



- Patrick Moorhead: Akash, it's great to see you and thank you so much for doing the track opener for the Six Five Summit 2022.
- Akash Palkhiwala: Well, thank you and thank you for having me here. I'm looking forward to this discussion and really the rest of the summit. I'm looking forward to listening to all the speakers.
- Patrick Moorhead: That's great. Saw you on multiple stages over the last couple months, a lot of things going on at Qualcomm, and it's really our pleasure to come in and pick your brain a little bit on behalf of the viewers.
- Akash Palkhiwala: It's been a busy time for us. There's a lot of stuff happening in the industry and we are fortunate enough to be at the middle of several transformations. So, excited to talk about it with both of you.
- Daniel Newman: We'll try our best to not throw you off guard with any of the questions that we'll ask but there is a lot of ground to cover Akash.
- Akash Palkhiwala: No problem.
- Daniel Newman: So where I was thinking of starting is let's start a little, cast a little wider net. I know this is a connected, intelligent edge and we'll definitely get into that. But Qualcomm at the center of so much of connectivity, you guys are looking at technology across the spectrum, right? And one thing we know is despite any macro headwinds, innovation will and must continue to accelerate. What are some of the more important tech trends that you are seeing right now?
- Akash Palkhiwala: So overall, when you look at the industry, Dan, there's just a tremendous amount of stuff happening. And then they're all pretty transformative things in the industry, in the society, which I think is an advantage for us. I'll go through a few but these are just samples from I think the overall landscape that we're looking at. The first one is digital transformation of home, especially through COVID, we really started seeing the home becoming an equivalent of an enterprise. And so in terms of the broadband performance, that's expected at home, how you use your PC, how you use your phones, how you interact with the cloud, just a tremendous transformation there. And we think that's going to continue as we look forward and work becomes a hybrid of home and office environment.
- Within the home we're also seeing a lot of other devices getting connected to the cloud in terms of whether it's the security cameras in homes, whether it's your thermostat, the front of your door where you have the bell and having, being able to CC have a camera there, a lot of transformation happening in the home. We're at the center of it. We're happy to see that, we think that trend continues, there's a lot more devices in the home that are not yet connected and there'll be a tailwind for us going forward.
- The second trend that maybe I talked about is digital transformation of industries and enterprise. As cloud computing takes off a lot of devices, both on the enterprise side, on the



industry side, are looking to get connected to the cloud. And when you want to do that, what you need on the device side is you need connectivity, whether it's 5G or WiFi, you need AI at the edge and you need low power processing. And Qualcomm is in a great place to be the, be the company that serves those technology to all those devices. We think that's a five to 10 year trend and we are at the very front-end of that trend taking place. The other thing I'll highlight is this was something that was definitely accelerated by COVID. And now that it's been accelerated in, we think it's going to happen rather rapidly. And we are only constrained by how many and how quickly we can get to that end market, so that's the second one. The third trend maybe to highlight is the trend of metaverse and the physical and digital spaces merging together.

As we think of the metaverse and XR, as one of the next phases of computing, we obviously had the PC, then the personal computing went to smartphones. And now when you think about the experience that metaverse and XR devices can deliver, that's another tremendous opportunity to add more information, to add more data, to add more experiences, to things that an individual does. And so we continue to think of that as an opportunity and I'm sure we can go in a little more detail into that in terms of our role in it later in the conversation.

Maybe a fourth trend is convergence of PC and mobile. When we think about what is happening to the PC, it has suddenly gone from being just a productivity device to a communication device. Now, we are doing voice calls, we're doing video calls on it, a lot of entertainment happens in terms of gamings and other things on the PC as well. And as that merging of the experiences across the smartphones and PC happens, that creates an opportunity for Qualcomm to play a disruptive role. And then maybe the last one I'll talk about is automotive, clearly that industry is going through a tremendous amount of disruption. It's not just the electrification of cars, we see cars gradually becoming a super computer on wheels. And as that happens, it opens up an opportunity for us as well. We're very excited about the last one and we'd love to talk in a little more detail about it as well.

Patrick Moorhead: Akash, a lot of things you talk about can be wrapped up. I've heard you and Christiano put a bow around the term of the connected, intelligent edge. And in fact, this is the name of the track that you're kicking off here. And I'm curious and it's impossible to get everybody on the same definition. I think what's important though can you talk about your definition of what the connected intelligent edge is and maybe drill down on its level of importance?

Akash Palkhiwala: Absolutely. There's a very broad understanding of the opportunity for cloud computing, there's a lot of large companies focused on that market. And when you think about what cloud computing really is it's about taking a lot of other devices and connecting them to the cloud. There is an opportunity for someone and Qualcomm aspires to play this role. For someone to be on the other side of the cloud computing paradigm and connect all the devices to the cloud. And that's, I think how we define the connected intelligent edgetouch.

If you think about today, the most cloud connected device is the phone. While there is a clearly a device experience that people look at, the second most important part of the device is really connecting to the cloud and delivering various kind of services. Now, as other devices try to



mimic the phone and effectively become cloud connected devices, we think they're going to need a lot of AI at the edge. They're going to need processing, they're going to need connectivity and Qualcomm is in full position in our minds to deliver those experiences to those devices. I mean, as we look forward, we think a lot of AI is actually going to happen at the edge, not necessarily in the cloud. And this is something that will compliment what will happen in the cloud. And that's the opportunity for us to us that is the connected intelligent edge.

Patrick Moorhead: And so literally anything that's outside of the cloud is the connected intelligent edge?

Akash Palkhiwala: That's right and there you can think of it as something that's at the home. That's something that is at the enterprise, something that is at a manufacturing site but also things that go into consumer devices, going into machines, go into construction, manufacturing equipment, all kinds of industries are taking advantage of it. And the power of connecting all of them to the cloud is really three folds in our mind. The first is the where, where is the device? Second is the how, how is the device doing? And then third is being able to manipulate the device from the cloud and make it do things that you wanted to do. So there's a new paradigm that is added to the performance of these devices when you connect them to the cloud and that's the opportunity.

Daniel Newman: It's interesting Akash because you centralize around device and obviously there's a lot of provenance about the handheld devices within Qualcomm. But you're also diversifying quite a bit into things like industrial IOT, a significant play there into PC, which you mentioned pretty much anything with a sensor, right? Anything that can provide feedback and send data back to that cloud really creates this connected intelligent edge. So we're talking about buildings, we're talking about smart cities, we're talking about all the data collection that we're going to utilize to, like you said, implement AI to solve big problems in areas like supply chains or to create next generation retail experiences. You can kind of it gets really big and what I'm saying is that some cases, it is like full on computing, which it's now the supercomputer that we carry in our pocket. But it can be all the way down to sensors that are inside of a cornfield that are helping farmers understand how to maximize crop production. And so all of this creates a super intelligent edge.

Another thing that you guys have laid a lot of focus on has been the automobile, right? And I think I saw a data point, something like a hundred million versus vehicles rolling out versus like 15 million servers on an annual or something like that is the number. I don't quote me because I'm just remembering something I read. But my point is we spend a lot of time focusing on how big the opportunity is with servers well, every vehicle is kind of becoming a rolling data center at the edge. This has been a big thing for Qualcomm over two decades but the last few years has been huge. I mean, I can't even name all the announcements you guys have put out. Talk a little bit about how that is evolving, how is the future of automotive evolving and connecting to this intelligent edge story?

Akash Palkhiwala: Absolutely. We are very excited about what's going on in auto, we think of it in a couple parts. First is when you look at cars, they're going through two key transformations. The first one is electrification, the second one is effectively becoming cloud connected computing edge



devices. And that's the journey to autonomous driving, which starts with ATS level two level three and then eventually going to level four and five. And the technologies that we have in handsets just, it turns out they're extremely relevant to the transition of the auto industry. So when we think about auto and you can think of the Digital Chassis auto, if you put on top of that physical chassis auto, you put on top of that Digital Chassis. That's what we aspire to contribute to the transformation.

When we think about Digital Chassis, we think of three components that contribute to it. First is a set of chips that we bring to the car that allows the car to connect to the cloud, so that includes 5G without a front-end. It includes WiFi, Bluetooth and GPS. The second platform is digital cockpit, which is really taking the inside of a car and transforming the experience to make it more modern. It makes the infotainment center of the car more modern, the dashboard, backseat entertainment, rear view mirrors. There is just a tremendous amount of opportunity to collect data, to collect intelligence, to improve the experience for the driver in the car. The next platform is the ADAS platform and it's a combination of Snapdragon Vision and Snapdragon Drive. And both of these technologies are what's going to take us to ADAS, eventually to autonomous driving. And then we've done some very interesting things recently, first step we took besides bringing the chipset technologies from handsets into the automotive is we acquired this company called Veoneer and kept the asset that's called Arriver, which really is ADAS software.

And the advantage of this transaction is it not just gets us the software it also gets us auto safety expertise, that is so important when you're deploying ADAS solutions at scale. The second important transaction that we did is our partnership with BMW, where we are going to jointly develop ADAS solutions for cars and which Qualcomm will be able to bring to bear to all other OEMs as well. So those are extremely important steps that we've taken and you see it in our success, you see it in the success in the number of ADAS customers. We've now announced GM, Volkswagen, Ferrari BMW, of course, as I mentioned and there's more coming. We're excited about what we're doing in the industry, the support we're getting from the leading OEMs and what we can bring to the table.

Maybe I'll finish by highlighting one key differentiating element of what Qualcomm brings to the table in automotive. In addition to the fact that we bring the full Digital Chassis to bear, which has all these solutions that I outlined, we also have the ability to go from the lowest tier car to the highest tier car. So if you're a very large OEM like Volkswagen and you're looking to bring a consolidated solution across tiers for ADAS. Qualcomm can be a great partner for you, because we'll be able to offer price points that are attractive across the board and they'll help you realize the vision you're looking at. Yeah,

Patrick Moorhead:

It's interesting looking at Qualcomm's past and what you did in the trucking industry, I don't know where Qualcomm started and then moving into the dashboard and doing telematics in between then and there. And then I show up at CES, I don't know, three or four years ago. And somebody asked me, if I wanted a ride in a Qualcomm Snapdragon based self-driving car and I'm like, I didn't even know you were in this industry. So good job on stealthing that and getting the backlog to double digit billions.



Now Qualcomm still is in the consumer connected intelligent edge and I wanted to talk a little bit about that. All I have to do is look at my WiFi settings and I think I have 37 connected devices in my home at least and there's two ways to look at that. One is look at how far we've come, look at how many devices are in there. But then it's like, well, wait a second, if everybody already has devices, where's the growth, right? Can you talk at an industry level, a Qualcomm level? What are some of the bigger consumer opportunities in the consumer space?

Akash Palkhiwala:

Sure. So consumer variety is very interesting for us. I think of it as very simple, in some ways, because all these devices on the inside in terms of the technology they need are very similar to a phone. They have a different form factor outside, they do a different function outside but they use the same set of capabilities that you find in a phone. Let me maybe quickly highlight a couple; Snapchat as an example, announced the Pixy camera, it's like a drone that follows you around and takes pictures. That uses our chip, I mean, that's a very different innovative use case leverages the technology that we have. You have the iRobot Roomba product that cleans the floor in your house that also leverages the technology that we have. Thermostats, various other things in the home and we think we're at the front-end of that transformation still.

I mean, although you have, I think you said 37 devices, there's probably another a hundred devices in your home. That for some strange reason are not yet connected and there's no reason why they shouldn't be connected. They're all doing a function and they can benefit from being in the cloud, being manipulated from the cloud to do things that you want them to do. And the garage door openers is a great security alarm is a great one as well, these are things that all need to be connected. And so when we think of the transformation that you outlined, we are at the front-end of the number of devices. Then maybe the other thing I would say is Qualcomm also has the opportunity to disrupt markets in this area. The first one that I highlight is metaverse and as we've talked about it as that market expands, in terms of more consumer devices and more consumers using it, we are in a great position.

I mean, I think of the XR devices really as the ideal device for Qualcomm, because all the problems that need to be solved in terms of connectivity, power, performance, having a great camera, having a great display. All of these things are things that Qualcomm's extremely good at and so we are excited about bringing our technologies there. If you look at our design win pipeline, every large company that's looking at making commercial devices for XR, every single one of them is using our chip and so we're excited about that.

The second device maybe to highlight is the PC, as we talked about earlier, the function of a PC is changing. And this is not just at home, it's also in the enterprise. As you start going to the enterprise and we get to a paradigm where people don't have a fixed place to sit, you are carrying a thinner device with you. You're always connected to the cloud, a lot of the computing is now happening in the cloud, the workloads are being run in the cloud. That kind of a device looks more and more like a phone. It uses the same capabilities.

You need an incredibly good camera. We are doing all these video calls and we need external cameras. Well with Qualcomm tips, we can eliminate the need to use external cameras, we can use the internal cameras and devices because they're going to be so good. We can make those



cameras better with the AI capabilities we're going to bring to these devices. Audio, video, there's all kinds of things that we have in phones that we can bring to the PC and really use those things to redefine the experience that someone's going to have on the PC.

Daniel Newman:

There's a lot to unpack there and I think all of us are longing for a future where we need less peripherals, except maybe the people that make the peripherals. If the camera's built in and the microphones were as good as the externals. And I think there's a lot of promise for that Akash, so we're definitely eager to see. I'm also eager to have a wearable, that look kind of like the frames you have on right now but give me that augmented experience because I still can't do the 10 pound. My head's heavy enough, it's already huge anything more I'm going to tip over.

But the connected, intelligent edge, a lot of it is industrial. A lot of it, even metaverse applications are autonomous simulation, future, we talked about vehicles. We're going to run vehicles in these omni metaverse environments to be able to create experiences. We're going to build buildings and we're going to create renderings and have them function. We're going to meet sustainability goals. I mean, talk a little bit about in your mind, what are these in the industrial use cases that you guys are most excited about as it pertains to the connected intelligent edge?

Akash Palkhiwala:

Sure. So to make it more tangible, maybe we pick a couple examples and go through it, I think retail is a key one to look at. When you go to a retail store today, you'll often see associates walking around the store with a handheld device that is either used to read prices or get information to help the customers out. We are in those handheld devices. If you look at point-of-sale terminals, they're being transformed from very large experiences to very small and portable terminals. And then that's something that also uses our chip. There's a large retailer we are working with to get to a place where we can have electronic shelf labels, which allows them to change prices on the fly. And if you think about the retail experience today, the online experience has a chance to change prices on the fly but the retail experience does not.

And it's a simple demand-supply dynamic that could inform how pricing changes from time to time and it's something that technology can bring to bear on the retail experience. Security cameras in retail and then using those cameras to make decisions on stocking shelves as an example, that's another one. If you buy something online and the retailer has to deliver it to your house, making it very easy for the associate to pick up the items and deliver it. That's another thing technology can deliver, so there's just a tremendous amount of examples that we can work with retailers on to improve the experience, to improve their profitability, improve their inventory management. And these are transformative things for the industry, it's not just a small step function.

The other is manufacturing. You go into a very large manufacturing firm at this point, there's so many robots that are really driving the manufacturing and to think that several of them are not connected to be to the cloud and they're notable from the cloud is just crazy. And that's an opportunity for transformation as well.



Having a private 5G network in a manufacturing environment and then securely with very low latency; connecting all cameras, all robots, all machines to the 5G network and then eventually connecting it to the cloud. That would really transform the way manufacturing is done today. And so we are working with partners across the board. Bosch is a great partner we are working with on that, where we can bring that kind of capability into manufacturing environments.

And then maybe the third one I'll highlight is utilities. I mean, there are all these utility companies that have assets spread all over the world. And for them to be able to track the assets, measure the health of the assets through wireless and processing technologies, through AI at the edge. To collect data from sensors and then process it and bring the right amount of information back to the cloud so that you can impact change. Those are all great opportunities for that industry as well. So when I look back and when I think about what's in front of us, we are not constrained by the amount of applications, by the amount of devices we can impact. We're only constrained by how quickly we ramp in these areas.

Patrick Moorhead: Well, I can't believe we've talked this long and haven't necessarily talked about networks and infrastructure. And I think Daniel and I had both spent a lot of time talking about the state of 5G throughout the last about the last four years. And I'm curious, I want to get your take on how the network and the infrastructure is evolving to support the growth of all of these devices. Are we here? Are we here ahead of time? Are we behind? That seems to be the one of the big debates right now.

Akash Palkhiwala: The fact that we are connecting all these devices to the network really transforms what is needed on the network side, right? These devices have different criterias, they're not just like phones. Some of them very low latency, some of them require very high security. And then data rates, everyone's demanding data rates, especially as you collect more and more data from the sensors and you send those back to the cloud after having manipulated them through AI. There is a lot of data rate requirements that are also going to show up. So, this is our sweet spot, this is where Qualcomm started, we love the fact that the demand on the networks, it just continues to increase and we are working on it.

I mean, there's the first thing I to highlight is millimeter-wave, we really believe that in the long-term millimeter-wave is going to be an important technology because the growth in data far surpasses the growth in availability of spectrum. And so it's just a function of math that those two lines have to cross in every geography around the world and when they do millimeter-wave networks will be required. The infrastructure side; when you look at the infrastructure that is going to go through transformation as well. I mean, vRAN is an area that we've been investing in, we think it's a different wave of how infrastructure is going to get deployed. Tremendous amount of support from the operators from infrastructure vendors and so we are excited about what that'll bring to the industry as well.

Daniel Newman: Well, Akash, that wraps up a really interesting and thoughtful discussion, I mean the connected intelligent edge. One thing I definitely came to the conclusion here is a lot of people want to bucket it as a consumer or a commercial or an industrial and it is really everything, it's all encompassing. We have a more intelligent world, tons of data compute everywhere. And then



obviously we need to find ways to get all that compute all that data to be utilized, to essentially make business better, life better, communications better. And it sounds like you guys are doing a lot of things to make that happen so I want to thank you so much Akash for joining us, helping us kick off this track, breaking down this important topic. And hopefully continuing to contribute to driving its future, so Akash, hope to have you back soon.

Akash Palkhiwala: Thank you very much. Thanks to both of you.