



- Daniel Newman: Mike Hogan of GlobalFoundries, welcome to the 2022 Six Five Summit. So happy to have you here.
- Mike Hogan: Thanks for having me. Looking forward to it.
- Daniel Newman: Yeah. It's such a big topic. Well, I mean, which one, right? IoT, automotive, semiconductors, all of them, right? All of these are really, really big topics, and for everyone out there, I'm going to take you on a little journey with Mike and we're going to talk about all these things and more. But yeah I'd say over the last couple years between the supply chain, the crazy demand for vehicles and all the intelligence that is going into cars, the automotive industry's got a lot of... has been in the news, maybe even more than ever. And of course, I think there's a genuine love affair between people and their vehicles. Is that what you see out there, Mike?
- Mike Hogan: Yeah, it's been interesting. Automotive wasn't always the sexiest place to be for semiconductor manufacturers. But with all the action you just mentioned, whether it's post-COVID supply crisis, sort of the amazing increase in content in all these vehicles, and as you mentioned, the enduring love affair that people have with their vehicles and what those vehicles sort of speak to about the driver, it's a great place to be. It's a great place to be and very exciting.
- Daniel Newman: It really is. I'm a passionate car enthusiast. Anyone that knows me well knows about this. You don't know me well, you'll have to get to know me before I would actually share a lot of this with you, but it's been a pretty amazing journey to watch the evolution of the automotive space the past few years, whether it's been electrification, autonomous driving, and next generation telematics and the navigation systems. So much, then of course, there's tons and tons of policy and government related issues now that are going to come on, as we do everything you just said, content, autonomy, safety. So much going on.
- This sort of frames my first thing I'd like to get your take on here, Mike. The car has sort of become what I would call the ultimate connected smart IoT device. They say the BOM of a vehicle, I think, by 2030's going to be more than 20% semiconductors and some are estimating higher than that. In your opinion, just talk a little bit about sort of the industry, the supply chain, and then of course how you at GlobalFoundries are thinking about the automotive industry.
- Mike Hogan: Yeah, it's a really good point. One of the reasons I really like automotive is I think it's ironically a small rolling IoT network in and of itself, which is also an element of a larger IoT, because it's connected to other things. It's connected to other vehicles, the infrastructure, so it's sort of a microcosm of the entire IoT experience. You have a very real analog interface to the real world, whether it's the radar or the braking, or the lighting, but it ultimately has to be connected up through a much more hierarchical computing infrastructure to deliver the kind of end user experience that people have become accustomed to when they think of things like their smartphone. So people use interesting metaphors, like "data center on wheels," "smartphone on wheels" but I think the most important thing is that the user experience is going to feel more like the one you have with your smartphone, where with it anticipates what you need.



It does a plethora more useful things than just get you from point A to point B. People forget this was just a phone, right? Now it's so much more and I think auto goes down the same glide path, but it's not going to be with the electronics in the semiconductors that were in the cars for '70s, '80s, '90s, and the aughts. I mean, this is a completely new deal, and we're seeing the signs of strain, we're seeing the signs of all that content leaning on a set of semiconductor investments that most people would've thought had seen their peak. But I'm here to tell you that 90% of automotive semiconductor content is good old 12, 14, 40, 90, the larger geometries, because it's a real-world application. You need real world analog power, compute, it's a really interesting time in automotive.

Daniel Newman:

Yeah, it's a pretty evolutionary space, Mike, because you certainly have sort of these next generation chips that are being developed, platform chips for automotive. We have some of these people here at Six Five Summits. We're talking about kind of the whole plethora, but I know I did dozens of appearances on different TV during the early days of the supply chain and people asking questions about it. Automotive was by far the most visible kink in the supply chain, if you want to call it a kink, right? Remember the photos of parking lots full of pickup trucks that all could not be completed, and this wasn't a leading edge problem. This was a lack of 28 nanometer plus type of technologies that could not be fulfilled. It was a single something maybe to power radio, or like you were talking about lighting, or just something very small that could be the difference between a final finished product getting to market and the thing sitting there in a parking lot.

By the way, it brought a lot of attention to this, but at the same time, I think your point is really important and is that we will certainly be evolving to some of these leading edge, and that will be part of that future story. But these vehicles, all the sensors, and I've looked at some of the diagrams and it's like hundreds, hundreds of chips per vehicle. You guys are obviously very focused at GlobalFoundries on this, and GlobalFoundries, because you're not necessarily doing the ADAS or the LIDAR doesn't always necessarily rise to the front, but you guys are what, 90% of the automotive semiconductor demand is being met by the kind of chips that you are making. Talk a little more about that. Talk about the features that you're supporting and enabling, and that you're continuing to invest at GlobalFoundries to make possible in the automotive industry.

Mike Hogan:

Yeah, so I'll just start where you left off. Think about autonomous driving. Sometimes that conjures up the image of, "Well, I need to have this massive brain that's going to implement layer four autonomy and it's going to drive itself. That's all well and good, and people can have different predictions about when that becomes reality. But the one thing that's real today is that the car is implementing, installing infrastructure so that it can see in every direction further, with more granularity, more accuracy, with better ability to sort of recognize what objects are. As much as you need some more compute capability to do some of that, let's not forget the quality of the imaging or the quality of the radar that comes in at the front end can never be recovered if it's not done well.

The precision, it's another wireless application, right? A millimeter wave radar shares a lot of attributes with what you have in your 5G millimeter wave handset, and the quality of that wireless application, the fidelity of the transmitted signal, the ability to receive an absolutely



perfect image of what you're going to hand to the processor, is the defining, limiting factor to how well whatever level of autonomy you have will ever work. You can never recover it if it isn't done in a quality way out at the sensor. That interface between the real world and the digital world in a car is a really important one. You had mentioned things like safety. In what world do you want a car that has, okay radar and imaging, if you're going to think about autonomy?

In what world would you accept that just good enough is fine, because it's the safety of your loved ones, and I think it's in some ways, when are people happy if their wireless connection is just good enough? There's nobody that says, "Well, this kind of works pretty well today. I'm pretty happy." That's going to be the same thing with your automotive radar. That's just one example, but the plethora of micro controllers and processors that go into the car, they have to be upgradeable, which means they have to have flash memory. They go in very harsh environments so you need to really invest in beginning to get to these different auto grades.

These aren't things that you just accidentally do. These are things that have to be elemental to your strategy, and at GlobalFoundries, we've really made automotive a priority. So a tremendous amount of our development goes into how do we create the feature sets that work in an automotive world where, like you said, the content and the capability is really exploding. So we think it's a fantastic opportunity, and it's a real opportunity for the automotive supply chain to sort of reengage with fundamental semiconductor technology. I mean, for many years, most of this electronics was outsourced, right? Didn't really have much of a concern as to where it came from. I think the silver lining of the supply chain problems is a realization that not only is the security of that supply really important to me, but it's actually going to define how my product works. It's how my user experience works.

We think there's been a really interesting renaissance in Tier 1s, OEMs, Tier 2s, just saying, "Well, we can't keep doing it the way we were. We've got to really look at this as a holistic problem and a holistic technology set of choices." So really, really, really fascinating pivot for an industry that for 50 years wasn't too concerned about what you chose to put in the car, to move your seat back and forth, until you couldn't get it.

Daniel Newman:

Yeah. You had a lot of good points here, Mike, and one of the points that I wanted to reiterate is the difference between good enough and good. You pointed that out. I think one of the really great benefits right now to the semiconductor companies working more closely, directly with the automotives is just being able to present the innovation. Like you said, not having kind of those intermediaries. There's nothing wrong with those tier ones in the middle. But right now, having the world's leaders, the companies that you're manufacturing and fabbing chips for, in these companies kind of showing what's possible, whether it's black box or modular design, what does the ultimate outcome of safety look like? What if you can add LIDAR to radar plus vision and put all these things together to really offer that next generation of safety? Because there is a little bit of good enough that sort of seems to, if it passes this test or this crash test.

I think what semiconductors can add to ADAS. We've all heard about, it's not perfect yet. Like the L2+, when we go to full autonomy, we're still seeing some issues. Too many people using autopilot, like it's truly, we've reached true L4, L5 type of.. We're not there yet, but the point is is



with these partnerships it's achievable. I think that is where we want to get to. We don't want to get to good enough. We want to get to as close to perfect as we can get. So it's going to be companies like yours that are going to help drive that.

Mike Hogan:

Yeah, and then this is what we love about the opportunity. You talk about wireless performance, radar performance, LIDAR performance, is sort of an open-ended set of metrics, right? Better is always better, because not only do you want it to be better, but you want to be able to put more channels together to make the resolution higher and higher. That sort of runs straight across the other sort of very open-ended set of capabilities, which is power. Power now becomes as important in a car, because the car is now run by a battery, as it is in the smartphone. I think people underestimate how much silicon and software is really dedicated in a battery-powered device to conserving every single electron, because we have a finite source. So it's not as simple as, "Hey, I get a battery that's big enough to move my car 350 miles on a charge."

It's "I want to do that. I want a smaller battery. I want a lighter car. I want more features, more LEDs, more screens, more connectivity." So it's an open-ended journey to see how efficient you can be with the power. When we focus on automotive, we focus on all the ways that you can manage power. It's the conversion, the conservation, the creation of the right amount of power for the right use case at the right time, that will make the automotive experience of the future feel just like it is with your smartphone. Remember when phones used to come with plug in batteries, right? That was just a step on the way, and I think we're going to find that once you solve the electric vehicle problem of basic range, then range is going to compete with every single other feature in the car.

You combine all these together and all of a sudden the cool place to be, the hot place to be, for electronics design, for semiconductor technology innovation is really automotive, just as they're becoming a much bigger part of the equation. It's really changing the way that supply chain thinks about the problem we have to go solve.

Daniel Newman:

So, Mike, I like how you sort of put that all together there. You mentioned a few things. I do remember there was a time when navigation systems were a differentiator in the sense of like there was a significant difference between some of the early electronics and then you get to that next generation and you added things like touch and then you had different companies with the eye drives and the different touch. What I'm saying is, you have seen that kind of come to a bit of parody. I mean, of course there's nuance now, but when you get to that certain level of vehicle, all of them have what I would say, a very good experience.

It's gotten less competitive because it's become more widely available where it's good at all levels. So you mention of that with range, once all the electric vehicles can do 400 miles of range, then it starts to become differentiated on something else. I'd love to kind of end and just take a minute. You guys are really the ultimate collaborators, as a global foundry. You work closely with many companies, the automotives, the chip makers altogether. This is going to foster innovation, is going to drive speed of development. What do you see here? How much more can this co-creation, co-investment really expedite and drive what I would say is the next generation of automotive innovation?



Mike Hogan:

Yeah, so I think automotive is a microcosm of the overall semiconductor landscape. Most numbers folks will tell you that we clipped a half a billion dollars last year in semiconductor sales, and that's going to be somewhere around a trillion by the end of the decade. To do that, you've got to invest enormous amount of money to create that capacity. As we've seen, that's pretty important, but putting that amount of capacity in play and remembering that for automotive specifically 90% of that is going to be on what people consider to be nodes whose volumes might have peaked, you need a different model. You need a different way of creating capacity that is suitable to solve the problem that will be at hand.

I think we've seen some real creative approaches from our traditional customers, from Tier 1s, even from OEMs saying, "How do I make this a strategic part of my business?" In the end you sort of have to peer down all the way through those layers and say, "At the end of the day, there's only five or six foundries of scale. There's some that are dedicating massive amounts of capital to chasing what's left in Moore's Law. But there's very few that are going to invest and do the kind of innovation that most of the automotive applications require, and I think that's where we firmly sit. Of course, but it is auto so whatever you're seeing today, that was all done in a completely different world, a world that no longer exists.

It'll take a few years from now to see how sort of out of the ashes of this supply crisis, the phoenix of innovation and a different kind of thinking emerge, and I think you'll find the automotive community being thought leaders. I think they've always thought of themselves as second tier relative to the Apples or the Samsungs of the world in how you leverage semiconductor technology, but they'll catch up, they'll catch up fast and they'll do it in a more unique way, because these are real long-term engagements and they can't just count on, "Well, somehow, somewhere, whatever I need, I'll scramble and it'll all be okay." They're very thoughtful and long-term thinkers, and that's a perfect match for our foundry model, because we have to invest a lot of money and we need to make sure that that demand is durable.

It turns out that there's a kindred spirit between the way an automaker thinks who has factories and builds things for a very long time and the way a foundry has to think who builds factories and builds things for a very long time. Actually, we hadn't quite found each other, hadn't had quite the motivation or the inspiration, but that's all been provided, so I think it's a very bright future for us and really exciting for the consumer. I think the user experiences are going to be mind-blowing when you think of how much cool stuff you can put in the form factor of an automobile, right? I mean, if you think it's cool that you stuck it in a little rectangle, give some more space to people to stretch out and really have a completely different entertainment experience, and it'll still get you where you want to go too, point A to point B, but oh, so much more. So I think that's what everybody could sort of think about for the next few years.

Daniel Newman:

There's that data center on wheels with all kinds of experiential computing at your service. I've been in some of these future cars, Mike, the ones where the windows are augmented reality, and you're able to look outside and see markings on buildings and the car in the omni-metaverse, whatever we're calling it today. But you make some great points. The collaboration is important. The next generation of technology will certainly see tech and



automotive meeting each other at a new summit. It's very exciting. I really appreciate you taking some time here with me at the Six Five Summit, Mike, so thanks so much for joining me here.

Mike Hogan:

My pleasure. Thanks for having me.