AMD's world-beating new chips have Indian engrs at their core

Their processors are running data centres and the world's fastest supercomputers

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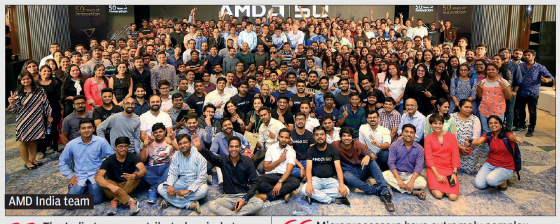
TAKES YEARS TO GRASP CHIP DESIGN; SPEND TIME TO LEARN IT



AMD India team

"The India teams contributed majorly to the success of Milan. A lot of hard work went behind this, especially when you consider the special circumstances that we have been under the last year and a half. But we had a commitment to keep. And the proof is in the pudding, Milan is performing exceptionally in the market.

Jay Hiremath | CORPORATE VP, PLATFORM & SOFTWARE ENGINEERING, AMD INDIA

"Microprocessors have extremely complex designs, and it takes years to get a good grasp and understanding of the design. Which is why I keep telling my team members that you have to invest in a company like AMD for years to complete your learning. Working on a design like Milan will be a career highlight and make you very valuable to the industry.

Jaya Jagadish | COUNTRY HEAD, AMD INDIA, AND CORPORATE VP, SILICON DESIGN ENGINEERING

For a decade starting around 2007, it looked like AMD had been demolished by Intel, both in the PC and server processor markets. And then, almost like the phoenix rising from its ashes, AMD rose again. It has been a spectacular rise over the past four years. And it began with the launch of a new server processor called EPYC.

EPYC is now into its 3rd generation. And AMD's India engineers have had a central role to play in every generation of EPYC. The first EPYC, based on a x86 core architecture design called Zen, was built from scratch with major contributions from the India teams in Bengaluru and Hyderabad. The updated 2nd generation version was released two years later and set over 170 world records in data centre CPU performance, security, and scalability. The 3rd generation, AMD's latest 7 nanometre chip and codenamed Milan, was launched earlier this year and is considered the world's fastest server processor. Crucial aspects of it – both hardware and software – were built out of India.

Designing the Hardware

Jaya Jagadish is country head at AMD India. She is also corporate vice president of silicon design engineering, and heads the cores team at AMD India, which is responsible for the development of the CPU or processor core. "In a processor there is something called the system on chip (SoC). The SoC contains several building blocks called IPs. The SoC team takes all the different IPs, connects them and stitches them together. We then verify the entire system, to make sure that the system is doing what it is supposed to be doing. We also do a lot of stress tests to ensure we have a system capable of being used in high performance computers," Jagadish says.

She says several of the critical IPs in the EPYC SoC were designed in India. Once the chip is designed, all the testing is done via simulations. After which the chip is fabricated and re-tested on a massive piece of equipment. This level of testing is done in the US, with the India team constantly sending new patterns to be tested and verifying the logs being sent back from the US for flaws and anomalies. After that, there is one more level of testing called board-level testing, which is done in India..

The hardest part of the whole process, Jagadish says, was the final design phase, when the pandemic struck, and lockdowns were implemented. Overnight, they had to shut down the campus and move to work from home. The last three months of the design phase is very critical for the SoC team, because the design is so massive that to just load everything onto a computer and run it takes about a week. Any mistake could cause delays by weeks. "But the passion and commitment from the team was just incredible and we were able to finish the work spread across the country working from home," she says.

It's extremely hard to find people who have experience with CPU design at this high-level of expertise and so AMD, Jagadish says, generally looks to hire people with solid tech foundations who are willing to put in the time to learn.

Building the Software

Jay Hiremath is corporate vice president of platform and software engineering at AMD India. He has been with the company for 28 years and says these are the most exciting times to be with AMD.

Hiremath's team has complete ownership of CPU software development and platform engineering. His team builds the entire software stack that goes into optimising the server processor to give world-record performance benchmarks.

Hiremath says the primary function of his team is to eke out the last bit of performance offered by the processors. "We have the best-in-class processor, but if we cannot leverage the computing power provided by these processors, then the hardware is no good. This is where software comes in," he says. The team works on tool chains – compilers, libraries and profilers – debug tools, system management, platform drivers and machine learning.

Benchmark statistics are what drive the average selling price of a processor. So the team had to optimise the performance for benchmarks, and then it needed to optimise it more broadly for all the applications it was meant to serve. "Whether it's the high-performance computing segment, enterprise segment or cloud segment, each has its own requirements and quirks, and that requires customisation in terms of performance tuning. That is why designing the software properly is so crucial," Hiremath says.

Today, most of the new supercomputers use AMD's 2nd and 3rd generation server chips. Frontier, powered by a custom-built AMD EPYC CPU and AMD Radeon Instinct GPU, will be the first exascale supercomputer in the world. Exascale computing refers to the capability to perform a billion billion (a quintillion) operations per second. The fastest supercomputers today solve problems at petascale. Frontier will deliver more than 1.5 exaflops of peak processing power, more than a 1,000 times faster than the best now.