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# EDITED TRANSCRIPT

VZ - Verizon Communications Inc at MoffettNathanson Media and Communications Summit

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## CORPORATE PARTICIPANTS

**Hans E. Vestberg** *Verizon Communications Inc. - Executive VP, President of Global Networks & CTO*

## CONFERENCE CALL PARTICIPANTS

**Craig Moffett** *MoffettNathanson - Analyst*

## PRESENTATION

**Craig Moffett** - *MoffettNathanson - Analyst*

We're going to get started in just a minute. Before we start the official session and before we start the webcast, I just wanted to tell everybody this is obviously a pretty special moment for us in that this is our fifth conference. And so it's an extraordinary thing how quickly time flies. We've been here at the -- what was once the Parker Meridien, now just the Parker, for 5 straight years. And a lot of you have been with us for 5 straight years, so we want to thank you for being our partners in this journey. And we're really excited about the next 2 days.

And by the way, for those of you in this room, get used to it, this is -- for those of you that are telecom track, you're going to be in this room for a long time today unfortunately in that we have a lot of telecom companies and a lot to talk about in the telecom sector over the next -- especially today, over the next 8 hours.

Look, I am -- this is a perfect way to start out the session with Hans Vestberg and with Verizon for 3 reasons. The first is every question these days seems to revolve around Verizon and what will Verizon do. That's usually code for people asking what will Verizon buy. But the question is -- that we get more than any other is what will Verizon do. And second because what Verizon will do, whatever it turns out to be, is going to be driven by its network strategy because everything that Verizon does is driven by a strategy that starts with network superiority. And third because the whole industry is focused on this question of 5G, and we're going to be doing a tremendous amount of talking over the next 2 days about 5G and not just what it means for Verizon but what it means for the whole industry.

And so it's really a privilege for us to have Hans Vestberg for our first session because Hans, as the Chief Technology Officer for Verizon and the guiding light for all of their network strategies, is at the center of all of these conversations. And so what we're going to try to do, as we do with all our sessions, is instead of trying to do thin and broad, we're going to try to go a little deeper in each of these sessions. And in this one, I want to go deep into the questions of the network.

So Hans, with that as an introduction, thank you very much for being here and for kicking off our fifth annual summit.

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**Hans E. Vestberg** - *Verizon Communications Inc. - Executive VP, President of Global Networks & CTO*

Thank you. Great to be here. A little bit cold (inaudible) and almost...

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**Craig Moffett** - *MoffettNathanson - Analyst*

It's -- you should know, for -- some of you will remember that -- I think it was either last year or the year before, that the air conditioning in this room broke.

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**Hans E. Vestberg** - *Verizon Communications Inc. - Executive VP, President of Global Networks & CTO*

Not this time.

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**Craig Moffett** - *MoffettNathanson - Analyst*

And I think that -- well, I think that the hotel is still doing their level best to make up for that by averaging down over a period of years. So first of all, I also want to thank the people who have joined us via webcast.

### QUESTIONS AND ANSWERS

**Craig Moffett** - *MoffettNathanson - Analyst*

Before we dig in to the details of your network now, I want to start with a question that goes back a little bit, to the moment, just about a year ago, when Verizon made the -- what was then surprise announcement that you were going unlimited. At the time, the broad consensus was that your network wouldn't be able to handle it and that the network would fail. What gave you confidence at the time that the network was prepared? And in retrospect, how well has it fared?

**Hans E. Vestberg** - *Verizon Communications Inc. - Executive VP, President of Global Networks & CTO*

Okay. Before I start and to meet the requirement from my team, to cover the safe harbor statement, I might say something that is forward-looking, who knows. I don't plan it, but given your questions, nobody knows. So take that into consideration to whatever I'm saying.

So I think that what gave me the confidence of doing the unlimited -- I'm not saying because I wasn't even there. I had worked 1 year. This was a decision taken before I came in. But what I can tell you is that when Verizon launched unlimited, there had been a lot of work done before. I mean, you cannot fix that in 1 month and saying that we have a great network, let's launch unlimited. It has been a long, hard work of the engineering team to put the network together to be able to do it. And I have to say, an amazing performance of the network since unlimited. I mean, first of all, you need to understand that if you go to unlimited, of course, we got the spike. I mean, a lot of the users using a lot of data came over and started using that. So for a while, you have a spike, and I think that the team handled that very well. And then after that, what you see is that then you come back to normal and track your old data growth that you had before. So over the period, in the beginning, you have a spike and then you come back to the same growth. At the same time, we had the tool kit or things that I've talked about at our sell-side meeting in November. Everything from carrier aggregation, new antennas, we had new basebands coming in, all of that were enhancing our capacity and, of course, doing densification at the same time. So what you can see after almost a year of it is that, first of all, we performed best in all the service that have been done during all this time, and we are ahead of the curve. We have a lot of capacity in the network, and we still have a lot of tools that we can put into the network. We're only using half of our spectrum before this deal. So I think that the combination of great engineering and planning ahead, so that's why we performed well.

**Craig Moffett** - *MoffettNathanson - Analyst*

How far -- when you say planning ahead, how far out are you planning in -- for individual cell sites and for the network overall?

**Hans E. Vestberg** - *Verizon Communications Inc. - Executive VP, President of Global Networks & CTO*

Long. I mean, we, of course, make assumptions, planning that goes years out in order to understand how the growth is and how we do the planning. Then, we have to correct if something changes. And some changes came in due to unlimited because we saw data usage outside peak hours. We saw our customers using the network instead of Wi-Fi in other sort of regions than normal. So of course, there were some assumptions, but clearly, we do forecasting on our data on a very detailed level. And then we plan how to do it using all the tools we have. I mean, when you talk about capacity, you always -- almost end up in spectrum. But remember also, you have a lot of tools, you have densification. And that combination, when you do the economics of it, that's really what makes the difference.

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**Craig Moffett** - *MoffettNathanson - Analyst*

Well, we're going to come to that in a second.

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**Hans E. Vestberg** - *Verizon Communications Inc. - Executive VP, President of Global Networks & CTO*

We'll come to that.

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**Craig Moffett** - *MoffettNathanson - Analyst*

I want to ask a question of the audience first. Obviously, a quick show of hands. How many people in the audience think that Verizon needs more spectrum?

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**Hans E. Vestberg** - *Verizon Communications Inc. - Executive VP, President of Global Networks & CTO*

Okay. [Now we're down].

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**Craig Moffett** - *MoffettNathanson - Analyst*

It's funny because I've seen that question asked before and where the vast majority of hands go up. And it seems like the -- if that's any indication, it seems like the audience has moved off a little bit of the view that Verizon is spectrum constrained. But can you just talk about that? Can you talk about, from a high-level perspective, how you think about the trade-off between spectrum and those other tools?

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**Hans E. Vestberg** - *Verizon Communications Inc. - Executive VP, President of Global Networks & CTO*

So first of all, it goes back to each and every service provider because we're all different. We are sitting on our spectrum 115, 116 megahertz on what we today call mid-band. We define that in the market. And we have over 1,000 megahertz on millimeter wave. Let's talk about position. Now of course, we already decided a couple of years ago that densification was more economical than, in some cases, buying spectrum. So of course, we're densified. And then, of course, what you see on top of that is an enormous new set of tools coming out from the network, everything from carrier aggregation, new antenna sets, QAM 256 (sic) [256-QAM], all these fantastic acronyms. When we put all these together -- and then the last piece, which we sometimes tend to forget, is also global standards because if you have global standard for equipment or handsets, that means also you get benefit of a lot of things in network. Those 4 things we put together in our financial model every time we think about, "Okay, here we have a projection 18 months out, we're probably going to have some constraints on capacity. What is the best way to solve it?" Remember, also now, we're coming in with unlicensed band, coming in like LAA and an all of that. So many things about what is the best to do. And remember, it hangs all the way from the equipment to the handset. So you can do a lot of great things in the network, but if there are no handsets, you're idling the capacity because nobody can use it. So it has to be a combination of that to work together.

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**Craig Moffett** - *MoffettNathanson - Analyst*

And you still got a lot of spectrum left to be dedicated -- even before we talk about 5G left to be dedicated to LTE. Can you talk about that, sort of where we are in that process?

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**Hans E. Vestberg** - *Verizon Communications Inc. - Executive VP, President of Global Networks & CTO*

Roughly -- I would say roughly -- we're using roughly 50% of our mid-band -- what we call mid-band portfolio today. So half of it is left, and we are constantly moving that thing where we see it's needed. But at the same time, we do densification as well. So yes, we have quite a lot of spectrum left on that.

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### **Craig Moffett** - *MoffettNathanson - Analyst*

So Cathy and I wrote about a year ago that the value of spectrum has to be viewed through the lens of the cost of all of those alternatives, particularly the spectrum reuse technology like densification. More precisely, we said that the amount of capacity that can be created by \$1 spent on network densification that -- as the amount of capacity rises, almost by definition, that means that the value of spectrum is, therefore, falling. At the time, that was a pretty controversial argument, to say that network densification is driving down the cost -- or the value of spectrum. Do you agree with that? Do you think the value of spectrum, particularly mid-band spectrum, is rising? Or is it falling? And do you think that investor expectations about spectrum valuations are appropriate?

### **Hans E. Vestberg** - *Verizon Communications Inc. - Executive VP, President of Global Networks & CTO*

It's a good question. I think that, first of all, it depends on which service provider you are because, again, it depends on what assets you have. So for certain, the value might have gone up. For others, it might go down. So I'm not here to speculate what I think in general. But I think that's an important thing, what spectrum holdings you have and how much densification you have, what type of handsets you have in the -- with your customers. All that makes a place where you sit down and say, "Should I buy some spectrum? Or should I continue with densification?" Put in -- I mean, think also about the technology evolution -- or let's say revolution. About 3, 4 years ago, carrier aggregation did not exist. And for the ones that don't have all the technology acumen here, carrier aggregation is basically one spectrum together with another. You combine them, and that becomes one road instead of having 2 separate roads. Today, you can do carrier aggregation up to maybe 6 different frequencies. It is an enormous capacity improvement. So when you sit and think about, "Should I do carrier aggregation on 5 bands? Or should I buy a spectrum?" That becomes an economical model you need around. Then, of course, you need to understand that the handsets or the device you're planning needs to have the same type of thing. All the time, you're sitting and doing those type of things. And of course, what we don't know is how much more the technology will evolve. But just looking backwards, how much we have learned of doing better spectrum efficiency in 5 years, if we have the same track the next 5 years, there's -- lots more things you will do with a spectrum. And I'm confident -- where I come from, I worked for a company that worked only with spectrum efficiency every day for the last 140 years. So of course, there are billions of dollars going into spectrum efficiency every day because that's what they do for business, and they are working for us and for some others as well, I guess.

### **Craig Moffett** - *MoffettNathanson - Analyst*

Well, I remember it was an extraordinary realization that over the last 5 years, for the U.S. as -- the whole country, not any individual carrier, but for the U.S. as a country, increases in spectrum over the last 5 years only accounted for 0.7% of the increase in capacity of the network. It's really an extraordinary statistic.

### **Hans E. Vestberg** - *Verizon Communications Inc. - Executive VP, President of Global Networks & CTO*

I think that's a very good comment. I don't know the exact number, but I think you saw it. Just imagine if we were still rounding on CDMA and GSM, which was 1 band carrier, you cannot do anything else. With all the data we have, it would be impossible, even though -- with all the spectrum in the market.

### **Craig Moffett** - *MoffettNathanson - Analyst*

Yes, that's right. And so the solution wasn't spectrum. The solution has been everything other than spectrum, yes. Now there's -- I want to stay with this topic of spectrum valuations for a second because you made a comment earlier that you had started to come -- you, Verizon, because this is a little bit even before you had arrived, had started to come to the realization that spectrum values in the auctions were becoming less attractive than network densification. Can you talk about that institutionally, how that knowledge began to be syndicated within the company and where it started and how -- sort of how it evolved in the thinking of Verizon?



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**Hans E. Vestberg** - Verizon Communications Inc. - Executive VP, President of Global Networks & CTO

Of course, I don't have that corporate memory because I wasn't there. But I guess, it was a calculation of how much would it cost for you to densify -- especially where you have the most data loads, which is in urban area, what would it cost you to densify there instead of buying spectrum. And I guess, in some cases then, for certain cities, it turned out, "Hey, it's more efficient for us actually to do densification." And we're sitting here now, I guess, it's 3, 4 years, since it happened, and that was a great strategy. And I can only tell the guys in engineering, they did a good job and they had made a good decision.

**Craig Moffett** - MoffettNathanson - Analyst

So -- but now you have to feel like a kid in a candy store all of a sudden because now I'm going to defeat everything I ...

**Hans E. Vestberg** - Verizon Communications Inc. - Executive VP, President of Global Networks & CTO

(inaudible) it's a great company.

**Craig Moffett** - MoffettNathanson - Analyst

But if I think about the amount of spectrum that looks like it might be coming to market, so there's not only -- we've got some of the individual potential sellers like DISH network and SES and Intelsat and the C-band or alternative proposals for the C-band. The FCC is working on the CBRS band. There's an upcoming auction on 28 and 24. There are smaller players like Ligado that has been, potentially, sellers for a while. I think it's sort of -- it suddenly seems like there is -- I wouldn't call it a spectrum glut but I would say there's a lot of potential sellers. And one of the interesting things is that, for almost every one of those sellers, the broad consensus from the investment community is that the buyer is Verizon. So can you talk about that? Can you talk about -- does the availability of more spectrum whet your appetite to say there might be an opportunity for -- suddenly for spectrum values with -- that it's suddenly a buyer's market for spectrum and it might change the calculus of...

**Hans E. Vestberg** - Verizon Communications Inc. - Executive VP, President of Global Networks & CTO

It's always -- as I said before, it's always a balance between what it will cost compared to the other tool sets you have, densification, carrier aggregation, all the things I've talked about. So -- and then remember also, another thing you need to think about is the global ecosystem of the spectrum, do you have the equipment on that or if you don't have equipment on it, then you need make it manageable all the time. You don't want to end up to be alone on the spectrum in the world. Usually, they don't have the economies of scale, but -- so you wouldn't out rule it. It might be a moment where you say, hey, the benefit is better on having more spectrum than continuing with all the tools we have, churning in new phones and all of that. So we will do that evaluation all the time and see what is the best for the company. And we have very, very detailed models for doing that down on basically the lowest entity and checking because, ultimately, it could be cities, it could be regions and, to some extent, seldom a nation that you're looking into, but then you're looking into how you do that best in that place. And so it's going to be an economic and a financial modeling we're going to do.

**Craig Moffett** - MoffettNathanson - Analyst

And what are the characteristics of spectrum that are most valuable? It used to be just frequency. It used to be low frequency was better, and higher frequency was worse. But now there's all these other characteristics of whether or not you have wide bands, particularly for 5G where the width of the band makes the difference. You talked about whether it's available in DMAs or in PEAs or so -- how large the coverage areas are. Talk about some of those characteristics and what makes spectrum, to you, more attractive now. What are the characteristics you're most interested in?



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**Hans E. Vestberg** - Verizon Communications Inc. - Executive VP, President of Global Networks & CTO

I think when you -- I was part of the initial planning and thoughts around 5G even though I wasn't the one doing it, but, of course, the company I worked for, and that was 2009. Remember then, when you started to design 5G, it was designed for industries and for society. Consumers had all the things they needed, and that was the idea and, of course, any benefit you will have. So that was also designed that the throughput should be 1,000x faster. You should get down -- come down to millimeter -- milliseconds of latency. You could serve 1,000x more IoT devices in a cell. All of that was designed in order to get the industries to use wireless technology for their industrial transformation. And then, of course -- and to make that happen, you need big chunks of spectrum. That's clear because some of these characteristics are impossible to do with 10x10 or something. So of course, it has changed then. So because -- when we're sitting with 4G, looked at the use cases for that, then you -- the mid-band was the most important. Data throughput, a couple of megabits was important. Here, we talk about gigabit, for example. So yes, that has changed also the view on which spectrums are important when you go and deliver services. But again, it also depends on what type of customers you have. I go to Verizon. We have more medium enterprise -- we have enterprise customers, we have wholesale customers, we have IT customers, we have wireless customers. So of course, we are playing in all the needs of that type of spectrum. And that's also why we came to the conclusion that millimeter wave is a very good fit for us, for example, that we now have in our portfolio.

**Craig Moffett** - MoffettNathanson - Analyst

Yes. I want to talk about millimeter wave for a second because, certainly, if we were sitting in this chair in the first summit 5 years ago, no one would have talked about millimeter wave as a workable wave -- as a workable frequency. And in fact, in those days, there was a very clear delineation of above 2 gigahertz were considered high frequency.

**Hans E. Vestberg** - Verizon Communications Inc. - Executive VP, President of Global Networks & CTO

Correct.

**Craig Moffett** - MoffettNathanson - Analyst

I suspect that just because of talking about millimeter wave for the last few years, we have come to conceptually think about 2, 3, 4, 5 gigahertz frequencies very differently. We've now started to call them mid-band as a convenience. But the physics of those frequencies haven't changed at all over 5 years. They're still what the physics were. Can you talk about how you think about -- is kind of high, medium, low still the right way to think about it?

**Hans E. Vestberg** - Verizon Communications Inc. - Executive VP, President of Global Networks & CTO

Yes. I think, to some extent, you can think like that. You're correct. I just want to correct you some because you say that the physics of the spectrum is the same but the technology advancement, how you use the spectrum has taken huge steps in order to how to use millimeter wave, and I agree with you. I mean, even 5 years ago, initial research on millimeter wave, we were doing and said, "Okay, it might work." Today, it's totally different. We see equipment coming out on millimeter wave. You see handsets coming out soon, et cetera. That is what we think about. So that's why I come back to the question, how would I look at millimeter 5 years from now, where we have a global ecosystem rounding on that? So -- but the physics is a little bit different. I mean, high band, high up will have a shorter range of coverage but a throughput that is enormous. Of course, you can have big chunks of spectrum. And of course, if you're in a very low band, you get the long coverage but a very narrow spectrum chunk, which means that getting high speeds and throughput is very hard. So yes, those physics are the same.

**Craig Moffett** - MoffettNathanson - Analyst

What -- and what about the physics of penetration and absorption? So I've almost -- I sort of think it may be more sensible, instead of thinking primarily about propagation distances, to think about spectrum that passes through obstructions, spectrum that is absorbed by obstructions or



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spectrum that ricochets off of obstructions. And one of the things that makes 5G interesting in millimeter wave is that it tends to ricochet around and find a multipath route to an antenna. Do the high -- what we used to call high frequency but now we've started to, I think, lazily lump into mid-band, is that -- does that spectrum suffer by virtue of the fact that it doesn't actually ricochet for that multipath benefits that you get from millimeter wave?

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**Hans E. Vestberg** - Verizon Communications Inc. - Executive VP, President of Global Networks & CTO

I think they're going to live in harmony because you need all of them. But you're right, the millimeter wave have totally different physics on how it moves around and it reflects in between and can find its way around, and others have less of that. But I think the combination of them -- and just imagine a carrier aggregation in between them, what power you can get out and how much benefit you will get from indoor as well because (inaudible) release of the spectrums when you have better outdoors. So the combination of that, that's sort of what we are looking at and how we think we can benefit tremendously from millimeter wave.

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**Craig Moffett** - MoffettNathanson - Analyst

And one last question about these widths of blocks that you were just talking about, does -- it used to be that when you were talking about launching a new technology, almost by definition you have to get new spectrum for it, and it had to be moved on that. With carrier aggregation, it's now possible to strip off little pieces of old spectrum and refarm it a little bit at a time instead of these kind of big, massive refarming decisions. Does that change the way you think about acquiring new spectrum? Is it less important now? I know for 5G, you need big blocks. But for just the way you think about spectrum, are the big blocks less necessary?

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**Hans E. Vestberg** - Verizon Communications Inc. - Executive VP, President of Global Networks & CTO

Yes. You get the benefit of the carrier aggregation that you haven't thought about before and again, that technology evolution in the last couple of years, which you need to evaluate. The same thing goes also if you think about 5G. I mean, 5G, when that will come, will come in different releases. Those releases -- 5G releases on software, they will be for all spectrum over time. So as we moved everything from 3G to 4G, that's going to be 4G to 5G as well on any spectrum. It's just that they're going to perform very differently if you're doing it on a low band to a mid-band to a high band. So of course, ultimately, you move -- if release 15 or release 16 on 5G is coming, you move all of the base on that because you want to have unique software on your whole network. You don't want to have different type of softwares.

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**Craig Moffett** - MoffettNathanson - Analyst

So I want to turn now to network densification because you've talked a lot about how that's become a larger and larger part of your strategy. And densification, obviously, can mean a lot of things. It just means more cell sites, but it can mean more antennas per site. It can -- with MIMO and Massive MIMO. But how is -- the prospect of 5G and using millimeter waves with sort of propagation, how's that changed Verizon's densification strategy? And how do you think about planning for small cells in a world where you're not just planning for densification of LTE but you're planning for years down the road now?

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**Hans E. Vestberg** - Verizon Communications Inc. - Executive VP, President of Global Networks & CTO

So if you think about the very urban area, you're densifying there because that's where you have the most of the traffic, like in New York, for example. So of course, if you think about -- come back to your physics of the different spectrums, if you then have millimeter wave, you tend to need fewer of those sites because millimeter wave will capture so much traffic on that distance. Because you have already densified, so you have already moved all the cell sites much closer to each other. And that's -- for 4G, when you are on those bands, it's less propagation than millimeter wave. So of course, we need to rethink a little bit where we're now coming to that phase of it, and we have been on to our densification for many years. So I think that is a part of the broader sort of change we are doing to the whole network where we go from -- remember, we have, let's say, at least visually, vertical networks where we have the joint venture with Vodafone, so we couldn't even share equipment. So what we have right now is



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we are building the Intelligent Edge network, which is a horizontal network where, basically, everything from the data center up to the access is the same equipment for any of our customers. It's a huge transformation. And then at the edge, we decide what type of access is best for the customer. If it's an enterprise customer, it could be fiber; if it's a consumer for wireless. It might be 4G, it might be 5G in the future. It could be [iPhone] for some. And that's basically how it works right now, which is very different from how it worked before. And then densification is one part of it, depending on what type of customers you have in that area.

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**Craig Moffett** - *MoffettNathanson - Analyst*

Is -- can you put any numbers around it for us in terms of -- you've been at this longer than any of your competitors. How many -- I know it's even a hard question to answer, how many small cells there are, because there are so many different flavors of depth and what have you. But can you put any rough numbers around the number of small cells deployed over the last 3, 4, 5 years?

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**Hans E. Vestberg** - *Verizon Communications Inc. - Executive VP, President of Global Networks & CTO*

No.

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**Craig Moffett** - *MoffettNathanson - Analyst*

Okay.

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**Hans E. Vestberg** - *Verizon Communications Inc. - Executive VP, President of Global Networks & CTO*

You should measure our network on the wireless. I mean, we have performed the best as long as I have followed Verizon. And so of course, lots of densification done. And you're right, because you comment yourself -- I mean, if you probably get the (inaudible), that's not important here. The important is you build a network that performs the best and then you use all the tools. And we are using all the tools and we'll continue. So talking about how many small cells you have is not relevant. It depends on. What tools you have in a network, how much densification have you done, what spectrum are you using. Those types of things are important to get the performance, not one individual, single thing you're seeing on the network. And that's what we think holistically in all our decision financially, how we deploy and how the engineering thinks when we're doing this.

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**Craig Moffett** - *MoffettNathanson - Analyst*

You made a splash a year or so -- I guess maybe a little over a year or so ago, talking about 1,700 strands of fiber in your preferred fiber backhaul solution.

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**Hans E. Vestberg** - *Verizon Communications Inc. - Executive VP, President of Global Networks & CTO*

It was my boss.

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**Craig Moffett** - *MoffettNathanson - Analyst*

Can you talk about that kind of concept though as to how you think about the backhaul piece of the network?

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**Hans E. Vestberg** - Verizon Communications Inc. - Executive VP, President of Global Networks & CTO

No, we have been on to fiber deployment for quite a while. And basically, already years ago, we were driving fiber to all our sites. And of course, you already mentioned, that's because the fiber is the cheapest here in the whole equation because everything else, the digging and things are the most expensive. So of course, you have all the dimensions. You are ready for whatever 5G will come and what type of traffic it would need to have. So I think when I think about 5G, even fiber is a crucial element for it. I think spectrum is also. Remember, what's the cost of millimeter wave. Especially if you want to have the real 5G use cases, you need millimeter wave. The other thing you need, you need also central offices because, ultimately, you're going to have thousands of small data centers that can do things. You need to have that. And finally, you also need to have been virtualizing the network, taking out hardware and software because that enables you. And you need AI, ML and all those components as well. And we are, of course, fortunate to have the whole Yahoo! team and AOL team that has been working with AI and ML for a long time. So all those 4 components will be super quick to get when you to 5G, and I think we are sitting on all 4 of them.

**Craig Moffett** - MoffettNathanson - Analyst

And the last topic before we turn to what everybody wants to talk about, 5G, the last topic on network densification...

**Hans E. Vestberg** - Verizon Communications Inc. - Executive VP, President of Global Networks & CTO

What's more important than 5G?

**Craig Moffett** - MoffettNathanson - Analyst

Is -- talk about siting small sites because there's been a lot of talk both in the FCC -- we're going to be talking to Commissioner Rosenworcel this afternoon. There's been a lot of talk about trying to streamline the process for siting and the location of small cells. What's been your experience of how long that process takes in different jurisdictions? And what are the competencies...

**Hans E. Vestberg** - Verizon Communications Inc. - Executive VP, President of Global Networks & CTO

It's very -- I can tell you it's quite dramatically. I think that what is important is you need to have a portfolio of sort of tools when you will come to the densification. I mean, you have one where you deploy your cells, you make agreements with the owners of the posts or whatever it might be. Another is, of course, you use third parties. A third one is like we're doing in Sacramento. You have a public-private partnership where you -- basically, you get shorter lead times, but at the same time also, you deploy certain technologies for the society or for the city. So I think we're working with all of them. But what is most important, you need to know every system, every community because legislation is different. If somebody is going to streamline, of course, it's great. But finally, you need to know each and every place and work in each and every place to make that happen.

**Craig Moffett** - MoffettNathanson - Analyst

And do you think that's a competitive advantage for Verizon? Do you think -- I've heard it said that you have much better relationships with...

**Hans E. Vestberg** - Verizon Communications Inc. - Executive VP, President of Global Networks & CTO

Relationship is always something intangible for me. But what I see, what we have on the ground in all these places, that means a big difference. Then I hope and I believe that we have good relationships. And we're a respectful company, and we're a great partner. So that I hope -- but that's intangible for me. What is tangible are people, organizations that have done it years and years and they were replicated. I mean, one thing that I saw when I came into Verizon is, of course, you can have certain competitive advantages. One is scale, scale in volume, et cetera, nothing -- we have certain, but can also have a scale in skills, your skills that you replicate again and again, again. And I think that, I have seen a lot, how we deploy,



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we replicate the best practices from another city, we replicate the way we do densification, how we interact with the city, we use people that knows. And I think that is a competitive advantage for us, and we should just continue to do that as good as we can.

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**Craig Moffett** - *MoffettNathanson - Analyst*

So I want to turn the conversation now to your fixed wireless broadband plans, which has been, I think, safe to say, one of the most controversial topics, not just...

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**Hans E. Vestberg** - *Verizon Communications Inc. - Executive VP, President of Global Networks & CTO*

Controversial topic?

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**Craig Moffett** - *MoffettNathanson - Analyst*

Not just for Verizon but for the whole sector. So about 6 months ago, you said the addressable market for -- at your Analyst Day, back in -- I think it was either late November or December, the addressable market for fixed wireless broadband is about 30% of the country. How did you arrive at that estimate? And what are the characteristics of a market that make it qualify to be part of that 30%?

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**Hans E. Vestberg** - *Verizon Communications Inc. - Executive VP, President of Global Networks & CTO*

So one thing you need to understand before you answer that question is how do 5G work because 5G is basically the technology and it's a baseband that can handle different use cases at the same time. So one needs to understand, first of all, its not a fixed wireless access network being built, its a 5G network. And one slice is fixed wireless access. Another is mobility. The third one can be enterprise solutions on milliseconds or it could be a private 5G network. All that is the same equipment. And I just want to go back to the Intelligent Edge Network that we're building. All the blocks are the same up to the access. So it's not a special network built for fixed wireless access. It's the same baseband physically, the same software handling different slices. One more design principle in 5G is that you can do slices on different use cases. And you can handle it -- when it comes to the handsets, you can even handle different slices in the handset. Up to 8, I think, is in release 15 or 16, probably next (inaudible) I'm wrong, but somewhere around that. So that is important before you come to your question. And then you asked me, "How did you arrive to the 30 million?" We need -- of course, we need a bottom up and a top down look into how we're going to deploy, where we're going to see a potential use case, what have we learned from millimeter wave. All that, we weighed in when we made that calculation. So that's how we did it. But the most important question is the first one. It's a multiuse network. It's a multiuse radio base station. It's not -- because in all other fixed wireless access sort of in the history, and I had been part of many of them, they are a single radio base station that is totally disconnected from the rest of the network.

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**Craig Moffett** - *MoffettNathanson - Analyst*

And that means the backhaul and everything else have to be thought of as -- in those cases, have to be thought of as separate, whereas you're doing it as a shared infrastructure.

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**Hans E. Vestberg** - *Verizon Communications Inc. - Executive VP, President of Global Networks & CTO*

It is exactly the same base stations, that, "Hey, in this area -- in this room, we're doing mobility for all of you, and you can run around waiting for 5G." But at the same time, I heard a couple of you in this room that I do fixed wireless access at the same time, in the same capacity that I have in the baseband.



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**Craig Moffett** - *MoffettNathanson - Analyst*

So how do I cost-justify that when I think about fixed wireless broadband? Am I saying that the cost of the shared infrastructure should be allocated to something other than fixed wireless broadband and fixed wireless broadband is just another piece? Or is it that I allocate it to the different products in a...

**Hans E. Vestberg** - *Verizon Communications Inc. - Executive VP, President of Global Networks & CTO*

Yes. Ultimately, you're going to have different products going on for all technology rather than the technology being one solution. So you need to calculate that -- you have different products and you have use case where you can multiuse the capacity. And remember, all the passive equipment, you can multiuse the capacity in front of you. Yes, you need a little bit more capacity, but that is what I'm mentioning and a smaller piece of the total investment.

**Craig Moffett** - *MoffettNathanson - Analyst*

And so again, that 30 million homes, roughly 30% of the country or something like that, what are the characteristics? Is it density, that higher density makes it more attractive? Or is it that it's not already overbuilt with fiber, which would make it less attractive? Is it the availability of a telephone pole in that census block?

**Hans E. Vestberg** - *Verizon Communications Inc. - Executive VP, President of Global Networks & CTO*

It was based on what we saw as possibility with our plans to deploy 5G technology. And that together with where do you have the households, where does it makes sense to have an offering and all of that. That was woven into that whole calculation. Of course, our business team were doing the work on it. And of course, we were still early on to understand the technology. We know the technology better and better every day, so -- but still that holds.

**Craig Moffett** - *MoffettNathanson - Analyst*

And you're getting more bullish. So you've talked about 1,900...

**Hans E. Vestberg** - *Verizon Communications Inc. - Executive VP, President of Global Networks & CTO*

Am I getting more bullish?

**Craig Moffett** - *MoffettNathanson - Analyst*

Well, no. I mean, over the last 6 months, Verizon has become even more bullish, based on your public comments, about how much of the country you can serve and how well the technology can perform. So you've talked about 1,900 to 2,000-foot radii for millimeter wave cell sites in fixed wireless broadband. It's safe to say that is much more aggressive though than most of your peers. Not just peers here in the U.S. but even globally are struggling to find that same radius. Can you talk about that. What is it that you figured out that makes it possible to get these frequencies to work over those distances?

**Hans E. Vestberg** - *Verizon Communications Inc. - Executive VP, President of Global Networks & CTO*

I think there's few companies in the world that has done so extensive trials that Verizon has done. So I think that's one of the keys. I mean, we have had 11 trial markets up for 1 year, 1.5 years trialing the equipment, the spectrum. And again, we are learning every day. And then it's a combination of the antenna, the beams, the reflections and all of that. You learn all the time. I would say that some of the Koreans, they find the same type of

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distance that we are seeing. So I think that it's more about how deep you are into the technology. And again, I can understand that others don't see it because they're not into the -- they might not even have it. So for us, this is a key technology and a key spectrum we've spent time on. We have people work on it every day. We work with all our key partners. And even when I came into Verizon 1 year ago, the whole market was basically saying, "I wonder if millimeter wave is going to work." Now all carriers want to deploy millimeter wave. We have equipment coming out on 28 gigahertz for us this year. It's going to come to 39 gigahertz next year as well. So it's mind-boggling how quickly it has changed what we can do with it.

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**Craig Moffett** - *MoffettNathanson - Analyst*

And you're fully confident that these spectrum bands, 28, 24, 37 -- 39, cannot just be line of sight...

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**Hans E. Vestberg** - *Verizon Communications Inc. - Executive VP, President of Global Networks & CTO*

Yes, yes. With reflection and so on, yes.

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**Craig Moffett** - *MoffettNathanson - Analyst*

And that's true even in dealing with obstructions like trees and -- in some suburban areas?

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**Hans E. Vestberg** - *Verizon Communications Inc. - Executive VP, President of Global Networks & CTO*

Yes. That's working. And again, it's all about also that you need the whole ecosystem, all the way from the antenna and the baseband through the receiver and how you bring it indoor. All that means to be well defined and all of that. So of course, you optimize all the time, and we are working on that. We are in the middle of our deployment right now, commercial deployment for our launch this year that we're going to do in 3 to 5 cities.

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**Craig Moffett** - *MoffettNathanson - Analyst*

And you've started in Sacramento.

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**Hans E. Vestberg** - *Verizon Communications Inc. - Executive VP, President of Global Networks & CTO*

Sacramento is the only one we have launched officially.

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**Craig Moffett** - *MoffettNathanson - Analyst*

And can you share any early learnings from Sacramento yet?

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**Hans E. Vestberg** - *Verizon Communications Inc. - Executive VP, President of Global Networks & CTO*

I can talk about all the markets we are launching in, but we are not telling you which they are. But no, we have commercial base stations up there right now. And we're going for the ones in the second half, where you're putting them in, we are densifying, we are checking that everything works before we're launching. So, so far, the time plan is working.



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**Craig Moffett** - *MoffettNathanson - Analyst*

And can you share anything more about the time frame that we should start to see...

**Hans E. Vestberg** - *Verizon Communications Inc. - Executive VP, President of Global Networks & CTO*

Second half of 2018 is a good time line.

**Craig Moffett** - *MoffettNathanson - Analyst*

Just for those 5?

**Hans E. Vestberg** - *Verizon Communications Inc. - Executive VP, President of Global Networks & CTO*

Yes. But remember also that -- and those -- you said 5. I said 3 to 5.

**Craig Moffett** - *MoffettNathanson - Analyst*

Let's say 4.

**Hans E. Vestberg** - *Verizon Communications Inc. - Executive VP, President of Global Networks & CTO*

Yes. So that's sort of built on our proprietary software that we built together with the Koreans. As soon as the NR, which is the standard 5G, is coming out, we're also deploying that. And again, you need to remember what I said in the beginning -- or in the middle here. The basebands will have 5G NR will be mobility as well as fixed wireless access. And we are preparing the network. As soon as the NR technology is coming out, we also will have that in the network in order to have 5G mobility at the same time. So sometimes, you get the feeling for -- that we're only doing fixed wireless access. The reason we are doing that -- in the beginning, we have the proprietary solution for that. As soon as NR is coming, which we are pushing everyone in ecosystem, we will be ready for that as well. You need some handsets and whatever devices you're going to have. That's important as well. The network is always ahead of the devices, remember that, so you can always enable the network ahead of the devices. And that's what we're doing.

**Craig Moffett** - *MoffettNathanson - Analyst*

So the \$64,000 question or I guess the 18...

**Hans E. Vestberg** - *Verizon Communications Inc. - Executive VP, President of Global Networks & CTO*

\$64,000?

**Craig Moffett** - *MoffettNathanson - Analyst*

\$18 billion question...

**Hans E. Vestberg** - *Verizon Communications Inc. - Executive VP, President of Global Networks & CTO*

17 to 17 point...

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**Craig Moffett** - *MoffettNathanson - Analyst*

CapEx. Talk to us about 5 -- doing 3 to 5 cities, sorry, 3 to 5 cities is obviously something that does not radically change the capital spending of Verizon. But a massive deployment of -- into hundreds of cities sounds like an awfully expensive proposition to investors. Can you talk about how you do this within the capital budget or how we should think about the capital budget for this kind of future network?

**Hans E. Vestberg** - *Verizon Communications Inc. - Executive VP, President of Global Networks & CTO*

So I made a guidance for this year, \$17 billion to \$17.8 billion. So I'm not here to change that one. Matt Ellis is managing that for this time. I think that, remember again, the majority of what we are deploying is common network right now. We're going to the Intelligent Edge Network. I told the market there were 2 reasons for it. One, in order to give new 5G services, I need the whole streamlining of the network to do it. Secondly, it was to take down costs. Because I don't need the 4 different transport solutions. I don't need 4 different ways of doing (inaudible). I need one and I need fiber for all of it. So -- and that's what we have been doing for quite a while. So then you come to ask me, "Okay, so will 5G be more expensive?" Much of the equipment already is prepared. Certain types of -- big amount of our radio base stations are software upgradable to 5G. So it's totally different than when we went from 3G to 4G, where, basically, hey, this 3G base station doesn't really work now that we're going to 4G because CDMA to LTE was not really super compatible. So...

**Craig Moffett** - *MoffettNathanson - Analyst*

But still bringing -- you described the public works aspect of fiber deployment as the most expensive part, not the fiber itself. So bringing that public works project to every street, avenue and cul de sac in America and bringing dense fiber, more cell sites for shared-use infrastructure or for small, medium business and residential and fixed wireless broadband, whatever the use case is, it's still a lot of money, right? I mean, it's hard to see doing that within the existing envelope of the capital budget, isn't it?

**Hans E. Vestberg** - *Verizon Communications Inc. - Executive VP, President of Global Networks & CTO*

No. I think that, first of all, we have been doing that for quite a while. So that's already in what we're doing today. I mean, I think that's -- you need to think that we're doing -- remember, we're doing, for example, fiber, we would have multi tenants over -- for the fiber. And of course, we're always looking to, "Hey, can we buy fiber from someone that is actually doing the sort of typology wrong? Can we rent it? Or should we do it ourselves, as anyone would do?" We have come to the conclusion, in certain areas, that we do it ourselves, and last year, we announced our collaboration with Corning with 12.5 million lines -- miles of fiber secured for doing it. So of course, we are doing more nowadays by ourselves, but that's because the economics is better than doing it from somebody else. So that should be good news. So now we will continue to work extremely efficient with our capital allocation. I take it as a huge responsibility for me and my engineering team, use the latest tools, the best technologies, best vendors in order to get the most out of our capital, and that's what we are doing. And I got the questions already early this year, should you spend more if you have tax money and all of that. Remember, you don't want to have spikes in your CapEx because this is something that is very prudent when you do allocation and you don't -- you want to plan it in the right way. And I think -- and I have nothing to do with it, but the Verizon team, they are good at it.

**Craig Moffett** - *MoffettNathanson - Analyst*

I have 2 last topics I want to talk about. I want to start with the cable operators.

**Hans E. Vestberg** - *Verizon Communications Inc. - Executive VP, President of Global Networks & CTO*

Two more?

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**Craig Moffett** - *MoffettNathanson - Analyst*

And I want to talk about Sprint and T-Mobile.

**Hans E. Vestberg** - *Verizon Communications Inc. - Executive VP, President of Global Networks & CTO*

Sprint and T-Mobile as well. I am Verizon, remember that.

**Craig Moffett** - *MoffettNathanson - Analyst*

Let's start with the cable operators. The cable operators, I guess, are increasingly sort of becoming frenemies to you. You obviously compete with them on access, but they're positioned to become some of your largest customers. How do you think about -- and they also have infrastructure that they could presumably be suppliers to you for some backhaul capability. So how do you think about the cable operators. Do you view them as competitors, frenemies, customers, suppliers?

**Hans E. Vestberg** - *Verizon Communications Inc. - Executive VP, President of Global Networks & CTO*

I think that's the word you're going with. With the technology implosion, you end up as frenemies. I think that the cable operators here are good customers of us. We have good working relationship on the wireless side. Of course, in certain areas where we are doing sort of cable services, they are doing as well, you are competing. So I think that's how you need to live. I mean, you need to be able to partner in the right ways and in the right moments. I mean, it's nothing strange.

**Craig Moffett** - *MoffettNathanson - Analyst*

Does their infrastructure fit with your vision? There was a lot of talk a year or so ago that cable dense wired infrastructure would be a big advantage as a supplier or even in a merger with a telecom company. And that has, to some extent, evolved partly because of Lowell's comment about 1,700 strands and his preferred architecture. How do you think about it? Is that -- how valuable is that infrastructure for what you're doing?

**Hans E. Vestberg** - *Verizon Communications Inc. - Executive VP, President of Global Networks & CTO*

First of all, I mean, I think that what -- if you're a wireless operator, your fiber needs to be in a certain way. I mean, Point to point might not be the right way. You want rings of fiber. So of course, you need to know what they have. I don't know what they have. But I guess, few have built it like that because they aren't building it as wireless carriers.

**Craig Moffett** - *MoffettNathanson - Analyst*

Okay. Let's talk quickly about Sprint and T-Mobile. There are...

**Hans E. Vestberg** - *Verizon Communications Inc. - Executive VP, President of Global Networks & CTO*

That would be very quick.





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**Craig Moffett** - *MoffettNathanson - Analyst*

Well, their argument is that it's not going to be possible for either of them individually to make the requisite investments in 5G unless they're allowed to merge. Do you have some sympathy for that argument? And has Verizon taken a view on the merger?

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**Hans E. Vestberg** - *Verizon Communications Inc. - Executive VP, President of Global Networks & CTO*

I have no comment to that.

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**Craig Moffett** - *MoffettNathanson - Analyst*

No comment.

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**Hans E. Vestberg** - *Verizon Communications Inc. - Executive VP, President of Global Networks & CTO*

No. We work with the right -- there's a lot of things happening in the market. So for us to have an opinion about that -- we let the ones being in those merger discussions have an opinion. We need to execute on Intelligent Edge Network, doing the best 5G for mobility fixed wireless access and whatever, how many use cases we have, that's my work and my team's work. We're hammering it every day, and we'll just continue.

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**Craig Moffett** - *MoffettNathanson - Analyst*

Which is to say you're going to duck the question for the next 12 months?

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**Hans E. Vestberg** - *Verizon Communications Inc. - Executive VP, President of Global Networks & CTO*

Yes, definitely.

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**Craig Moffett** - *MoffettNathanson - Analyst*

Okay.

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**Hans E. Vestberg** - *Verizon Communications Inc. - Executive VP, President of Global Networks & CTO*

I mean he's honest ...

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**Craig Moffett** - *MoffettNathanson - Analyst*

Yes, that's right. Well, they're going to be next in this room.

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**Hans E. Vestberg** - *Verizon Communications Inc. - Executive VP, President of Global Networks & CTO*

Yes. So they're going to answer. So there's going to be (inaudible)

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**Craig Moffett** - *MoffettNathanson - Analyst*

So I want to wrap up with a big-picture strategy question. At the end of the day, I know what you're going to say here, but...

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**Hans E. Vestberg** - *Verizon Communications Inc. - Executive VP, President of Global Networks & CTO*

So why do you ask?

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**Craig Moffett** - *MoffettNathanson - Analyst*

Is real network advantage still possible, especially in wireless? Is it still possible to really differentiate a network in wireless? And then, more pointedly, can Verizon really maintain a sufficiently large differentiation on network advantage that it matters to customers?

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**Hans E. Vestberg** - *Verizon Communications Inc. - Executive VP, President of Global Networks & CTO*

Yes, I think so. I think also that as the wireless technologies broaden out to more customer segments, not only consumers but industries and societies, it will be even more important that the performance of the network will be a key differentiator because in certain of the characteristics also of 5G with low latency or enormous throughput that can only be done from building a network in a certain way. That doesn't mean that all carriers will build the same because it depends on what customer groups you have and what revenues you are looking for. And we are looking into a big part of the customer segment because we're all in there and we think that this transformation will create new possibilities for us when it comes to 5G. So yes, I believe that performance matters.

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**Craig Moffett** - *MoffettNathanson - Analyst*

Well, it's -- you had a lot of promises as a company over the last year about the financials, ARPU and that sort of thing recovering. And it's funny when I was putting together my state of the industry slides for tomorrow, it really -- it's very clear that you're delivering on the things that you said you would deliver on. All of that starts with the network.

And so with that in mind, I want to thank you for kicking off this conference with a really in-depth session about Verizon's network because I think it's fascinating to me. And I think, at the end of the day, you can't avoid the engineering questions if you're really going to understand this business.

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**Hans E. Vestberg** - *Verizon Communications Inc. - Executive VP, President of Global Networks & CTO*

Absolutely.

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**Craig Moffett** - *MoffettNathanson - Analyst*

So this has been enormously helpful to everyone here, and I thank you for joining us.

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**Hans E. Vestberg** - *Verizon Communications Inc. - Executive VP, President of Global Networks & CTO*

Thank you.

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