

S1 EP 1 : Future Vision of Electronics Packaging

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Mark Kuemerle, Distinguished Engineer - Integrated Systems Architect from Marvell's ASIC Business Unit discusses electronic packaging with podcast host Chris Banelos on the first episode of the Marvell Essential Technology Podcast. Mark returns from the 2021 IEEE's Electronic Components and Technology Conference (ECTC), discussing some of the new developments in packaging technology that contribute to high integration and low power consumption.

Speaker

Mark Kuemerle

Distinguished Engineer -
Integrated Systems Architect -
ASIC Business Unit

Host

Christopher Banelos

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C Christopher Banelos 00:04

Welcome to the Marvell Essential Technology Podcast. I'm your host, Chris Banelos. On today's episode I'm with Mark Kuemerle, Distinguished Engineer integrated systems architect from our ASIC business unit, and today we're discussing his recent participation in a panel discussion at the 2021, IEEE electronic components and Technology Conference. Mark, I am super excited to have you on our very first episode of the Marvell Essential Technology Podcast. You just returned from the 2021 IEEE electronic components and Technology Conference. What I thought we could do today on our very first episode is talk about some of the discussion points from the panel. And also talk a little bit about your career here at Marvell.

M Mark Kuemerle 00:54

Sure. So I can I'll start with the ECTC, what, what the heck are we doing there? And one thing that's really interesting is that our interest in electronics packaging is really has really exploded. And you know, when we looked at the number of participants that we had at the conference this year, I think we had, you know, we had close to 20, participants were versus years before, we only had, you know, a select few. And it really shows I think how, how packaging technology is becoming more and more important, not only in our company, but in our industry, what I was doing there was actually participating in a panel discussion with some some really talented folks who work at other companies and who are interested in the same things. And what we were discussing was really, you know, what's changing in electronics packaging? And, you know, what, what is the world need to know about? Or what are the big what are the big paradigm shifts that we're seeing? And I was attending that kind of you had asked, you know, what do I do here at Marvell, it was attending that, in my in my role as a distinguished engineer and architect in our ASIC business unit. And we're working very closely with our ASIC customers to develop some of the most groundbreaking packaging technology so that we can provide them with the, you know, the greatest value possible for their chips. So we're really investing in cutting edge technology, not only for building chips, and kind of the next generation process nodes. But being able to integrate those chips onto a package in a way that's going to, to really build systems that have, you know, the lowest power possible and the highest integration possible. So our customers get all the performance they need. And their devices, regardless of how quickly technology is, is scaling up to meet their requirements.

C Christopher Banuelos 02:56

Mark, can you explain to our audience what exactly packaging is? And can you also describe how it's changed over the years?

M Mark Kuemerle 02:58

Sure, the package is actually the green stuff, shown here that holds everything together. So this is a laminate structure, layers of metal interconnect, and layers of polymer that are basically used to talk to the outside world through the other side. And the bottom side, there's a grid, different bumps that will connect to a large printed circuit board. And that's how the chips going to talk to the outside world. So in the past, electronic packaging was really straightforward. Generally, you'd have maybe one chip, and it was usually smaller than this, and a much smaller package. And it would, of course, do the same thing communicate with the outside world. So that's what a package is. It's really just an increasingly important piece of technology that connects a chip possibly to other chips and to the outside world.

C Christopher Banuelos 04:01

A moment ago, you mentioned in the past things were a little bit more complex. In these days, it seems like there's data being processed everywhere. Can you walk me through what are some of the challenges that the industry is facing today?

M Mark Kuemerle 04:13

One of the biggest challenges that we're we're facing as an industry is, we need to move more and more data every generation, we need to make these devices more powerful, every generation. And so one way that we do that is by making the interfaces to the outside world, run faster, every generation, right? So too, we move data faster, every new device that we make if we can if technology will allow it. And that actually creates one of the challenges. As we move data faster. We can't move the data as far right so if I move data twice as fast, I might only be able to move at half of the distance. And it becomes increasingly expensive from a point of You have power consumption to move that data, even that shorter distance. So it's really, it's a very interesting paradigm that I think, I think we've been experiencing slowly over generations. But now it's really, it's really coming to a head. What if and what it's doing is creating another issue, which is increasing package sizes, right? So so as we put more and more stuff, right onto that, onto that package, we've got more more components on that package, we're moving more data off of the bottom of that package, it makes it bigger and bigger. So what we're seeing is really, this, this need for being able to support more and more bandwidth, there more movement of data is driving large package sizes, which is, which is creating our may or may be pointing to one of the third challenges, which is, you know, how are we going to? How are we going to build these devices with these really large packages, and it really is going to challenge us, as an industry from a tooling, from a materials point of view, to evolve to meet these to meet these, you know, what I see as, as a step function in an increased challenge that we're experiencing right now.

C Christopher Banuelos 06:22

how can Marvell take these challenges and turn them into opportunities?

M Mark Kuemerle 06:26

Yeah, absolutely. And I think, you know, part of it is the kind of discussions that we're having today, you and I, Chris, and the discussions we were having at ECTC. So a big part of how we address the challenge involves the whole industry, right? So I think being clear and upfront with the industry about what these challenges are, so that we can all work together to resolve them makes a big difference. Now, of course, we're trying to have these conversations publicly. So that we can, we can kind of create that change and that awareness of what needs to happen. But we're also working a lot with our partners to make sure that we've got solutions for our customers, for these next generation systems. Right. So you know, certainly we're pushing the envelope in terms of of chip to chip integration, we're developing methods to put multiple die together on a package with the lowest power consumption possible. So that we can we can resolve a lot of the system challenges people are seeing. And we're also working with, with partners in the industry to make sure that we can supply those those solutions to our customers. And of course, one of the most exciting things that we're doing at Marvell, is really making sure that that we're absolutely on the forefront of next generation interconnect. And probably nothing illustrates

this better than a recent announcement that we made about the acquisition of Inphi, where now we've got this capability at Marvell, to build leading edge devices and do this multi chip integration to move from standard electrical interconnect to optical interconnects in the future, which is really going to be transformative in the industry.

C Christopher Banuelos 08:13

Mark, let's talk about the changes that you just described a moment ago. And can you tell me how it's going to change this explosion and package growth?

M Mark Kuemerle 08:22

Yeah, absolutely. One of the things that I think is really key, right, we talked about, when we when we want to talk from when we want to communicate from one ship to the other, we're moving faster and faster, and we move faster, we cross less distances, but we're still spending the same kind of power to do that. So power is driving a lot of these changes. Because what one of the interesting paradigms as well as that, you know, when we look at moving data at these really high high speeds, the distance that we need to travel with that data is going to modulate the power that we consume, right? So we're really seeing a need to make the distances between chips as short as possible so that we can keep the power consumption minimized. And it's driving architectures that will, that will move chips closer together, keep them on the same package. And when we do that, our IO count to the outside world ends up exploding as well. So what that's doing for us today, or what that's doing to us today, is that there's a growth in in package size that we see is really like going I'd say if we kind of rewind to previous generations, we had maybe maybe a 10% growth at most, going from generation to generation and package size. What we're seeing today is nearly a 60% growth to go from one generation to the next, just because of this integration because we need to move more data off of this package. And because of that, challenges have kind of scaling up the the interface and the distances that we can travel. So we're just seeing a huge step by step function increase in package size, which is really completely unheard of right, we've never experienced that kind of change in our industry. And I think what is happening is it's catching a lot of people off guard, right, our traditional suppliers. They're not used to this kind of rapid change, because they've had decades of predictable, predictable change. And it's really, really driving a pretty significant need to, to retool, and to figure out as an industry, how we can sort support these changes.

C Christopher Banuelos 10:42

Mark, I wanted to change topics here and talk about the recent acquisition of Inphi what kind of opportunities does that present? And how will it shape the industry?

M Mark Kuemerle 10:52

Sure, yeah. So it is, it is going to change architectures as we as we look forward, right, a lot of the challenges that we see now are really driven by that paradigm that when we connect chips, electrically, the distances is ever ever decreasing. And the power consumption for going those decreasing distances isn't changing. The really interesting thing I think about about having the Inphi team as a part of that the Marvell family is that now, you know, we have this opportunity to look at our architectures and see, you know, what, what does this look like if I connect electrically? What is what is it going to look like to me from from a package size growth. And really, with the acquisition of Inphi, we're starting to look at these next generation technologies, like co-packaged optics, that allow us to put the to allow us to put optical interconnects, actually onto our devices themselves onto these packages that we've been talking about. And in distance no longer becomes a challenge, right? If I have optical interconnect, I'm no longer limited by the scale up and speed really decreasing the distance I could travel, I could go from, from server to server, I could go from rack to rack with some of these technologies. And it's really going to transform our industry and help address some of the challenges that we've been talking about today.

C Christopher Banuelos 12:21

If our listeners weren't able to attend your panel discussion at ECTC, what are the main topics that you'd want them to know?

M Mark Kuemerle 12:29

I think the real key message that that I wanted to share at ECTC. And that we really need We need as many people in the industry as possible to hear is this is this really fundamental challenge that we have on supporting these ever increasing package sizes? Because driven by this, this massive push to integration? So what what we we, you know, we definitely want to look at as an industry is what can we do to, to retool, to support this extreme paradigm shift that we're going to see over the coming years. And it's going to, it's going to really require a fundamental rethinking of everything along the way, right, we're going to have to look at the materials that we use to build the package so that we can, we can get the lowest, lowest electrical loss through the package as possible, it's going to affect the way that we manufacture these packages. Right? We're oftentimes working with suppliers who might have technology that they've been using to manufacture for, you know, for decades, even, or at least over a decade, and supporting the next generation, this evolution and package technology is really going to require the industry to to relook at how we manufacture things, right, looking at using techniques more like we do in a fab to get, you know, very fine lines, and high rate, you know, high yield manufacturing, for very complicated devices, is going to be essential to our success. So if there's one thing I really want to make sure that people who weren't able to attend get from the discussion we were having is really that need and I and it was really echoed by the other, the other panelists in the discussion as well, that there really are fundamental rethinking that needs to happen as an industry to tool up and be ready for this next generation.

C Christopher Banuelos 14:38

Mark. I wanted to say thank you so much for being on our first episode of the [Marvell Essential Technology Podcast. I appreciate your insights and also hearing about the technology that you and your team are working on.

M Mark Kuemerle 14:50

It's great talking with you today to Chris, I tell you that it helped open my mind to how we can kind of share our story here at Marvell with the rest of the world and, and really, you know, share this call to action across our industry as well.

C Christopher Banuelos 15:08

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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