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TECHNOLOGY

Computer Chip Visionaries Win Turing Award

By CADE METZ MARCH 21, 2018

SAN FRANCISCO — In 1980, Dave Patterson, a computer science professor, looked at the future of the world's digital machines and saw their limits.

With an academic paper published that October, he argued that the silicon chips at the heart of these machines were growing more complex with each passing year. But the machines, he argued, could become more powerful if they used a simpler type of computer chip.

This counterintuitive idea spread across Silicon Valley, driven by the work of Mr. Patterson at the University of California in Berkeley and a second academic, John Hennessy, about 40 miles away at Stanford University. They called it RISC, short for "reduced instruction set computer."

On Wednesday, the Association for Computing Machinery, the venerable computing society that represents industry professionals across the world, announced that Mr. Patterson and Mr. Hennessy had won this year's Turing Award, often called the Nobel Prize of computing. They will share a $1 million cash prize.

Named for the British mathematician and pioneering computer scientist Alan Turing, the award carries an added resonance this year, as the chip industry takes

another step toward the kind of future envisioned by Mr. Patterson and Mr. Hennessy.

Today, more than 99 percent of all new chips use the RISC architecture, according to the association.

"This is the one fundamental idea that has been sustained over the last several decades of chip design," said Dave Ditzel, a chip industry veteran who studied with Mr. Patterson at Berkeley. Mr. Ditzel helped popularize many of the same ideas and is now building a new RISC chip at a start-up called Esperanto.

Mr. Patterson and Mr. Hennessy were interested in simpler chips because they ran faster, consumed less power, made life easier for chip designers and allowed machines to evolve at a faster rate. In the mid-1980s, new RISC chips emerged from two Silicon Valley start-ups, Sun Microsystems and MIPS Technologies, becoming the standard for the computer workstations and servers that underpinned big corporate operations.

Those processors were eventually eclipsed by chips from Intel, which put its considerable muscle behind a competing design. But as computing expanded into smartphones, tablets, and other small devices — where power and space are at a premium — more and more chips used designs from a British company called ARM, short for Advanced RISC Machine.

As a book written by the two researchers in 1989, Computer Architecture: A Quantitative Approach, became the standard text for chip design, even Intel took a partial step toward the RISC idea. Its chips continued to use their own complex way of talking to a computer's software, but started to use some aspects of RISC.

Intel chips still drive the data centers that power the internet. But as these chips approach their physical limits, internet giants like Google, Facebook, and Amazon are pushing tasks onto a wide range of simpler processors that consume much less power, sparking a renaissance in chip design.

"Complexity is even more of an enemy than it was before," Mr. Ditzel said. "We have to design differently."

Mr. Patterson and Mr. Hennessy are at the heart of this change. Their book is now in its sixth edition. Mr. Hennessy is on the board of directors of Google's parent company, Alphabet, after serving as the president of Stanford for 16 years. And Mr. Patterson works in the Google research lab that is designing low-powered chips specifically for artificial intelligence.

As time goes on, the world could move even more toward the RISC way of doing things, thanks to an organization called the RISC-V Foundation, which has published a chip architecture that anyone can use for free, said industry veteran Dennis Allison. The organization was founded by Dave Patterson and others from Berkeley.

"I expect this to play a vital role in the future," Mr. Patterson said. "And the architecture is not that different from what John and I described back in 1980."

Follow Cade Metz on Twitter: @CadeMetz

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