

# S1 EP9 - Silicon Photonics Platform Solutions

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Radha Nagarajan, Senior Vice President and Chief Technology Officer of Marvell's Optical and Copper Connectivity Business Group, discusses key insights into Marvell's critical solutions for next generation infrastructure as well as optimal approaches for power reduction and low latency in the data center. Be sure to read Radha's blog post for more information: <https://bit.ly/33v6DW4>

## Speaker

**Radha Nagarajan**

SVP & CTO, Optical and Copper Connectivity

## Host

**Christopher Banuelos**

Senior Manager of  
Global Social Media Marketing

### **C Christopher Banuelos 00:04**

Welcome to the Marvell essential technology podcast. I'm your host Chris Banuelos and today I'm with Radha Nagarajan talking about Silicon Photonics platform solutions. You can also read Radha's blog posts on low power DSP based transceivers for data center optical fiber communications by clicking the link in this episode's description. Radha, it's great to have you on today's episode, what I thought we could do is start off with a brief overview of your background, and what is your position here at Marvell?

### **R Radha Nagarajan 00:41**

So my background is photonic integrated circuits or high speed optical components. And currently I'm a Senior Vice President and Chief Technology Officer, Optical and Copper Connectivity Business Group.

### **C Christopher Banuelos 00:53**

Radha in our conversation today, I wanted to talk about Silicon Photonics platform solutions, can you give us an overview?

### **R Radha Nagarajan 00:59**

So, the silicon photonics platform has a number of components in it, versus the highly integrated Silicon Photonics chip. It has the modulators, high speed photo detectors, and a variety of optical components to manipulate light and cool optimized with that optical component, our drivers for the modulator and transimpedance amplifiers for the receiver. And as part of the platform, we have a digital signal processor chip, and ASIC and a controller ASIC, which often also includes a micro controller for the whole platform. So, it's a combination of five chips, which forms the platform, and we design all of them at Marvell.

**C Christopher Banuelos 01:52**  
Why do you think these solutions are critical to the infrastructure business?

**R Radha Nagarajan 01:56**  
So, the infrastructure as defined, we can take as an example. As part of the investor day, we said it's cloud-optimized silicon, cloud and data centers. So, the infrastructure we refer to is the data center infrastructure. So, a typical data center as routers, the data comes into a router typically switches, and then the servers where the compute is done. So, the switches connect the servers, and then the data exits to the router, and then comes back to you. All these boxes need to be interconnected, I mean, I defined as a box, but data centers are large. And the interconnect distances run into hundreds of meters all the way up to a kilometer and connecting these boxes using low loss interconnects or optical devices. So that is the reason why these platforms are critical for the infrastructure. business that we are in these platforms get then incorporated into optical modules, they get incorporated into a variety of devices that enable all these components to be interconnected, efficiently in low power, and in large numbers.

**C Christopher Banuelos 03:24**  
So as an organization Marvell is focused on having product lines that are designed to increase optimization and use less power, what are some of the solutions that you and your team are working on?

**R Radha Nagarajan 03:36**  
That's a great question. Power consumption is a big theme concern constrained with our customers, so, the way to think about power consumption is as you refer to the infrastructure, the building depending on when it was built has power constraints. The cable that comes into the data center, the power electrical power is fixed in size and for the life of the building, and the power that comes in is fixed in quantity. So, as the data center compute grows, as you process more and more data, you are actually power limited at any one of these locations. So, as we go to higher and higher speeds, what our customers want is power consumed per unit data rate to actually go down. So, one of the things that we do and with our partners and Foundry partners is the reduction in power. As we scale the CMOS nodes, we have announced that we are 5nm going to 3nm that helps in the reduction of power in the DSP chips. We follow the same path for transimpedance amplifiers and drivers and the controllers, and we do device level optimization on the silicon photonics chip to achieve power reduction as well. So, that's a reason why it's a platform. There is no one solution that would actually take you down the path. It's the optimized platform that gets you to a lower power consumption. eventually.

**C Christopher Banuelos 05:28**  
So my last question today is, in addition to the power reduction approaches that you previously discussed, are there system architectures that Marvell's working on, that would allow improvement in performance at higher data rates?

**R Radha Nagarajan 05:42**  
All the time. So, we got to higher and higher data rates. The margin, let's call it the margin that you need. Over a fixed distance, communication distance goes down, the communication distances have not changed. Data center sizes have not changed. But as the data rate increases, it becomes increasingly difficult to cover the distance. To get past that you need a lot of architectural differences. First, right off the bat, you need faster and faster devices. And you to achieve that within the power constraints I've already described. Secondly, we work on a variety of signal processing techniques, signal impairment mitigation, that's exactly what a digital signal processing is. We have multiple groups that excel in devising new ways to mitigate signal impairments. We work on fault error correction. You make a mistake in the signal you transmit we have ability to correct it at the receiver. And then we work on packaging. That is actually a very important aspect right across Marvell optimized packaging actually reduces power and improves performance, or you get both. So, these are the pillars of both power production and performance improvement across our product lines.

- C Christopher Banelos 07:25**  
Radha, I wanted to say thank you for your participation on today's podcast is great getting to know you and also talking and learning about Silicon Photonics platform solutions.
- R Radha Nagarajan 07:35**  
Thank you very much, Chris. It's been a pleasure talking to you.
- C Christopher Banelos 07:40**  
Thank you for listening to the Marvel 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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