



- Patrick Moorhead: Hi, this is Pat Moorhead. Welcome back to The Six Five Summit, day one, here with a friend of mine, GB from Analog Devices, talking to Connected Intelligent Edge. GB, how are you?
- Gregory Bryant: Pat, I'm doing great, and really, really fantastic to be here with you at The Summit and in the new role and t4swalking to you again, again, for the first time, so always a pleasure.
- Patrick Moorhead: I know. Listen, it was great to watch what you were doing in your previous career. It's really awesome to see what you're doing at Analog Devices. Looks like you're having fun. I'm seeing you in intern shots, welcoming the crew, flying around the world again to talk to different employees, really exciting to see.
- Gregory Bryant: Thank you. Thank you. I'm learning a ton. Any time you make a move like that, as you know, Pat, in your career, it's just you hit the accelerator on the learning curve, and it's just been a wonderful time and I've really enjoyed it so far.
- Patrick Moorhead: Well, it's hard to believe it's only been a little over a year as president of the GBU. Can you tell me a little bit about the role and what brought you to the company?
- Gregory Bryant: Yeah, sure. So at Analog Devices, I run the Global Business Unit, so basically Vincent Roche, our chairman and CEO has consolidated all the businesses into a single organization under me, which has been great. So I've got responsibility, for example, for all the R and D of the company. But if you just take a step back, I think you and I, we've been around for a while now. We've worked together for a while. I've been in the industry for more than 30 years. And the thing that I've always had a passion for, and you and I have done this together, is really just the application of tech, it's not just technology for technology's sake, it's the application of technology to solve complex problems and to have an impact on people and on the world. And then I always add, at scale. And I think that was really what drew me to Analog Devices.
- I met Vince through a mutual acquaintance of ours. And I had heard of Analog Devices, as I think many people that would be listening had heard of Analog Devices, but I didn't really know the company well, obviously great reputation for engineering, been around for almost 60 years. But when I got to know Vince, and I really understood the history of the company and how Analog had kind of put together four franchises, so Analog Devices, Hittite, Linear Tech, Maxim, into this kind of powerhouse of Analog, Mixed Signal, RF Power Technology, and then furthermore, was kind of transforming and focusing on solving bigger problems and moving up the stack and focusing on solutions. I mean, for me, that was really exciting. And just like any prospective employee, I went out to the website. I was looking at the signals plus page on the website looking at these solutions and in healthcare and automotive and industrial, consumer, and it just blew me away. I mean, there's a ton of innovation happening in the company. I think it's one of the best kept secrets in the industry.
- I used to tease my kids, Pat. I'd be like, "I defy you to find a technology or a product that doesn't have some ADI component in you, I defy it. I defy you to do that, even though you've never heard of it." And I think for me, it was this kind of combination of the vision for the future, the purpose of the company, and then the people, and Vince, and the leadership team that I met that led me to come over to Analog Devices.



Patrick Moorhead: Yeah. I love that. Hopefully your kids weren't unboxing your car, or your TV, or behind the scenes. GB, you're one of the few senior executives in the industry that has seen the world from a lot of different areas, and whether it's the smallest endpoint at the edge, or the largest hyper-scaler data center, and everything in between. And you've really had a front row seat in the way in compute and data workloads have changed over the past decade, decades. And so I'm curious. What do you think is unique about where we are today? And where do you think compute is going in the future versus, let's say this client mobile and cloud era?

Gregory Bryant: Yeah. Thank you. That's a great question. And you're right, I think my generation obviously grew up and we got to go through a few now major eras of computing back when it was mainframe when I was a kid and in school through kind of PC, internet, and cloud mobile. And through that time, as you know, semiconductor industry grew to be \$500 billion industry over the last 50 years. And Moore's law was a heartbeat of the industry, if you will, or kind of a beacon of the industry over that period of time. And innovation really drove successive waves of growth in the industry. I'm really excited because I think as we go forward in the next decade, we think semiconductor industry's going to double now just inside the next 10 years to a trillion dollars or somewhere around a trillion dollars. And that growth is not just being driven as you kind of alluded to by centralized computing, highly optimized workloads running on specialized platform.

But it's being driven by the innovation and the demand for more intelligence at the edge of the network and closer to where data is being created and closer to the physical world. And I think that is being underpinned by what I like to say is several secular growth drivers across a lot of industries as everything moves to be more digital and connected. And I always love to use examples, Pat. I came over to the company, and one of my favorite examples in automotive and electric vehicles is battery management systems. Battery management system, how is that intelligent edge or an intelligent computing device? But actually, this company, Analog, we were the first to put out a wireless battery management system, and it has intelligence to deeply understand through sensing and algorithms, the state of charge and the state of health of the battery. And if you understand that deeply and you put the right intelligent solution around it, you can actually extend the range of a car by up to 20%.

And furthermore, by making these solutions intelligent and wireless, you can make it more modular. You can make it easier for in this case, automobile OEMs to manufacture their products. You can improve their time to market, et cetera, et cetera. So across all these industries, I think we are starting to clearly see cases where having more intelligence at the edge near that sensor is delivering some real benefit.

Patrick Moorhead: Yeah. I mean, I started my career right in the middle of when mainframes were ... I mean, they still are going, but right in the middle, I started my career in 1990, and so I saw a lot of mainframes. But kind of watching us go, and it's funny, technology is never or, it's typically and. Right?

Gregory Bryant: That's right.

Patrick Moorhead: I guess mini computers went away. But to mainframes, to minis, to client server, smartphone, tablets, moving the intelligent edge, moving the intelligence to the edge, it makes sense



historically because compute and information processing has always found its way closest to where that data was being created. And part of that is efficiency, otherwise, we would all still be using 3270 tubes plugged into an IBM mainframe, and including cars. That's just not the case because it's not the most efficient to move forward. But we do throw this intelligent ... I mean, the name of this track is The Connected Intelligent Edge. I'm throwing around the world intelligent edge. How do you define intelligent edge when you say that? Just so we're on the same page here.

Gregory Bryant:

That's great. And it's funny, I get that question a lot. And I think people have their versions of the definition. For us, and for me, intelligent edge is really the intersection of the physical and the digital world. A lot of folks when they say intelligent edge, they mean the edge of the cloud or they mean edge of the network. They might mean some [inaudible 00:08:59] way that's going into a factory. For me and for Analog and our customers we're focusing on, what I would say is the edge of the edge. Right? It's that physical, the digital boundary, which is kind of the unique role that we play in the industry. And when I'm talking to the customers, and I've been out now with hundreds of customers so far over the last little more than a year. And they are increasingly working to create applications and systems, and those systems need to be more autonomous. And you know this, Pat. It's all about kind of decision making in real time, acting in real time.

And that need is critical, and the challenge as you know is it's a constrained environment. The intelligent edge is constrained. Why not do everything at the edge? It's constrained. It's constrained by power and energy. It's constrained by latency. It's constrained by space. It's constrained by cost. It's constrained by weight. It's constrained in the need for performance. So that's what makes it to me, challenging. It's what makes it exciting. It's what makes the intelligent edge fun and challenging is that trying to create that intelligence, that ability to act in real time while addressing all of these constraints, kind of a system or an application level which is what our partners and customers are looking for. And it's why we focus so much on kind of co-creating with our customers.

And yeah, I think one of the examples that I had that's interesting in industrial, everyone knows factories are becoming more digital. They're automating. There's a labor shortage broadly in the world. There's re-shoring that's happening. So now one of the things, I'll give you an example that we focused at, at the edge, was kind of this platform for motor or motion control inside of a factory. And if you step back, we know that 70% of the world's energy is used in industry and buildings. We know that 40% to 50% of electricity is used in kind of e-motors and motors more broadly. And by building a platform, an intelligent edge platform again in a constrained environment, we know if we can more precisely measure control, drive the efficiency of these motors, we can have a massive impact on energy consumption. We can target 20%, even more, of energy consumption, and we've got a platform to do that called Trinamic Motion Control.

But it's all about using that intelligence at the edge to reduce energy consumption. Another example, just totally on the opposite end of the intelligent edge spectrum is in healthcare, we've got a digital healthcare business. And we could probably talk for an hour on how consumer and healthcare are kind of coming together, kind of this fitness and health are kind of merging in some areas. But we worked with a startup called Truvian over in Europe. They're taking what was kind of a smart watch that had functions like steps and heart rate and oxygen level, and they're using it now with some complex algorithms that we've developed with them to actually



give very accurate and detailed health information, not just to the consumer, but to the healthcare provider. So I mean, these are just total opposite ends of the spectrum.

Patrick Moorhead: There's so many.

Gregory Bryant: Both great example of the intelligent edge, yeah.

Patrick Moorhead: So I research a lot of companies who talk about addressing the intelligent edge. I think your description of it is unique in that way that you're looking at it. When I peel back some of the verticals in the use case, there is some similarity. What is it that sets ADI apart from the competition here?

Gregory Bryant: Thank you for that. I think maybe a couple ways to come at that question. One is I think we talk about intelligent edge and the approach, I think our focus is on intelligence. I actually think intelligence is the operative word. Right? And it used to be in the old days of Analog, it was like, "Well, can you recover a signal?" That was intelligence. Can you recover the signal? Then it became, "Well, can you do the conversion? Can you turn that signal into data?" And that was intelligence and that was the value. Now fast-forward to today, now it's, "Okay. Well, can you take the data and give me understanding and insight and drive action and create value?" And increasingly, as you know, that's through applying AI assisted acceleration and algorithms and techniques, as well as secure connectivity, et cetera, et cetera.

So the notion of I think intelligence, the definition of intelligence what we mean has shifted dramatically in the industry and for us. And I think one of the things that makes us most unique, I mean, one, it's as I said before, we are at the intersection of the physical and the digital world, which I believe drives you to have to understand the physical domain better than anyone. That physical domain, that sensing, that understanding, that depth is critical. But the second is, we start with the customer application, Pat, and we work kind of edge in. I think a lot of companies that I've worked with in the industry and a lot of my prior life, it was kind of working core out.

Patrick Moorhead: Yes.

Gregory Bryant: Right? It was data center out, big compute out. But I think if you start with where your customer is, which is at the application, and at the application and you work your way in, it's pretty unique. That approach is pretty unique and I think you uncover a lot of insights. And again, what kind of would jump to my mind when I always think about that is I was just over in Asia meeting with our customers. You obviously know we have a huge position in 5G base stations. And a great example of that is, okay, well, if you work with your customers like O-RAN customers, 5G base stations, you kind of go edge in. We've developed an entire base station reference platform. I mean, we're talking radio units, software stack, ASIC, software defined transceivers, signal processing algorithms, power solution, all that stuff at the edge to optimize for performance and power and kind of created a breakthrough architecture that they can build on. I was talking to Samsung, NEC, others who are adopting it, and then you work backwards and say, "Now how can I deliver the entire solution kind of edge to cloud?" But just it's a great example of how we're coming at the problem differently I think than some of our competitors.



Patrick Moorhead: Yeah. It's definitely different. And as I kind of look at the edge and how it has evolved, I mean, there used to be islands that were not connected and really didn't share data anywhere. And then we got into to this hey, M to M state, which everything was bespoke, there were no standards, and we still weren't getting the data out of the edge that we wanted to, to activate on. And one of the things that really inspires me about this new era of intelligent edge is that we have standards. There's interconnectivity, and more than not, businesses are really getting around this idea that it's data and information if they want to do anything with automation, increase efficiency, supply their customers better, or even have different models. Do something as a service.

I ran into a company that used to just sell oxygen bottles to manufacturers. And now they're selling oxygen as a service because they've put connectivity in these incredible meters on the edge, completely it fundamentally changed their business model, which made their customers happier and them more profits, which is all good. So we have over 125,000 customers out there. And I'm assuming like most companies with that many customers, some of it are held directly, but a lot of it's through the channel. Sometimes to describe the edge because there's so many verticals and so many customers is hard to do. I think you've done a good job highlighting a lot of these use cases. But is there any parallelization or actually merging applications, again, across this broad base of customers out there and solving their problems, like highest ROI type of challenges?

Gregory Bryant: No, that's a great question. That's a great question. You're right. And I think if you think about where we started, Pat, at the very beginning with the different eras of computing, I mean one of the things that's kind of transcended certainly the last two eras and as we move forward is building platforms. And I think sometimes when you think about various industries, and you're right, today I think in the industrial segment and broader industry, energy, very fragmented space today still. And our customers are struggling with a lot of complexity, as you say.

And I think the key for us as we go forward are to create platforms. And I think we saw platforms emerged in PC internet era, we certainly saw platforms emerge in cloud mobile. And I think even in places if you think about autonomous vehicles, electrification now in the automotive industry, you're starting to see some horizontal and vertical platforms, Pat, emerge. Right? So I actually believe that we can apply that conceptually and take various architectures into industrial for example and really help customers innovate and take out some of the complexity. And I think that helps us create value. And as I said, whether you're addressing a latency problem for autonomous driving, or a power problem in a wearable, or data problem in a smart factory, God knows we haven't even talked about, and something we're really focused on inside the company is the security platform because as you connect things, the attack surface goes up.

So doing that in a scalable way by building platforms is important. And as I came to the company, one of the things that Vince and I talked about was, hey, we've got to build a software defined version of ourselves. Now think about that as what used to be an analog component company now building analog digital software security, AI accelerated solutions, which is what we're doing. Right? And then saying, "Okay, now I've got to actually up my game. I've got to create various levels of abstraction so that customers can focus on building their applications and their systems and not worry about all this stuff that's going on underneath the covers down below." Otherwise, that complexity's crushing.



I answered the question a little bit different way, Pat, but I think to me, that is the key. That's an incredible way to unleash innovation and value in what today is still a fairly fragmented and complex application space.

Patrick Moorhead: I think it's a good answer. If nothing else, what I notice across my research of the semiconductor companies that are doing the best, they don't just show up with a bag of parts like we used to 20, 30 years ago. They're showing up with a solution. And what that does is A, it improves time to market for that end customer. Point B, it's likely going to operate a lot better because what you're doing is that one customer's leveraging all the work that has been done to enable this. And quite frankly, five, six, seven, 10 years down the road, will it still be supported? Likely, right? So there's a lot of merit in showing up.

Now on your side, I know I make it sound easy, but these are some big investments that you've had to do because it's a lot less expensive to show up with a bag of parts and say, "Hey, customer, put this together. We've got a field engineer, an application engineer who might be able to help at some point," but showing up there with something that's pre tested, it just makes sense, particularly too if, again, in my chronicle of going from not connected, N to M, to intelligent edge, one of the biggest things holding up, and I'll call this Web 4.0, Industrial IOT, is its complexity. So whatever you're doing to make it simpler for your customers has to be a good thing, and companies get rewarded for delivering what their customers want.

Gregory Bryant: That's right. That's absolutely right. I think when you kind of take a step back, this company was a component company for a long time and had some of the best performing, had leadership portfolio products. I think the bold move that Vince made with the team and one of the reasons I joined the company and I'm so in love with the place is that we said, "Hey, we pivoted years back to be more market focused," and said, "Two truths for us or the two real anchor points for our business is just being close to the customer, customer intimacy, understanding the domain." And I actually think we probably could talk about application of artificial intelligence, machine learning. How's that going to change things? I think one impact, you have to understand the domain more deeply.

I actually think domain knowledge becomes important because the strength of the company, and then two is, okay, then you've got to go drive real innovation and build these platforms and reduce complexity. And I think the decision we made was to take that complexity internally away from the customer, thereby creating value. And then as you said, to build these solutions. I mean, I think the other thing, just kind of a little bit tangential to it, but that I think is really important that we've heard is just the other thing is just as we've gone through the pandemic, the supply chain crisis, one thing is the world has become more acutely aware that semiconductors are critical and that they're the lifeblood of kind of the modern economy. And we say that, and we've been in the industry.

Patrick Moorhead: Yes. I didn't need convincing. You didn't need convincing. But not being able to get the car that you wanted because of a 10 cent module or chip pretty much woke the entire world up, PCs, tablets, smartphones.

Gregory Bryant: That's right. And I think as you know-



Patrick Moorhead: Semiconductors are important.

Gregory Bryant: I'm going to say it out loud. I know it, you know it. But I think I'm remiss if I don't say it. Some of those, a lot of that constraint was not on leading process nodes and the highest performing semiconductor. A lot of these things were on mature nodes, which are a lot of the chips, as you well know, that go into cars and factories and various consumer electronics devices and things that people rely on and take for granted as a core part of their life. So the good news is I think the world has become aware of just how important those things are. And for us, not only are we investing in more capacity, I think we fared as well as anyone through the supply chain. And I can just say, huge, huge appreciation in the way that the company worked with customers to work through their toughest challenges.

But now people are thinking about it more strategically and they're thinking about supply chain more strategically. And they're talking to us more strategically. And the fact that we've invested in kind of this hybrid ... We have a resilient hybrid manufacturing strategy, which is a little bit unique. I mean, we want to take advantage of the outside and the inside and the best of both worlds. We want to have not just capacity, but the ability to move products between external factories and internal factories for resiliency's sake is pretty unique in the fact that we can do a lot of that. And then two, obviously we're investing in capacity for the future independent of what the near term little bit of ups and downs may hold. We're focused on that trillion dollar market in semiconductors mid to long-term.

And as I said, Pat, it's not just the leading edge notes that tend to get a lot of the publicity and the notoriety in the press. But we're investing in these kind of critical notes that are required for these products. So both of those things are valuable, yeah.

Patrick Moorhead: It's funny, I'm going to swing all the way from when we couldn't get chips to the current macroeconomic environment that listen, we're in a downturn. Right? You and I have been doing this forever and we've seen ups and downs. That's just the nature of the game and that's just the nature of economies. A lot of this stuff is driven on GDP and interest rates. How are you helping customers kind of weather the storm here in this new kind of need, time of need that they hadn't seen since probably 2008?

Gregory Bryant: One, as we just were ... That's a great question. One is obviously we want to be their most trusted semiconductor partner, supply chain partner. And part of that is this, I think is really unique, this resilient manufacturing strategy and capability is critical. And then obviously, staying ahead of demand and getting out in front of their needs is absolutely critical, so that means partnering with them closely getting way upstream because as you know, the development cycles for these products, it starts early. We've got to be years upstream with customers and partners as they design our products into their greater solutions and applications, and being on our front foot in front of that and close to them is absolutely critical. And I would say as well, I think to the degree that we can ... Maybe to take a step back, I think one of the things, Pat, that's probably less appreciated as I go talk to folks who are kind of outside the small circle of people in the industry is, look, the demand for semiconductors, I think people tend to think normal people, consumers, think in terms of units like ... As you said, well, in the past, the semiconductor industry, it's kind of tied to GDP, or my industrial business should be correlated to GDP. That correlation is loosening. Right? Why? Because the amount of



semiconductor content going into those systems is a multiplicative effect on the base unit growth.

So if you look at an electric car, a premium electric vehicle versus a regular combustion engine vehicle, six times the amount of semiconductors in that car. Right? There are industrial systems where in the past might've had tens of dollars or a hundred dollars of semiconductor content in them, now have north of \$1000 of semiconductor content in it. So I think one of the things that collectively we need to kind of get our heads around and plan for is this incredible increase in the amount of content in these devices has to become more intelligent and make sure obviously that we've got the right support for that demand, and as I said, we don't get distracted by any near term challenges or fluctuations.

Patrick Moorhead: I love that long-term point of view. And I know that not everybody is taking it. And yeah, it is easy to forget the amount of what we call in the industry, content, inside of comparing a 3G, 4G, 5G, base station together and looking at the difference between an EV and a gasoline powered car, it's absolutely incredible to see the growth. There's other pockets of growth. So I'm glad you pointed that out. And GB, thanks for spending time here and catching up. It had been a while since we had chatted, kind of giving the audience and myself kind of your point of view on what attracted you to Analog Devices, some of your approaches on problem solving and productizing, and bringing not just a bag of parts to the table, but more of a solution. And like your definition of intelligent edge, it's unique and it's correct. As an analyst, I'm always trying to shoot multiple holes in everything.

Gregory Bryant: I'm going to write this down, Pat.

Patrick Moorhead: And give feedback. No, no. I know. But when I look at ... Because one side of our business is we are talking to enterprises that are trying to revamp their supply chain. They're trying to make warehousing more intelligent. Car companies that have been around for 100 years, trying to make this shift into that, I really think you're speaking music to their ears. So in way, you're talking to your customers. So GB, this has been great and wide-ranging conversation. I would love, though, I'm going to pin you down, you only get two answers here.

Gregory Bryant: Okay. Oh, no.

Patrick Moorhead: What are the two most things that you're excited about in the future related to the company, technology, your customers? I'll leave it up to you.

Gregory Bryant: Wow, that's a little bit like: Which of your children do you like the best? That's hard. I'd say if I was going to pick two, one would be digital healthcare, which was very new to me coming into Analog Devices. And I think we talked a lot about the intelligent edge, and I think if you think about our bodies and our biology, we're actually kind of gaining the ears in order to understand what's happening in our bodies, the phenology, the mythology, the syntax, the semantics of the body's language. So if you think about the future and you think about the potential of having remote continuous clinical grade vital signs monitoring, for you at all times, I think the advancements that we're making in sensing and in computing, these things started as a little bit of a novelty, that steps into something that is now becoming a powerful ... It's a diagnostic



system that can alert you and prevent people from going to the hospital and having these critical events, Pat.

We're developing solutions for patient monitoring and congestive heart failure and COPD. And all of that kind of outside of traditional healthcare environment, all about enabling better outcomes for patients, while at the same time, I think delivering better care or reducing costs, et cetera. I think we're just on the edge, just on, no pun intended, just on the edge of the technical capability about bringing these solutions and the impact that it can have on us. I think it's going to be incredibly beneficial to people's lives and greater society, so that's one that I'm really excited about.

The second one is energy and sustainability. I'll be really open with you as always, when I talk inside the company, what I love to say is, "A lot of people talk about energy sustainability. There are few companies that can mean it in the way we can, not just in that we want to reduce our own footprint within our four walls, but the way that our technology can help companies get to net-zero I think is really special." We focused a lot on electrification, as I told you, in vehicles, but we're also working on the grid. And you would appreciate this, if you stepped back as a systems guy, or guys like we are, and you think about, hey, the grid's got to transform from something that was centralized and unidirectional, to something that is now decentralized and multidirectional, bidirectional. That's an incredible, incredible challenge and undertaking for us around the world.

And the fact that our solutions can help with the conversion, the management, and the storage of energy around that grid, I think is incredibly exciting area, an area I know we can have an outsized impact on the world at large. So if I had to pick two, those were the two that I'd pick.

Patrick Moorhead:

I appreciate that. And I got a little glimmer of that in some of the examples that you gave. But no, those are really important areas. GB, man, I wish I could just sit here and talk all day long with you, but time is coming. You just want to thank you for coming on the show and just giving us, giving the audience really an inside view. I mean, hadn't heard much from you. You had a big following in the world out there and hadn't heard much, well, in certain areas. I see you on social media and obviously all the big events that you have. But it's just great seeing you, but what I think I appreciated was so much better understanding about Analog Devices, the company. And I put my brain space and research space in certain areas. Check mark, I've got to spend more time researching Analog Devices in the future. And I think more people need to check out what you're doing. I mean, your approach going from bag of parts to solutions can only do great things on the edge.

And like I told you, part of my company's research, we're meeting with enterprises who are trying to fundamentally redefine how they do logistics, transportation, warehousing, healthcare, and they just can't do it without your technology. So it's super exciting to kind of close the loop. We hope we'll have you on the show again sometimes.

Gregory Bryant:

Pat, thank you so much for having me, and thanks for letting me introduce Analog Devices to people. I'm sure they've heard of it, but maybe to see us in a new way, and always love working with you. And by the way, happy to have you out to Boston or out to California to see us and to show you some of the goodies that we're working on, as always, so look forward to seeing you again.



- Patrick Moorhead: Man, thanks. I like goodies and I want to come out and check it out. And I get to pick between Boston and out in California.
- Gregory Bryant: That's right. I'll let you choose either one.
- Patrick Moorhead: I'm equidistant too, here in Texas. So I want to thank everybody for tuning in, talking the connected intelligent edge with GB of Analog Devices. Hopefully you'll tune in for more content about the edge. Also, we have day two and day three that you can tune in. And some people are watching all of the episodes back to back, and we love you and we love our fans. But for those of you who want to be maybe a little bit more selective or don't have time to watch all three days, you can pick whichever you want and watch it whenever you want. So anyways, we appreciate you. Good morning, good afternoon, good evening, wherever you are on the globe. Take care.