



Daniel Newman: Patrick Little, CEO SiFive. Welcome to the 2022 Six Five Summit. So excited to have you here.

Patrick Little: Yeah, really excited to be here, Daniel. Looking forward to it.

Daniel Newman: It's great to have the opportunity to sit down, have a conversation. So much going on in the semiconductor space. It's a really interesting time in the market and the economy. I'm going to pick your brain about a lot of things. Hopefully everyone out there in the audience can walk away knowing a little bit more about SiFive, a little bit more about RISC-V and maybe even learn a little bit more about what's going on in the world of technology and how semiconductors are continuing to change the world, or as I like to say, eat the world.

Patrick Little: Right.

Daniel Newman: Absolutely. Let's start with RISC-V. Hearing a lot of buzz about it. We've been covering it, talking about it, but it's not necessarily household name yet. So for those in the audience that are hearing about RISC-V or maybe have heard about it but don't really know much about it, how do you explain, define, introduce RISC-V to that audience?

Patrick Little: Yeah, I only do this like 20 times a day, so happy to kind of lay the foundation. At first, I have to giggle at what you said about the changes in tech. 10 years ago, if you were to mention hardware, there'd be a mad rush for the door. And now it seems like hardware's really kind having a Renaissance and this computing super-cycle is just profoundly strong, it'll outlive all of us. But RISC-V, so let me take you back, I don't know, all the way to 1880 when Dave Patterson first started, even coined the term RISC and really started working on reduced instruction set computers architectures at Berkeley. In fact, when I was going through college, I used Dave's textbooks. And so I kind of view him as the father of the entire thing, in the entire RISC architecture.

But then you kind of fast forward to about 2010 and we have Krste Asanovic who's a professor at Berkeley who has a research program and he needs to solve, he's looking for a new instruction set architecture that gives him and his team the ability to collaborate across projects, to collaborate even across universities, but something that is clean slate, modern, scalable, and he couldn't find anything out there. And it was not only the commercial pieces of not being able to access the technology free and openly and collaborate openly, but it was also just the tech itself. He wanted something small. He and his team wanted something small and very modular, but also scalable through extensions. And so they sat down for a brief summer session to try to really design something and they came out with the RISC-V architecture, which I will tell you is going to have profound repercussions across this industry for not five years or 10 years, but 50 years.

And so the idea behind it was let's design something that is open for collaboration across academia, not just at Berkeley, but across all of academia initially, but something where anyone can pick it up without an upfront fee, without the encumbrances up front and work with it and scale it and devise their own computing architecture around the RISC-V core. And that was kind of the essence of it. But really at the very heart of it, collaboration. And so they were quite successful in doing that. And some five years later, it started to go into not only other



universities, but other countries. Very quickly spanned into India and China and Europe and many other territories. And so that what you found is that by 2015, the entire architecture was put into something called the RISC-V Foundation to ensure that it remained open and accessible to really everyone.

And so all of that IP that was generated at Berkeley and beyond was donated to the RISC-V Foundation, which now has become RISC-V International. And another thing occurred coincident to that in 2015 is that team from Berkeley went off and started a new company because they saw the commercial aspects of the technology. And so they started a company called the RISC-V, really with the same fundamental principles in mind, collaboration across partnerships, collaboration across a community of participants and also collaboration with customers. And so that was kind of the nucleus in the starting of SiFive back in 2015. But I think it began with David Patterson in 1980 and it just progressively RISC-I all the way through RISC-V, gotten stronger and stronger. And I think it sets a brand new model in computing where things are open and available, and it just makes it a lot easier for smaller companies or universities, or now very large companies to innovate around the compute architecture.

I think it's a, not only a new architecture, and there have been many, but I think it's a new model for collaboration on computing platforms. Most of the computing platforms are the instruction set architectures that have been here through history have been but from a single company. And so most of the failures of those have been that sponsor company failing financially. And so I think what a lot of our customers see is since the community now owns this, literally thousands of companies, universities, software companies, you name the type of tech company are collaborating, it's protected. And I want to say recently we closed a very large design win with a very well known space and aeronautical company. And one of their primary reasons for choosing it is they felt that this is a standard that's going to last for decades and decades into the future.

And that the software they write today will be scalable into the future and this platform will continue to have strength and existence over the coming decades. And so that's what started in Berkeley some decades ago and primarily 12 years ago for RISC-V and incredible legs on it. And frankly, I'm very proud to be part of it because it's something that's going to be going on. My children will be learning RISC-V in college, like many do. And so it's great to be part of something that's going to outlive all of us, but that's kind of the nucleus and the intent behind the RISC-V architecture.

Daniel Newman: Absolutely. And you touched on a lot of things there, and I'm going to want to dig in a little bit more into some of the differentiations and the verticals in which you're serving. We'll hit that in a minute. But SiFive, so one of the well known participants in the RISC-V arena, but you started to kind of allude a little bit to the finding of the company and what was the basis of SiFive. But give us just a little more on that because I'm interested. Talk about the mission of the company. You mentioned all these different participants. What's the SiFive story? What is your role to play?

Patrick Little: Yeah, great question, Dan. I think first and foremost, our role I believe is the brand standard. So the same team that founded RISC-V at Berkeley is the team that founded SiFive as I mentioned.



And so we feel a responsibility to keep the virtuous essence of the architecture around for the collaboration, for the scalability, and to try to protect and grow it. And not only as SiFive, but also as a community member in the RISC-V Foundation. So first and foremost, we feel kind of responsibility to extend the seed that began at Berkeley some 12 years ago.

And then the rest of our mission today, it's going to sound a little corny, but our mission today is all wrapped around the success of our customers. When we talk about success, we don't talk about a design win or a product release. We talk about what can we do to perpetuate the success of our customers, to deliver best in class products in their end markets.

And so that's what we're focused on. We're very right to left. If you walk the halls of SiFive, you'll hear the term right to left an awful lot. And so we believe that if our customers, we want RISC-V and SiFive to do amazing things this year and over the decades. To do that, we really need to empower our customers success. So we focus on that. Their success always translates. The transitivity from their success to our success, and frankly, down to the success of RISC-V is highly linear. And so that's what we do is we focus on collaborating with partners, working with them to drive their innovations, frankly, in almost any market and application you can name and drive that innovation all the way through SiFive and back into this standard. And I think this is one of the reasons why the standard will last for many decades.

The architecture was well defined in the RISC-V standard, but not the implementation. And so the micro architecture, or the implementation of the standard is less left open intentionally for interpretation. And so one of the things we do at SiFive is we interpret that in a way that benefits our customers. And so one of the areas that I think that we're very unique, and the RISC-V standard is very unique, is that we always knew that it was going to be clean. We always knew that it was going to be modular and scalable and therefore tight and efficient. But one of the things we're really finding out, you mentioned how we differentiate ourselves. One of the things that we're finding out now that we're actually taking this into real world applications is that our performance per watt is profoundly better than anything out there and it has to do with the focus from the very beginning and the cleanliness of the architecture.

And so we have, and I mean anything from edge AI all the way to the cloud implementations, our customers are coming back to us saying, "I don't know if you guys really know this, in the lab and in our products, we're starting to see some outrageous performance per watt advantage." And at the edge, it's very obvious that customers would need that power efficiency. But now Daniel, when you talk to any customer on any vertical, any application, they're trying to get the maximum performance they can in a power envelope. Very obvious in mobile, first order obvious in mobile, but same thing for automotive and same thing for the data center and many, many other applications. So in addition to the openness of the architecture, which we believe is foundationally unique for this ISA, we believe that on its own, right technically speaking, it's super low power, super area efficient.

And then I think another thing that's very important is it's highly scalable from the smallest micro controller to the largest, very parallel processing monster that we design. And one set of software works across that entire continuum. So one set of software binaries can work on any



RISC-V machine that's compatible, and that's whether it's from SiFive or another vendor. And so these are some of the attributes that I think do differentiate SiFive. And we do view ourselves as the brand standard and the founder of RISC-V, but we also think that the value that this ISA is bringing to our customers is profoundly different and differentiated and very powerful. And this is why I think we'll be around for decades, decades to come.

And then I should say something about the culture. It's wacky, super, a lot of Birkenstocks as you might guess, but great group of people, incredibly humble, incredibly focused on not this year or this quarter, but on really bringing this ISA and changing the industry and driving low power and collaboration. Community collaboration is top of mind for us. Every time we think about something for our company, we think about, "Well, how can we also move the community?" So it's a wonderful mission that we're on. And that's why you see we're starting to really build our engineering team super quickly and we're getting a lot of very excited candidates knocking on the virtual front door.

Daniel Newman:

So, Patrick, I think you can read my mind a little bit, because I was going to hit you up. I was going to say, "Hey, talk a little bit about the differentiation," but you kind of nailed it talking about everything from low power to open and you mentioned several other, so I'm going to kind of jump ahead a little bit, because I'm going to talk a little bit about the traction in the market because I think that's a lot of time the rubber meets the road proverbially speaking, when customers start to utilize and buy. You did mention when we talked a bunch of applications though, you talked about the edge a few times, you talked about the data center. So these are edge, data center, AI, automotive, these are a number of the areas where these new architectures are being looked at, new competition entering markets. You're seeing hyperscalers are building home grown. You guys are obviously identifying opportunities and a big market and a big market opportunity. Where are you seeing SiFive and RISC-V gain commercial traction?

Patrick Little:

Right. Great question. So the company actually had two phases. The first phase was to prove out the architecture, build the brand. And we did that through embedded, a series of very scalable embedded products and in very established markets. And so we did that for the first 4 to 5 years of the company. We offered the very smallest cores and the very largest embedded cores. But because we focused on embedded, our application applicability was extremely broad. We were in 5g infrastructure. We were in mobile handsets. We were in WiFi gear. We were in networking. We were just, if you name it, we were in those applications. Over hundred customers, hundreds of different design wins and applications. And so the early adoption of the company's tech was very, very broad and frankly it really enabled the company to make a name for itself and prove that we could deliver the quality at a commercial and enterprise level.

And so we proved ourselves in those early days. Since coming onboard about two years ago, we pivoted to higher performance applications. And so our objective is if you can get it from any other vendor at any level of performance, you'll be able to get that same thing from SiFive. We're probably about a year and a half away from that intercept point where you can look across all of the existing ISAs and say SiFive has best in class raw performance in every category. But what we look at now is the applications that we're servicing now are still quite broad because the nature of the ISA. We are in quite a few of the edge AI solutions with our vector



products. For example, we have one customer who is building security cameras, and it was originally an embedded device that was IOT, so it was connected, but it kept sending you notifications to your phone when the trees blew.

And so what they wanted, and this is a very well known company, what they want in high volume, what they wanted was some intelligence at the edge so where you don't get a notification at work when trees are blowing, but only when someone with a black mask is at your front gate. And so that's one example of something very small that's battery powered that we're servicing with our new products. Another example was we also have a brand new data center customer who's developing multi-core, multi-cluster, extremely wide compute solutions. And we're sitting alongside in cooperation with their computing pieces. And so you really do see this very broad applicability of the RISC-V or the SiFive architecture. And so we're enjoying all of the applicability across the board.

We do have some areas of focus I think in the immediate term that make a lot of sense for us because we feel like there are underserved markets in very exciting applications. One of them in particular is automotive. So when I look at the, I'm from automotive, I recently left Qualcomm where I ran automotive to come here. And so those applications, those customers, that industry is close to my heart. And so there's a lot of intelligence going into those designs. There's a lot of compute going into the car where there wasn't so much even 10 years ago. And so we're partnering quite publicly with quite a few of the automotive customers. We feel like we're a great fit. They love our outright performance. They love the openness of the architecture. And then there's another, so that's one category, another category where I feel like we're really getting a sharp, rising edge on the uptake is around vectors.

And so those customers that want to add AI to their existing solutions. And so a lot of them will need vector processing alongside of their kind of traditional scalar processing. And so what we're finding is many customers don't want to be captive to an existing proprietary solution in a new category. So if they're moving to a new category, they're thinking everything's wide open, the software's not really established yet, the ecosystem's not really established yet, let's go with an architecture that will take us 20 years into the future where we won't be captive, where we'll be open to innovate with a partner, without a partner, but also, and I think Intel is a perfect example of leadership and maturity. They are a partner of ours. They're a customer of ours. Many people might look at that and say, "Why wouldn't you be natural competitors?" But the truth is they're one of our best customers and one of our best collaborators because they look at the X86 architecture.

Then they look at the RISC-V architecture with SiFive and they see an ability to achieve different things at different design points. And so they're an investor in our company. They recently joined RISC-V International, which I feel is a historic moment that was overlooked by a lot of people. Everyone should have turned their head and said, "Wow, the maturity there is pretty phenomenal." And I think that Intel's joining RISC-V International is really a tipping point for the entire foundation and entire ecosystem because they're doing so much. They're bringing so much tech in cooperation with us and the rest of the foundation. It's pretty amazing what's



happened there. And I think that we'll end up doing some phenomenal designs, hybrid designs with them.

Daniel Newman: Yeah, it's a little bit of a sneak peek into the future. And we have a minute or two left in this conversation, Patrick, and I want to thank you because it's been great insights. I think anyone out there that didn't know about RISC-V or wasn't overly familiar has to know quite a bit more now. So that's 20 minutes well spent. As I like to say, it's the Ted talk for RISC-V. But you say something, or I've heard you say something in the past along the lines of RISC-V has no limits. Bold. It's a bold statement. You believe that. What do you mean by that? And what does that mean for the future of SiFive and RISC-V?

Patrick Little: Yeah, the reason why I say that is first and foremost, we're living in the computing super-cycle so just timing is everything. We're so lucky with our backgrounds to work into an envelope in time where computing is so profoundly important to the world. And this is from medical to communications to data center, so important to the world. And so when I look with objective eyes at the RISC-V architecture and the difference it can make in the trends that are going on in the world, I see such an incredibly good match. And then when I layer on top of it kind of back to the virtue of why this thing was even started in the first place, let's make it open, let's make it clean, let's make it scalable. And most importantly, let's make it collaborative where the best idea wins, whether it's Intel's or ours or somebody else on the RISC-V or even a competitor's idea if they put it into the RISC-V International pot of ideas.

I just think that this is, it's the computing super-cycle really taking this world to a whole new level and RISC-V kind of coming off the on-ramp on the perfect time to be able to deliver a lot of the attributes that are necessary. And so we're seeing it live. It's incredibly exciting at the company. We're in handsets, we're in 5g infrastructure, we're in cars, we're going into data centers, we'll soon be in client computing. We have not seen anything about the architecture that would limit it from servicing with very high impact into almost any application. And so it's super excited about, I'm personally excited about being part of SiFive and incredibly excited about just being part of the RISC-V movement. It will make a difference in this industry that's going to outlast both of us and we'll be standing on the hill next to our customers and next to our partners, and next to academia, because we'll all be collaborating. But super exciting times.

Daniel Newman: Well, you totally spoiled my self belief that I'm going to live forever there now that I know this is going to outlast me. But in all serious, if you've been out there, you can read some of the analysis that I've written after some of the recent moves that you've made, Patrick, as CEO of SiFive and I definitely see a lot of potential. We are definitely in that super-cycle as I often say and continue to say that semiconductors will change and eat the world because you can't run all this software on nothing. It can't run on air. It's got to be built in a world of chips. And if the shortages that we face during this pandemic didn't make people just acutely aware of how important semiconductors are, then I don't know what would. But Patrick Little, SiFive, congratulations. Thank you so much for joining me at this year's Six Five Summit. We can't wait to hear more, to watch and see how SiFive and RISC-V continue to change all of the areas in which you're participating. So we'll see soon, Patrick.



Patrick Little:

Thanks, Dan. Exciting times ahead and future is bright. Appreciate it. Enjoyed it.