

NEWS AND ANALYSIS

Chips and the Open-Source Secret

Can China develop chip self-sufficiency with RISC-V International, a nonprofit that promotes open-source semiconductor technologies?

BY ISABELLA BORSHOFF — AUGUST 7, 2022



Credit: RISC-V via [Twitter](#)

As China pushes for semiconductor self-sufficiency, it's found an unlikely ally: an international foundation dedicated to open source technology, with its origins in California's libertarian computer culture.

When it comes to a core chip element known as “instruction set architecture,” the vital semiconductor component that allows a chip's hardware and software to communicate, the global market is locked up by two companies: the U.S.'s Intel, which dominates computing, and Arm, a Japanese-owned, U.K.-based company that supplies almost all smartphone chip architecture. These firms license their technology to chip design companies for huge sums.

But that could soon change. [RISC-V International](#), a non-profit born from the work of a team of computer scientists at the University of California, Berkeley in 2010, and now based in Geneva, Switzerland, has developed an increasingly popular open source alternative to Arm and Intel's designs, and Chinese companies are buying in.

Of the organization's 24 fee-paying premier members — who each pay \$100,000 a year for a seat on the organization's technical steering committee or \$250,000 for a board seat as well — 12 are now Chinese, including Huawei, Alibaba Cloud, and the [Institute of Computing Technology](#) at the Chinese Academy of Sciences, as well as leading Chinese venture capital firm [Chengwei Capital](#).¹ That's up from just [two of 15](#) premier members in 2017.

Chinese companies are increasingly experimenting with RISC-V too — the first laptop using its technology, made by Chinese firms DeepComputing and [Xcalibyte](#), is [set to ship from China](#) in September.

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— [Nathan Brookwood](#), a semiconductor industry expert

“The experience with U.S. Commerce Department export controls has galvanized Chinese government support for developing a RISC-V ecosystem in China as a long-term alternative to both Arm and Intel’s designs,” [Paul Triolo](#), a senior vice president for China at Albright Stonebridge Group, a consulting firm, said in an email to *The Wire*.

For China, reliance on Intel and Arm designs is uncomfortable. Since then-U.S. President Trump sanctioned Huawei by adding it to the “U.S. Entity List” in 2019, the Chinese technology giant has been barred from licensing Intel chip technology. The proposed – although ultimately failed – acquisition of Arm by U.S. company Nvidia in 2020 left Chinese companies anxious that they could face similar disruptions in their dealings with that firm.

China isn’t the only player dissatisfied with the Intel-Arm lockup. RISC-V International’s founders took their cue from Silicon Valley’s software engineering culture, where open source models are valued for their innovative potential. In an email to *The Wire* RISC-V International said that its open source model can “ensure design flexibility and freedom and create a more cost-effective licensing approach” compared with proprietary alternatives.

Open source rivals to Arm and Intel face major hurdles in challenging their dominance in this crucial chip design component. Switching costs are high for chip buyers thanks to the level of integration required for components, and the existing players have the capacity to provide sophisticated after-sales support. But RISC-V is showing signs of success. In a testament to its growing clout in the industry, even Intel has paid the \$250,000 annual fee for a premier membership.

“If you’d asked me five to ten years ago ... I would have said the world didn’t need another microprocessor design,” says [Nathan Brookwood](#), a semiconductor industry expert. “I’ve been proven wrong.” The number of RISC-V chip components shipped globally has skyrocketed over the last five years. This year, 10 billion RISC-V chip cores are expected to ship, according to [Semico Research](#). That’s projected to climb to almost 80 billion in 2025, or around 15 percent of the world market.

“RISC-V is definitely becoming a more important element of the semiconductor value chain, with more and more companies announcing designs based on the open source architecture,” says Triolo, from Albright Stonebridge Group. “There is no doubt that the architecture has generated a massive upswing in interest in the industry over the past two years.”

Open source technology like RISC-V is also appealing to China because it’s cheaper, and it provides a pathway around U.S. export controls in an increasingly decoupled technology market.

“It is very, very difficult for any government – including the U.S. government – to restrict access to open source technology,” says [Antonia Hmaidi](#), a technology analyst at the Mercator Institute for China Studies (MERICS), the European research institute. Even so, RISC-V International took the precaution of moving its global headquarters from the U.S. to Geneva, Switzerland, in 2020, in an effort to reduce its exposure to political risk amid the U.S.-China trade war.

Several U.S. Republican lawmakers criticized that move, with Congressman [Mike Gallagher](#), a Wisconsin Republican, [telling Reuters](#), “The Chinese Communist Party is trying to circumvent our export control system to support national security threats like Huawei — we cannot let it succeed.”

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— *Antonia Hmaidi, a technology analyst at MERICS*

Still, doubts persist about China's prospects of developing semiconductor self-sufficiency on the back of open-source technologies.

While RISC-V looks increasingly competitive in certain mass-market applications, like Internet-of-Things and car chips, some experts think it is unlikely to compete with ARM and Intel in higher end applications, like artificial intelligence and data servers, which generate most of the value in the global semiconductor market. In response, RISC-V International says its designs are being used across the full range of chips, and that high performance computing and data centers are two of its highest growth applications, contrary to industry assumptions.

Additionally, the instruction set architecture is far from the only segment of chip manufacturing where China relies on foreign technology. “Because RISC-V and chip design represent only a small piece of the overall semiconductor value chain and production process, the U.S. and allies retain huge influence over supply chains and tools to restrict access to key technologies,” says Triolo from Albright Stonebridge.

“You could still screw up China's plans if you wanted to,” agrees [Woz Ahmed](#), a semiconductor industry veteran and managing director of Chilli Ventures, a consulting firm. “If you develop a high performance chip, you need good design tools and you would want to manufacture it in a leading geometry. China doesn't really have those sorts of technologies yet.”

Others question whether China really can sustain a vibrant open source community. Recently, Gitee, China's equivalent of the open source code website Github, [announced](#) it would be taking down all code for review, and would be assessing code before publication from then on – a move widely attributed to pressure from Beijing.

“Open source advocates will tell you knowledge should be free,” says Hmaidi, from MERICS. “This of course actually goes very much against what China believes, that information should be nationalized. I am personally quite doubtful how successful that can be in the way of creating real innovation.”



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COVER STORY



Pole Position

BY EYCK FREYMAN

In public, Chinese diplomats and climate negotiators deny that they see any link between climate change and geopolitics. But there is a deeply cynical consensus within China's academic and policy communities that climate change creates geopolitical opportunities that China can exploit — and must exploit before its rivals do. Greenland was the proof of concept for this strategy. And it caught the U.S. flat-footed.

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BY GARRETT O'BRIEN

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Q & A



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