically find in mobile phones and tablets. He wants to use ARM processors.

ARM microprocessors don't pack a big punch, but they burn very little power. That's why you can find them in billions of iPhones, Android devices, and other small, thin pieces of hardware. So the marriage of ARM chips and high-performance computing may seem odd, but ARM's low-power design just happens to address one of the most important qualities in tomorrow's supercomputer: power efficiency.

A supercomputer like Tihane-2 is stitched together from hundreds of thousands of chips, but the next generation of computers will need to have so many processors that it's not exactly clear how they will be powered and kept cool enough to do their jobs. For Ramirez, a manager at the Barcelona Supercomputing Center, the best way forward is ARM.

His project is part of a larger movement towards this new breed of low-power chips. As Ramirez builds an ARM supercomputer in Spain, web giants such as Facebook and Amazon are exploring the use of these low-power chips in the servers that run their massive online services. These days, both supercomputers and the world's web services run on processors from American chip makers Intel and AMD, but now there's a brand new player on the horizon.

For Ramirez, this shift could provide an added twist to his new super machine. He not only aims to build one of the world's most powerful supercomputers. He wants to build one entirely with parts sourced from Europe, and with ARM chips, this is a very real possibility. ARM — the company that's behind these chips — is British, and it doesn't actually manufacture them. It licenses the core designs to other outfits.

In theory, Ramirez can buy his chips from licensees in Europe — rather than from an American company such as Intel. "Thanks to the convergence of high performance computing and embedded computing maybe we could take Europe back onto the HPC train," he says.

In the supercomputing world, where processing power has traditionally been prized above everything else, Ramirez's plan is "audacious," but it just might work, says Wu-chun Feng, a Virginia Tech computer scientist who is a pioneer in power-efficient supercomputers. He says

Ramirez and his team are now “probably in the best position,” to build an ARM-based supercomputer.

But a few things have to happen first. For one, ARM needs to deliver 64-bit processor designs, which are required for the large-memory systems used in high performance computing. Chipmakers are expected to deliver the first 64-bit ARM chips in about a year. Ramirez expects early supercomputing efforts to run on a fusion of ARM CPUs and graphical processing units, or GPUs. The GPUs will do the number crunching, but they’ll be controlled by the CPUs.

Then Ramirez will need to find a system integrator to produce the compute nodes that will make up his computer — not mention local hardware suppliers. He’ll need not only a local chipmaker but a European networking company such as Extoll.

The irony is that Ramirez is taking his cues from the way Intel came to dominate the world of big iron in the ’90s. It’s cheaper processors elbowed out Unix supercomputer players such as Sun, DEC, and Silicon Graphics. The question is whether Intel can handle a taste of its own medicine.

Intel is still very much the king of the hill. But in addition to Ramirez’s project, China is working on its own, non-Intel chips in its massive supercomputers.

Whatever chips they use, many researchers — and many countries, including the U.S. and Japan — are now working to build machines that provide unprecedented speed. These are the so-called exascale machines. An exaflop is a quintillion mathematical calculations, or a thousand petaflops. Tihane-2, the current world record holder, can perform 33 petaflops per second.

The United States hopes to build its first exascale system by around 2020, but budget cuts have meant that federal funding for some of these projects has tapered off. “Since about 2010 our funding has been flat or downward. It’s noticeable after three years,” says Horst Simon, the Deputy Director of Lawrence Berkeley National Laboratory.

Will that give Europe a shot at being the first to exascale? Ramirez isn’t so sure. He says that there aren’t many next-generation supercomputers being commissioned in Europe right now. But he doesn’t hesitate when describing the future of ultra-low-power processors. “It will definitely be possible to build a high performance competitive platform based on ARM,” he says.

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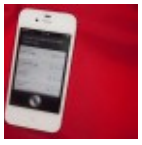

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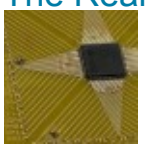

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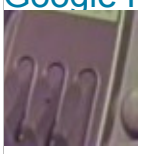

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Darkness • a day ago
apple has their A7 solution although it doesn't sell its chips without an 'i' in front. Probably a little pricey for the HPC.

While the idea is interesting it is hardly notable currently. Definitely worth reporting on and following but we are talking several years or so to gain enough traction to call this a real project versus a cool idea. Cool as in heat, not neat.

First, someone other than apple will have to release the 64bit and it will need to be fabbed in EU, which is possible with Global Foundries and a license. Two years to build the chips and two years to build the system, which should overlap but Murphy indicates it is best to assume the opposite.

The chip might take less if there is no tweaking to the standard IP. Although ARM's 64-bit processor leaves much to be desired for HPC, it is a simple little beasty and taking on any of the chores one associates with HPC might be daunting.

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enricofermi • a day ago
Wait a second, the A7 chips by apple are 64-bit arm processors, so those are already out. I assume they need quad core versions, which the A7 is not.

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Brendan ↗ enricofermi • a day ago
either that or since the A7 has the gpu integrated into it, maybe coding for external gpu's is impossible if not inefficient?

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