

## REALTIME FILE

Verizon - 5G Podcast Transcript  
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>> Welcome back to Up To Speed, a Verizon podcast where we share stories about technology in the media. In today's episode, Katie Regner sat down to talk about 5G with Nicki Palmer, Verizon's chief network engineering officer and head of wireless networks, and Ed Chan, senior vice president and chief technology architect. From the engineering technology to their real-world application, Nicki and Ed explain just what a 5G network means today and how it will drive us into the future.

>> KATIE REGNER: Hey, everybody. Welcome to Up to Speed, a Verizon pod cast. I'm your host, Katie Regner and today I'm talking with Nicki Palmer and Ed Chan about 5G. Nicki and Ed, thank you for being here. How are you today?

>> NICKI PALMER: Doing well. Great to be here.

>> ED CHAN: Great. Thanks for having us.

>> KATIE REGNER: All right. Let's get started. So first, tell me a little bit about your backgrounds. Growing up, did either of you think you wanted to become engineers? What got you interested in the field?

>> ED CHAN: Well, growing up, I thought we were just going to go back to growing up in the business. Not growing up, growing up.

>> NICKI PALMER: Take us back.

>> ED CHAN: That's way back. I don't know if I did know anything growing up per se,

but I would say that when I was in college, it was the thing to do I would say as far as going into engineering. At the time it was interesting for me. I actually was more software than it was hardware. I had an electrical engineering background. But it wasn't coding. It was doing hardware stuff at the time.

>> NICKI PALMER: Way back when. And it's good now, right?

>> ED CHAN: Right.

>> NICKI PALMER: To have that background.

>> ED CHAN: Correct. Actually, I would say C programming is still in.

>> NICKI PALMER: Oh, yes. 4 Tran.

>> ED CHAN: You know. (Laughing)

>> NICKI PALMER: Let's go back.

>> ED CHAN: That's far back. The world changed quite a lot, I would say. Even back in those days, you engineer things to exactly the target you want. Now the world really is different. But anyhow, that's my background. Most of my time here was growing up in wireless. And then spend some time in wireless per se, but there was planning in wireline. And then now in planning on both wireless, wireline.

>> KATIE REGNER: And Nicki, how about you?

>> NICKI PALMER: Yeah, so my work background is a little opposite. I started in wireline for many years and worked on oh goodness DSL.

>> ED CHAN: Copper!

>> NICKI PALMER: Copper-based products. Our I.P. networks. It was really fun. Then into FIOS. And then moved to wireless about ten years ago and have kind of gone back and forth. In terms of background, different than Ed. In terms of the thing it was the thing to do. I feel like I just lucked out. I was always good in math and science. And I talk about my father who was an engineer and I just followed in his footsteps, plain and simple.

And I was lucky to have someone like him to say here is what an engineer does and you might want to try it. And a mother who said you know what, you can do whatever you want to do. And just work hard. And so that's how I got into the field. Just really followed in my father's footsteps. But it's been a great ride because to me an engineer is just taking what is, you know, what's new and exciting in technology and innovation and actually changing it into a real solution. And so it's about problem solving and it's extremely rewarding.

And that's why I love working with Ed. (Laughing)

>> ED CHAN: Because I present a lot of problems? (Laughing)

>> NICKI PALMER: Yes, you're the technology guy. We make it happen.

>> KATIE REGNER: Speaking of make it happen, that's a good segue into the topic of our conversation, 5G. More and more we're seeing the buzz about 5G on television and in the news. So tell us, you know, in the plainest and simplest terms you can what is 5G?

>> NICKI PALMER: I'll take a shot at that and Ed can certainly provide a bit more detail. But it's a bit of a loaded question. You would think when we hear 5G, you'd think that's just the next step. We had 2G, 3G, 4G, and now 5G. But to think that's just a next step in wireless technology really underestimates how absolutely transformative this technology will be. Because there's a lot more to 5G than just a smartphone going, you know, a little bit faster on the network. So this next-generation technology will be frankly one of the biggest leaps forward that I think we will see in the near term. We'll probably get a chance to talk a bit about the unique capabilities of 5G and what it promises. And of course Verizon's approach to 5G, which is always, you know, to do things the right way, to do it with the customer in mind, and to do it at scale. But, you know, one thing that our chairman and CEO Lowell always says is that it's like ushering in the fourth industrial revolution. So if you think about those terms and you think of Lowell as an engineer, you know, you don't just say that without really, you know, surveying the landscape and knowing what it portends. So, you know, we're very excited. It's a massive change in capabilities of networks.

>> KATIE REGNER: The third generation partnership project recently released the first version of the 5G standard, which essentially provides the industry with guidance on how to prepare for 5G-capable devices. Why do there seem to be so many varying definitions on what 5G is? And what is causing that confusion?

>> ED CHAN: Wow. I know we're not confused. I would say that our definition is rather clear. In that we are talking about gigabit level of services to individual customers. We're talking about, you know, the ability to lower latency by a whole 10X better. So we are not confused. I think what may be confusing is similar to what happened in 4G or just before 4G happened, there were a lot of folks trying to change the game by doing if you will marketing as the definition rather than the technology definition of what we're bringing to the marketplace and to the customer.

>> NICKI PALMER: That happens a lot, right? Every company, and we're in a very competitive marketplace. Everyone has a set of assets that they bring to the table. But, you know, as we move into 5G networks, the performance difference and that execution excellence becomes more important, not less. So the reliability of your connection, you know, the ability to get on the network and stay on the network no matter what

technology you're using, engineering in a very disciplined and deep way. I mean those things are, you know, are critical to the networks today. But more critical going forward. I mean the tolerances get tighter, right Ed?

>> ED CHAN: Absolutely. You think about what we were talking about earlier with the type of applications that we have. You're talking about going into these things for smart cities and things along that line. I often joke do people think that connectivity is going to less important over time. I don't know about where you live. But as far as where I live, if I have a hiccup in my connection at home, that's much worse than my electricity or water going away. That's the most important thing. I can have bottled water and everything else, but the broadband is the most important thing. This idea of network being less important I think is almost crazy. Everyone is going into cloud and digitizing their lives. Whether it's work life or home life, it's insane that anyone would think that network would be less important. Because to me you would need that to get to the cloud or anything else.

>> KATIE REGNER: Before we start getting into the applications of 5G, can we go back in time a little bit and talk about the G's. So what about kind of their evolution from 1G, 2G, 3G, 4G, even what G stands for?

>> ED CHAN: Oh my goodness.

>> NICKI PALMER: Ed, you brought in 1G networks. So why don't you start?

>> ED CHAN: That's funny! People used to say, you know, you feel your age when you are removing technologies that you put in. But in wireless, I don't think that should be measured that way because we surely put in a lot in and taken a lot out. Even in the short amount of time. I mean in the first generation, I mean it's all about voice. It's actually funny. Back in the day, FM radio was a two-way FM radio that actually hops between different base stations. So anyone with a scanner can actually listen to conversations. And we used to have fun with that. But you unfortunately only hear half of the conversation so it makes it even more -- .

>> NICKI PALMER: It's not that interesting. Or maybe it is.

>> ED CHAN: Yeah. So 1G was all about voice. And that unleashed a lot of innovation for folks who now can take their phone anywhere else. So communication has changed as a result of just that 1G. 2G was also still similar. It was fine tuning voice, but then we added a little more such as short messaging. So I think when we started adding short messaging services things got even more interesting. People's communication started changing more and more in that case. When we went to 3G, you started seeing a little bit more now, now a little bit more machine-like communication. That's when some of the data communication started to come into play with 3G at the time. But at that time it was still mostly I would say data communications that are kind of locked in. We used to call them walled gardens. So

everybody else had to own a little walled garden for their own 3G data services. So if you remember some of the days we would have these things called WAP, BREW. All of those really interesting things that were early applications. We had applications running on those things. Tetris was big back then. Bruce had a lot of Tetris at the time. At that time there were enterprise companies starting to take advantage of it. Folks were using that for running license plates. That was a big deal. Yeah, public safety. That's a very big deal for them. So they were early on users in that case. And what changed and 4G became, we open up. So one of the big things that happened from 3G to 4G is we went from a closed system to an open system. And that created a massive amount of innovation, because you can unleash the entire ecosystem of developers onto this platform. And that became this whole proliferation of everything else. So on top of adding better speed, you know, better throughput and then opening it up for outside innovation, unleashing the walled garden, that became this gigantic ecosystem that everybody benefited from.

>> NICKI PALMER: The change to 4G was enormous. I remember I was just coming into wireless from wireline at the time.

>> ED CHAN: Fun times.

>> NICKI PALMER: And I was happy to be at the ground level of building the 4G network with you and the team.

>> KATIE REGNER: So with all of that history in mind, how does it feel to be working on the 5G network?

>> ED CHAN: It's super exciting, number one. I would say if you even go back to when we launched 4G, I would say there really wasn't any other way of doing it than going and building it. I mean I often look back at how we created 4G. And the way we did invent a lot of things along the way. And I'm excited again because we are leading the industry and leading how this the gets done. Leading how it gets engineered. And leading how to work with, you know, all of the municipalities to getting this to place. I mean it is a global race. And I mean it when I say we are excited about being in the forefront of this because it drives the entire U.S. It's not just driving for Verizon alone.

>> NICKI PALMER: Yeah, that's right. If you think about everything that we brought to bear for 4G and, you know, seven years later or so now being able to talk about the next generation, it is incredibly exciting to think that you have these cycles of technology in your career. I mean as an engineer, as we spoke, you know, you don't often sort of get these, you know, pivotal moments where you're bringing technology to life in a way that fundamentally changes the way that people live and work and, you know, have fun, and enabling of businesses. And 5G is going to be all of that. So just like 4G really changed the landscape, you know, I'm very proud of this company because, you know, the work that Ed and his team have done to bring us in the forefront of 5G, you know, that's going to pay dividends. And it's going to cement our technology leadership.

And as we deploy this network, we know that we will do it reliably and we'll uphold the brand the whole time. So it's just a good time to be in the network team, I think.

>> KATIE REGNER: So what steps have we taken to lay the 5G network, to deliver on those promises of speed and low latency?

>> ED CHAN: I always start with, you know, the spectrum foundation is number one. So I always said externally that we saw and knew that the new next generation of millimeter wave was coming to market and we need to start leveraging it. So that was number one. So we need to cement, you know, the use of millimeter wave spectrum.

>> KATIE REGNER: And you can explain for us, Ed, how millimeter wave spectrum is different than the other types of spectrum out there?

>> ED CHAN: Good point. As I think of millimeter wave, the way I think of it is instead of these individual really small lanes of highways that we have today, imagine that you have this really wide, really, really wide ten lanes highway.

>> NICKI PALMER: Bigger than any highway we have today in the U.S.

>> ED CHAN: Exactly. And by the way, like you said, just not any highway. We have tens of thousands gigantic lanes in this highway put together. That's how we are delivering 5G. So that's why you see this massive differences in the ability to deliver the kind of bandwidth. So imagine you're not going to just drive individual little cars through, but you can pack a gigantic set of really large trucks right through that network at any speed that you want. So that's the kind of innovation that we're seeing in millimeter wave.

>> KATIE REGNER: So as your teams are racing toward 5G, how do you balance that with the need to maintain our 4G LTE network?

>> NICKI PALMER: Well, actually that's easy. They're very much related. First and foremost, performance on our 4G network not only is award winning and the best in the business, but it's foundational for 5G. So every new cell site we put in the network, every new small cell that we add, all of the new capabilities that we put in radios and on top of the towers, I mean they all lead us to where we need to go with 5G. So, you know, it's really not hard. We know what we need to do. And we keep building that network to handle the demand for today. And it positions us with fiber and deep cell, small cell locations that are perfect for 5G.

>> KATIE REGNER: So we talked a little bit about the feed of 5G and gigabit throughput. Can you give us an example of what that means in the real world? What kind of speeds can we expect to see from 5G?

>> ED CHAN: I think that is the speed that we are talking about. Today, in 4G today if

you look at the kind of throughput that we're getting, on an average basis a customer would get maybe 50 megabits per second. Or depending on the locations, it could be higher or lower in that case. Right? But if you look at, you know, where we're going from a 5G perspective, we're talking about on a per-user basis, you should be on average getting the gigabit per second of throughput. So you imagine that kind of difference. You can download things essentially in the snap of a finger before you can even get to it. So this actually does happen to many sometimes when you're on an airplane, you're about to take off. You are trying to download a couple of songs. I don't know about you, but I actually do sometimes. And you are trying to get that done. And it is different when you're in that mode. You're like oh, they just came to tell you to turn off your phone now. Can I just leave it on for now?

>> NICKI PALMER: So said differently, in the time it took for Ed to answer that question, we probably could have downloaded 20 gigabytes of data.

>> ED CHAN: Right.

>> KATIE REGNER: A couple of movies.

>> ED CHAN: Exactly!

>> KATIE REGNER: Let's turn to talking about the commercial application for 5G. Who is the primary audience for 5G? Who is the technology being built for? Consumers? Industry? Smart cities? What are some of the first use cases for 5G?

>> ED CHAN: Yeah. We think it's being targeted to serve multiple kinds of use cases. One of the attributes of 5G is to be able to do all of those things inclusive of what we've been calling the massive IoT, which is not just the total number of units that you can put on the network, but it's also about the fact that you can create and improve the latency by about ten times compared to the 4G network today. So you actually can have the ability to be much more reliable in your communications. So that opens up a whole new set of potential users and usages in that case. And a lot of times we like to use the traffic management and smart city as one of those examples where, you know, look, if a vehicle is going to be a self-driving vehicle as an example, it has its own sensors. But the sensors are limited to how far it can go and how far it can sense. But if you were connecting that vehicle with a sensor that's around a corner that the smart city has, it could be informed now with an information about maybe a puppy is running out on the street that you really need to slow down the car. In that case you really need low latency and reliable services for that infrastructure to actually tell the vehicle hey this is something that the sensor outside of you, that you need to take into account. That's one interesting application that I believe is going to be in that case. On the more consumer side, we've been playing with a lot of the V.R. and A.R. capabilities because both V.R. and A.R. has pretty high demand on that throughput and also low latency. Think about the way the V.R. goggle works today. We try to download all of the information into that goggle ahead of time so when you move

around the image and everything is there already. But if you have the low latency and high bandwidth combined together for 5G, you can now stream live information to that goggle. In fact, I think we did a recent demo quietly at the Super Bowl.

>> NICKI PALMER: Mm-hmm.

>> ED CHAN: That did something along those lines to highlight the difference and application for 5G.

>> NICKI PALMER: Yeah. And that's why it's important to be out there. I mean we have a very large test bed with, you know, hundreds of 5G nodes in 11 cities across the country actually on air right now. So, you know, we use that to get the engineers, you know, hands dirty a little bit. Test it out, see what it can do. Try some things, see how to deploy it, et cetera. That's been actually going on for some time now. And we know that there will be a lot of use cases here that will range from different smart city solutions, enterprise vertical solutions, and consumer applications, like Ed mentioned. But it's a little bit like trying to predict the future here. What we're doing is building a network with the idea that it's future proofed. But any engineer will tell you can't really do that 100%. But that is the goal. Because we know that the Verizon name is on the line if an application emerges that the network can't handle. And we take that very seriously. So we want to be sure that the network is outpacing the application's ability to consume it. So we have a lot of teams right now, really smart people, thinking about what future applications and, you know, most of them that might not even exist today, mind you, but what they might require out of the next gen networks. Ed mentioned a very. Very promising initial uses could be the autonomous vehicles, robotics, of course V.R. in particular really can't be done well on 4G networks. So that's the type of use case that we're really looking for. IoT applications. We have a great IoT network right now! But being able to scale that to the billions of connected devices, not just the millions. That's the new level of connectivity. So anything that will benefit from very low latency and the speed characteristics, the throughput that we mentioned before, those are the type of applications that will really pop in 5G.

>> ED CHAN: Nicki, don't forget. Remember when we talked about the history when we went to 4G, we might not be the best predictors of all the innovations that are going to come.

>> NICKI PALMER: That's right. That's right.

>> ED CHAN: One of the things as a network business that you need to do is bring in the innovations from the outside and partner with other folks. I think our imagination, like I said the reason when we first pushed this with the 3G PP, with the standards body, look, I don't think you can future-proof to Nicki's point by defining all of the applications that would happen. When you go way back, did you think that we would have a touch screen phone?



>> NICKI PALMER: Right.

>> ED CHAN: Did you think that we would have augmented reality that goes into your glasses? A new screen is about to emerge. I don't think we know what other applications are going to use the network the same way. I think we are just scratching the surface in terms of our own imagination.

>> NICKI PALMER: Absolutely.

>> ED CHAN: But I think this is another call to all of the rest of the partners to come and work with us to develop new applications that will blow people's minds.

>> KATIE REGNER: When you guys think about 5G, is there a specific application or technology with 5G that you're particularly excited about?

>> NICKI PALMER: I want a self-driving car. I think it would give me a lot of time back in my day.  
(Laughter).

>> ED CHAN: Yeah, I love that. I actually want, since I wear glasses, I do want this to be my screen. I think there's a huge productivity improvement. Because today my phone screen, my laptop, whatever version of screen that I have, it's kind of restrictive.

>> NICKI PALMER: That's true.

>> ED CHAN: I want my entire 360 degree view around me to be my workspace.

>> NICKI PALMER: On a serious note, one of the areas that I'm particularly excited about, and we all are here at Verizon is bringing next generation of learning to students and to schools.

And if you think about what 5G could offer, you know, we already have distance learning. So we can do a lot with today's technology. But 5G can usher in a whole new set of techniques and immersive learning experience that will make it feel like you are there. If you want to go to the bottom of the ocean, we can create experiences for you on the 5G network that will make it feel like you are actually there. And what better way to, you know, have students learn than to really change up the standard classroom setting where you sit behind a desk and you have a teacher that lectures you all day long. So I think 5G can really bring in a whole new set of the way that students learn.

>> KATIE REGNER: So as we go down the path of developing 5G technology, what are some of the larger socioeconomic impacts will it have? How do faster connections and greater bandwidth translate to solving real-world problems?

>> NICKI PALMER: That's a great question. I think it really starts with the ability of our networks to have pervasive, fast, responsive access to information everywhere. And

that's very different than what we have today. And when you have that, you can very easily get to what our chairman and CEO, Lowell McAdam, calls the fourth industrial revolution. And to me the socioeconomic impacts of that are enormous. You can think of impacts on things like healthcare. You know, remote healthcare being completely connected with your doctor. Or with the ecosystems in that environment. Things like smart cities. You know, we have a long way to go here. And we have solutions even today where, you know, things like intelligent asphalt that can reduce carbon emissions dramatically in a city. That's just one small example. We can take cities to a whole new level of efficiency and capability. And one I'm really excited about is the learning environment and what the kids of tomorrow will be able to achieve not just based on where they live or grew up or their zip code as we like to say. But based on pervasive access of technology, and truly immersive learning experiences that can be brought to everyone. So those are just some examples of how this future technology can really have an impact on our society as a whole.

>> KATIE REGNER: So what are some of the challenges associated with 5G from both a fixed and wireless perspective?

>> ED CHAN: I don't see any.  
(Laughter).

No, so I mean like we have started with the ecosystem. So you need the developers around this entirety of the 5G technology. So it goes all the way from the chip sets that goes into the devices to the spectrum that our government in the U.S. will be able to provide for us and put it into the market for use. And it also goes all the way to the infrastructure manufacturers that actually create the radios and things along those lines. And then you wrap around all of that you need a deployment capability. That's the reason why we started early to make sure we understand how to work with municipalities to get things going not just for the radio, but also for fiber. And then you lift from there and add in all of the innovation that Nicki just pointed to earlier. And then you can see it expand from that point.

>> NICKI PALMER: In a way, I would say many of the challenges won't be new challenges. We have a way to bring new technology to life even though it's different technology. In terms of deployment, we partner with progressive cities and progressive municipalities who are committed to help streamline the process of building infrastructure. So that gets down to permits and approvals. And, you know, the very unglamorous part of actually getting things built. But that's absolutely a priority for us and has been for a while. There will be more of that. To unleash this innovation quickly, we will rely on like-minded state and local governments to make sure we can get the technology deployed in a timely manner. That benefits the citizens of those cities. And, you know, they're out there. So we're excited on continuing to work with them.

>> KATIE REGNER: So when does 5G become mainstream for the general population?

>> NICKI PALMER: So mainstream is really hard to say. But I think you'll see a fast start this year in 2018, with 2019 being a much more significant year for 5G. We have said that we will launch in three to five cities this year a home broadband product. So we're very excited about that. And that will certainly happen this year. We're committed to being first. But being first on sort of a lot of fronts. I think what you'll see with 5G is yes we'll be out there with home broadband. It will be the first one of its kind here in the U.S. Mobility will quickly follow. And, you know, all these tests and all these deployments. We just have a cadence to them. And that's what it's really all about. To keep pushing the ball forward with this exciting new technology.

>> ED CHAN: Yeah, I definitely think 2018 and 2019 is when you start seeing the early on movements, as well as scaling in 2019. And I think one of the key pieces of this is communications has always been a strength of the U.S. And I think in this particular global technology race, I think we are right up there and I think you'll see us establishing the lead again. And with us, you know, being a piece of that first to market globally.

>> KATIE REGNER: What excites you most about the work that you do today and what you see coming down the road?

>> NICKI PALMER: This is a dream. Seriously. To be able to work on a project this transformational as bringing the next generation of technology to life. It's what an engineer really looks forward to when they wake up in the morning. It's not always going to be easy. There's challenges. There are many people, many companies to work with. You know, but it's about pulling it all together and always having a goal in mind. And there's nothing like rallying around a goal. And we're a technology leader. So we know how to do this. And that's what's fun. I mean being able to just rally the troops to do what's new and exciting. And to learn new things. I mean, engineers are curious. And as I tell my team all the time, I mean what a better time to, you know, be here than a time where we get to usher in this new technology and learn something new. It's always a good day to me when you're able to learn something a little bit new ask then put it to use.

>> ED CHAN: Yeah. I think for me it goes back to the kind of generational shifts that we have been seeing in the wireless industry. And I go back to in each of the phase of the change they always bring something brand new in that I would say is almost unexpected. And if you think all the way back to when I mentioned earlier smart messaging changed the world. That's not what we thought. We thought we were replacing pagers. So you think about how we're going to go from 4G into 5G. The excitement for me comes from not just being the lead in driving this, but I think the amount of innovation that is going to come in the next generation and the kind of new services that's going to come on top of that I think is yet to come. And I am excited along those lines, because I know for a fact for every single one of these generations that preceded 5G, there were new surprises to us.

>> NICKI PALMER: That's right.

>> ED CHAN: And I can't wait for the next surprise that's going to come with 5G.

>> NICKI PALMER: Well put.

>> KATIE REGNER: Nicki, Ed, thank you so much for joining us today to give us a little glimpse into the future of 5G.

>> NICKI PALMER: Our pleasure.

>> ED CHAN: Thank you.

(Music).

>> Thanks for listening. Stay tuned to Up to Speed for more conversations about technology today.