S1 EP17 - PAM4 Everywhere

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Matt Bolig, Director of Product Marketing, and podcast host Chris Banuelos discuss PAM4's importance to the cloud data infrastructure market. Hear insights from Matt's experience working in optics as well as his take on the trends driving the extensive PAM4 portfolio pioneered by Inphi (acquired by Marvell in 2021). Matt also describes the new markets PAM4 is entering, such as 5G, and where the technology is headed.

Speaker
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Christopher Banuelos 00:04
Welcome to the Marvell Essential Technology Podcast. I'm your host, Chris Banuelos. Join in on a conversation between me and Matt Bolig, Director of Product Marketing on PAM4 its importance to the cloud data infrastructure market. Here insights from Matt's experience working in optics, as well as his take on trends driving the extensive PAM4 portfolio pioneered by Inphi, which was acquired by Marvell in 2021. Matt also describes new markets PAM4 is entering such as 5G and where the technology is headed. To stay up to date on future episodes, be sure to subscribe to the Marvell Essential Technology Podcast. So Matt, let's, let's start a conversation off today with what is PAM4.

Matt Bolig 00:49
So PAM4 is is essentially a way to get a deliver more data versus NRZ. So traditional modulation would be NRZ, just two levels, and four allows you to deliver twice as much information for a given period of time.

Christopher Banuelos 01:08
And Matt, why is PAM4 important for the cloud data infrastructure market?

Matt Bolig 01:13
It's it's really kind of exciting time, right? Because PAM has been around for about five years and is well established in these markets today. So everybody's, you know, every different data center operator is on their own kind of trajectory. But you can say right now, from the kind of, you know, early adopters, to the fast followers, all the hyper scalars in the world use PAM4 today. Now, as we look ahead a little bit is, is that that, you know, we've got these established kind of areas for PAM4, but now we've got these new growth opportunities that are emerging. So you know, kind of I look at this in two different ways. From a connectivity perspective, you have like, established networks today that have PAM4 in the top of rack going up into the fabric. And what's

happening now is, is we have people now starting to establish PAM4 connecting down from the top of rack to the neck. So this is a huge growth factor for opening up that part of the network for PAM4. The other thing kind of on a connectivity side is we we up until this point, we've been looking at PAM4, as is an Ethernet protocol. And now we've got these other protocols that are opening up PCI Express and Fibre Channel that are also adopting PAM4 with their new generations. And so that's on the connectivity side, looking at applications, right we've got we've got all these established applications where you've got you know, all the social networks run on PAM4 today. And then you've got the then you've got the sort of infrastructure software as a service. These is all this is all established PAM4 networks. But then you've got this new, you know, really tremendous growth factor would with with AI and ML, and I was just looking at this statistic, this marketing firm, they said that in this year, you've got they're expecting AI to be like a $50 billion business going to 125 billion in 2025. So really a tremendous story here for AI. And from a networking perspective, what we see this kind of sort of a first for first kind of instance of a place where because these inference machines and training machines require so much data, that that the there's now I think a view on the network operator side, that the networking is a critical piece to dilute to growing their revenue. So we see even stronger pushes for increased increased bandwidth in these AI and ML applications, even versus our more traditional applications.

Christopher Banuelos 04:04
Inphi pioneered PAM4. And that has put the technology in the spotlight as a key enabler for optical connectivity. How did that come to be?

Matt Bolig 04:14
Yeah, sure. And I think it's it's really kind of the you know, there was a little bit of magic at Inphi where the the there the team there at the time really kind of had the vision to understand that PAM4 was the right answer. I think many people have forgotten that that if you go back to the to 2013 timeframe, there was there was actually quite a few different modulation protocols under consideration by IEEE in some sort of substantial companies, a very large network enterprise networking company was not a supporter of PAM4for so there was a lot of reason to think that PAM4 wouldn't win. However, the kind of technical experts and the executive leadership at Inphi believed in the PAM4 solution and invested in it heavily early on. And so what that allowed them to do is deliver a product called Polaris 50 gigabits per second PAM4 DSP, very early ahead of the competitive competitors. And then partnering with the sort of early adopter data center operators, then we really drove the PAM4 adoption into into hyperscale. So that initially, so we're probably looking about five years ago right now. And then this was right there. So this players fit that point became the first DSP to be or five level solution of any type PAM4 them to be deployed at scale. And at this point, no, Polaris has shipped millions and millions of units. And we can continue to ship today. And so that the ball kind of kept rolling there we had Polaris, we delivered to the market. And very quickly after that, we delivered a 400 gig product. So the 100 gigabit per second prima, so I think that's the established that's the sort of establish the basis for the invite business.

Christopher Banuelos 06:17
Marvell has a really broad portfolio of and five PAM4 DSPs and technologies. Could you highlight some of the offerings and how they're being developed by Cloud customers today?

Matt Bolig 06:27
Absolutely, Chris. And today, I'll be talking about the optical DSP business, the copper business would be for a later podcast. So right now, one thing to understand is over all our products. continuous innovation is the key tenant that drives the whole machine. Now there's two parts to this one is first, the fastest, this is absolutely key to delivering for our early adopter customers who absolutely need this connectivity to drive their applications. Now, this is what I'm talking about. First, the fastest, this is the guys that are the AI Ml. So and then then driving the core networks behind that. So this is the Spica product family that we just released to production a couple of months ago, our 800 Gig re timers, right then and then this is ramping This is a global ramp right now you look at US and international data centers, everybody's pushing this this product out. And again, you know, we've got traditional networking in AI driving this, it's also our our Porima Gen four product where we had gone

and reduced power in the 400 Gig gearbox. This is another strong market driver for us across the in the core networks. Now, in in for the later emerging PAM4 networks, we do we have a different we are continuing to innovate for for these guys as well. And a product that I like to talk about there is Atlas. So this is a product that we introduced last year. It's for late later market adopters. And we see this going in pretty much everywhere with multimode and singlemode applications. And we see this even now starting to have the first sort of optical connectivity to the machine here. So a lot of poll in the market for this atlas product.

Christopher Banuelos 08:35
What new markets is PAM4 entering, and what can I help enable?

Matt Bolig 08:40
Well, you know, PAM4 that, by its nature enables more data flow. So really, this is we're starting to see this push across all different parts of networks now. Now one thing that I alluded to earlier is PCI, so now we've got PCI Gen six and enable 64G transfers per second. And so you've got PAM4 right inside the server. Now that is a next gen storage. We've got, you know, the PAM4 is now going into its second generation and storage with 64 Gig Fibre Channel being deployed today. And T11. Now looking at 128 Gig Fibre Channel and process of doing that definition, and then of course in 5G, so we've actually been shipping into the 5G network it since 2019. So a version of our Polaris products is shipped in there. And and that's been going into the mid Hall and backhaul markets. So now what we see now is that that 50G fronthaul is becoming a place of interest. And we expect field trials to start later this year for 50G fronthaul. So Pam, kind of now propagating everywhere throughout the 5g Network.

Christopher Banuelos 10:00
Matt, one of my last questions is what is Marvel's vision for PAM four? And where do you see the technology heading?

Matt Bolig 10:06
Well, there's a few constants and networking in and that's you always want to go faster and always want lower power and lower cost per bit. So that that'll that will change is as we look ahead. So you know, right now the IEEE is discussing 200 gigabit per second, right, so that that's going to happen for us what what we look towards, you know, in addition to the sort of fundamental parts of advancing networking technology, is how we can go and partner with, with our end users, and with the module development companies to go in and add value to the products on our roadmap. And, you know, there's a couple of sort of historical things I'll point to here. In in one of them is bear dies, we were an innovator of a bear die. And what that means really, just like it sounds, is, is eliminating the package. When we eliminate the package, we do a couple of different things, there's a couple of benefits, strong benefits here. The first is, you know, is supply chain agility. Now, what that means is, if I don't have to a constraint for for a package, I can deliver more products to my customer more easily, especially on forecast and products. So this is this is, of course, a huge issue. And this, you know, 2022, or supply chain constraints are everywhere. And of course, there's some cost savings as well, when you don't have the package and the assembly charges associated with it. So we were first to market with the bare die DSP with our with our Atlas product, you know, and then then the other part of thing that Atlas did is is we, we went in, we integrated the TIA phase, and we integrated some high current drivers. So again, innovating to go deliver more value to our customers beyond those kind of, you know, faster lower power, lower cost.

Christopher Banuelos 12:19
Matt, hey, thanks for joining today. I thought this was great. I'm looking forward to doing a part two with you in the future.

Matt Bolig 12:24
Super Chris. I really enjoyed it as well. Looking forward to getting back and talking again real soon.

Christopher Banuelos 12:31
Thank you for listening to the Marvell Essential Technology Podcast. As always, please feel free to visit our website to learn more, and we'll see you on the next episode.

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