GLOBAL IT SUMMIT

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Conference Debate Session III - 5G in the North American Market: Trials, Misdirection, and Incompatible Technology

Introduced & chaired by Dave Bolan, Core Industry Analyst, Dell'Oro Group

Panellists:

Kelly Ahuja   CEO, Versa Networks

Jeff Lipton   Vice President of Strategy and Corporate Development, Aruba-HPE

I'm Dave Bolan. I'm an Analyst at Dell'Oro Group. Testing. Today we're going to talk about the 5G in the North American market; trials, misdirection, and incompatible technology. With us today is Jeff Lipton from Aruba-HPE and Kelly, he's going - we'll let each individual introduce themselves. Kelly, can you introduce yourself please?

Kelly Ahuja, CEO, Versa Networks

Thanks Dave. Kelly Ahuja. I'm CEO of Versa Networks. We're a fast-growing company in what we call software defined branch space, with software defined WAN being a part of that. I've been there for about three years after having been at Cisco for about 18, where I ran the networking portfolio.

Dave Bolan, Core Industry Analyst, Dell'Oro Group

Jeff?

Jeff Lipton, Vice President of Strategy and Corporate Development, Aruba-HPE
Great. Thanks for the opportunity. Jeff Lipton. I run Strategy and Corporate Development at Aruba, which is a division of HPE. We're the edge division of HPE. We do - just to give you an idea, for those of you that don't know us. We do about three billion in revenue; that's last fiscal year. Nice growth. Our main products would be wireless LAN, ethernet switching, security, and we are entering the SD-WAN market as well.

Dave Bolan, Core Industry Analyst, Dell'Oro Group

Okay. Thank you. I want to give you a little bit of background on where we're at in 5G today. I want to go through each service provider so you have an understanding on what's the status of 5G as it's been deployed in North America so far. AT&T has taken an interesting tact. They introduced early back in December 2018, in 12 cities with a hot spot device before handsets were available. It was a - you could get on Wi-Fi onto the hot spot, which then talked to the 5G network. It was only available to businesses. You can't walk into an AT&T store today and get a 5G phone and get 5G service. In June they introduced the smart phone for the business users. Then, you see there, as of today they are in 20 cities and one NFL stadium, that being AT&T Stadium in Dallas. They also implemented with the millimetre-wave band at 28 and 39 gigahertz. They have promised in the future they they'll have nationwide coverage by the first half of 2020.

Sprint launched in May of 2019 in four cities and then as of today, now, they are in - I can't quite see that, nine cities with 2.6 gigahertz band. We'll talk about the significance of these bands in just a second. Their future is to hopefully merge with T-Mobile and we know there's some headwinds there, so it's a little bit of a question mark right now. Then T-Mobile, they launched in June 2019 in six cities. They're still at six cities as of today. They also launched in the millimetre-wave band. Of course, they have said they'll be nationwide sometime in 2020, and of course their future is merging with Sprint.

Verizon launched in October of 2018, what they call for fixed wireless access, the 5G home in four cities. They didn't call it a trial network back then, they just said it's - 5G is here, but it was a proprietary standard, it wasn't the industry standard that we're using today; 3GPP. Now they're calling it a trial. They're kind of holding off on implementing that until they can get devices that are 3GPP compliant before they expand into the fixed wireless access. They launched their 5G mobile in April of 2019 in two cities. To date, they're up to 13 cities and 13 NFL stadiums. They also launched in the millimetre-wave band. They said if - they've announced 13 more cities, which will be up and running by the end of the year. They promised a total of 30, so there's four cities that are unannounced at this point in time.

That's where we're at. When you look at it on a map - this is from Ookla, they have a 5G map. They track worldwide all the deployments of 5G. If you count all those dots on there, there's about 20 dots. If you go to Ookla map, you can expand on each one of

those and see which carrier and what city is located there. Very interactive map. The thing that's disappointing to me as a consumer, I went back and I looked when Verizon launched LTE. They launched 38 cities and most major airports all at once. All four vendors combined aren't at 38 cities yet. To me, it's been not a very robust launch of 5G. It's what we call 5G non-standalone. Before I get there though, there's also device limitations.

Today you can get a Samsung phone with a Snapdragon X50 5G modem in it. You can see there that it works in the millimetre-wave bands, it works in the low bands. It can only do time division duplexing, and it can only work with what's known as the non-standalone mode. The next generation devices that will come next year will add frequency division duplexing, which means in the lower bands and standalone. A person buying a 5G phone today, won't be able to work on the lower bands next year and in the 5G standalone that's coming.

What 5G standalone is - this picture is one step ahead, where it says 5G core at the top. Today it's working on the evolved packet core, or the 4G core from the LTE network. That's why we call it non-standalone. The 5G new radio in the blue is connected to the 4G LTE base station. This is what we call the 5G non-standalone architecture. If you're in the millimetre-wave band, your footprint of your 5G is very small compared to the 4G. This is the status. Even though there's 5G in a lot of these cities, the footprint is very minute compared to the 4G coverage. Except for Sprint; they launched at 2.6 gigahertz. They have much better coverage for their 5G where they've deployed than the other three carriers. They still can't penetrate indoors like the 4G does.

So, where's the industry need to go? First, they need to get to the 5G core so we can move to 5G standalone and start rounding out the coverage with more 5G standalone cells. They can only anchor one 5G to each LTE. You can't put out more LTE nodes. You already have the coverage in LTE and now you can start populating with more 5G standalone nodes to round out your coverage. That's where the industry needs to go and that's what they're going to be doing in 2020 as they launch more. The other thing they can do is what's known as dynamic spectrum sharing, where they can put - share the 5G spectrum on the red LTE node and make it when there's 5G users asking for capability there, it can run 5G. When it's the 4G it can run - and it can run them both at the same time and dynamically allocate spectrum between the two based on demand.

That will give them the bigger footprint. They can say it's 5G, but it's on a footprint in a frequency band that has limited spectrum. If they're still using the LTE spectrum, because 5G, the promise of that, is because they can have one gigahertz of bandwidth. In LTE we only had 100 megahertz of bandwidth. If you have limited bandwidth, you have limited capacity, even though it could still run a 5G phone on that network.

What the industry wants to do is move to the 5G core. This is what we call the 5G service base architecture. These are the network elements, or the network functions, that run in the 5G core. At the top you have the data layer. In the middle you have the control plane. In the purple - red, purple in the bottom, you have the User Plane, or the User Plane Functions. You can see there that it separates, and now I have a User Plane Function that's separated from the control plane. I can start now having edge data

centres. I can move these edge data centres anywhere I need them. Regional data centres, local data centres in a metropolitan area. Even data centres inside an enterprise. That's the promise of 5G, to be able to put this data centres wherever I need it to lower latency or to reduce back haul costs on not moving data back and forth to the central office all the time.

Then in the lower left, you see the different access network technologies. The 5G core service base architecture that's been designed, has been designed not only for 3GPP access 5G, but also non-3GP access, like Wi-Fi, could also access this. Also, the way this service based architecture is orchestrated is with the different planes; the data plan, the User Plane, the control plane, and the data layer is for these network functions to be cloud native network functions. All the trials that were seeing now with 5G core are with cloud native network functions. To date, there is no 5G core out there. It's all working on the 4G core, non-standalone and we're going to be moving forward to the 5G core in - sometime in 2020. Probably mid-2020. We'll see these 5G standalone handsets probably come out in the Mobile World Congress, Barcelona, next year. Announcements being made and be available shortly thereafter, in the April, May timeframe. We'll start seeing some 5G standalone networks being announced.

With that as a precursor of where we're at today. You can see, maybe some of the mistrials and missteps. Verizon got out there a little bit before they could get the ecosystem with 3GPP compliant for fixed wireless access. If you're an AT&T user, you already see 5G on your phone. It's called 5GE. It's really 4G with a lot of capacity that 4G can deliver. A lot of consumers may think they already have 5G. Very spotty coverage to date. We don't have a lot of coverage. In fact, the exception of Sprint and T-Mobile, coverage maps don't exist. It's very hard to even know where to go to use your 5G if you have it. When we say it's in nine cities, it's probably nine cell sites. Those nine little blue dots in those cities. It's not pervasive coverage yet.

I would like to ask each one of our panellists to talk about how they can help the 5G core and the service providers, in their networks. First, I would like to start with Kelly and talk about how Versa Networks can help, especially in the User Plane Function, that is where we can now move that User Plane Function to the edge. I think the big challenge is how you're going to manage that.

Kelly Ahuja, CEO, Versa Networks

Thanks Dave. First of all, kind of putting things in perspective. In the 4G world, the network architecture was very centralised. In the context that - much like you have traffic going from all these cell sites, it would actually go to a handful of locations around the US, where you would then have the network perimeter to go out to the internet. The network architecture was very centralised. The promise of 5G is really about using any type of access, as you saw earlier, and being able to deliver the performance to the user, the speeds and capacity to the user, but at a cost point that the SP can deliver that service at which is much more effective. With that model, what you're going to see is a lot more distribution of the network.

That's what Dave was talking about, which is the edge of the network today in 4G, is a handful of locations, maybe N times 10. In the 5G context, those edges could be very distributed. Could be 100 or 1000 times where that 5G edge could be on an enterprise premise, it could be at an airport, it could be at a store, it could be anywhere else. Those functions that you saw in the core network, some of those could be sitting on those. If you put that in perspective and you say, what is a network required to run those functions, or connect those functions together, that's where Versa and the technology that we have plays in. While we've been known to do things in the service provider world for business services, the technology that we build applies to any network that you want to be able to go build.

For example, we're a simple router with a lot of intelligence, with SD-WAN, and a full security stack. What can you do with that? At every edge node that you have out there, you can actually have a Versa instance running, whether it's running bare metal or as a function, that's really the customer's or the provider's choice. It can sit beside any of these mobility functions; UPF as you call them, the User Plane Functions, or other types of functions. The thing that the edge needs to do is the following, which is halve traffic coming in from 5G users coming into that edge node, determine what the SLA that's required for that application or service, and send it to the best path that's going to deliver that. Whether it's a low latency path, a best effort path, or something else; call them slices. We can actually take that information, take that traffic coming in, understand what the SLA required for that is. If it's a real time application that's requiring a voice call, maybe you'll want to send it off to the internet directly at that edge node. If it's an on-net requirement for that traffic going to a centralise data centre or a secure connection to an enterprise data centre, you want to keep that traffic on-net as far as possible.

We have the intelligence to be able to detect what that traffic type is, based on policy settings, we determine where that traffic needs to go, and guide that traffic. With that model in mind, our approach to building the 5G network is to really be the underlay and provide an overlay connectivity. Why? Many of these User Plane Functions that will sit across many of these locations, have to be connected together. They - just like in the mobility world, you had PGWs that connect together and SGWs that connect together. UPF have to connect together and many of the signalling plane functions have to be connected together. To build that across any underlay network, you need an overlay network.

An SD-WAN fundamentally is an overlay technology that allows you to build a large-scale network sitting on top of any underlay. It could be fibre, it could be internet, it could be MPLS, or radio, it doesn't really matter. We've actually been working very closely with some of the leading providers of 5G on the infrastructure side and leveraging our technology into use cases they feel are going to be necessary. The simplest one though is not even the UPF function. It's really 5G as being a access technology as a failover technology to 4G, which is actually - we've done tests with providers and vendors that actually do that. That's kind of where we fit in Dave, with - in a nutshell. There are a lot more things to talk about; I'm sure we'll get into that after maybe Jeff gives his…

Dave Bolan, Core Industry Analyst, Dell'Oro Group

Yeah, you're right about that. The service providers are actually waking up to the point that we're not going to have 5G voice right away. So, when you want to make a voice call on your 5G phone, it's going to fall back to LTE, which is VoLTE or Voice over LTE. It can't go back to 3G or 2G, which a lot of people do today. If VoLTE fails it goes to 2G or 3G. In 5G world we don't have fallback to 2G or 3G - we only have fallback to VoLTE. Now, service providers around the world are upgrading their users as fast as they can to 4G and VoLTE. In fact, I think Verizon will be turning off its 3G network at the end of this year and they will only have LTE and 5G on their network.

I talked about non-3GPP access to the 5G core. There's been a lot of debate in the industry where does 5G stand relative to Wi-Fi. I thought it was interesting to note that Verizon, who said they have 13 NFL stadiums, one of them being the Indianapolis stadium, also is putting Wi-Fi 6 in there. So, they're putting 5G and they're putting in Wi-Fi 6. I'd like Jeff to maybe talk about what's Wi-Fi's role here with 5G coming, and why would a service provider do that?

Jeff Lipton, Vice President of Strategy and Corporate Development, Aruba-HPE
Sure. Thanks Dave. The first think I'd like to do is to back up for just a minute and say, what are we trying to accomplish here? What's the meta-trend? To me, the meta-trend at the edge is we're at a point where we're trying to connect more things and we're trying to derive context out of those things. Those things could be users; they can be an iPhone or it could be a computer. It could be a thing at an oil processing plant or in a manufacturing plant. There are lots of things we're trying to connect. To connect those things, there are a number of different serving technologies. Those would include 5G, they would include Wi-Fi 6, they might include Zigbee. Another technology may be AI or ML. There's edge compute. I think you're starting to see a bunch of different technologies that are really trying to serve that. That's the first thing.

If we drill down into the connectivity technologies. How does 5G compare with Wi-Fi 6? Which one is good for what? We've done a lot of extensive comparison. What you'll see is if you do a constellation map of the different capabilities of Wi-Fi 6 and 5G and you look at things like throughput, and connection density, and determinism, they're pretty darn close. Where they really differ is macro area coverage. That's one area where 5G is good; so if you're out and about and you need to cover a really big area. Highspeed mobility, where you need to do highspeed handoffs. That's where 5G, like LTE, excels. That's what it's designed for.

In order to get those two capabilities, you're going to pay at a minimum of three to four x the network costs that you would of an IEEE type of platform, like Wi-Fi. Like anything else, you look at, well what do I need to do, and then how much do I have to pay to do it, and what makes sense for me. Our view is that going forward, you'll still see 5G work where you need that mobility in your macro coverage and you'll still see Wi-Fi be dominant in places like inside of buildings where you need to connect things.

The next question is, how do they work together? Kelly and Dave mentioned a couple of different things that I noted down. Kelly mentioned SLAs for carriers, which is an important thing. Dave mentioned this idea that 5G cores are agnostic to different RANs. That's really a key point. That's something that's coming out, I think, in R17 of the 3GPP 5G spec.

Dave Bolan, Core Industry Analyst, Dell'Oro Group

Release 16.

Jeff Lipton, Vice President of Strategy and Corporate Development, Aruba-HPE
R16. Okay. R16, which isn't quite here yet. When that happens, you'll be able to connect basically any RAN to the 5G core, including Wi-Fi and Wi-Fi 6. So, who cares? Why is that interesting; why is that exciting? Right now, what you're seeing is, if you're a carrier and you want coverage inside of your building, you have different ways of doing it. You can use a DAS system, which is a - it's called the neutral host system because you can have one system cover many different carriers. That's attractive for obvious reasons. You can have small cells, which are not neutral hosts. You would need one small cell system for AT&T, another one for Verizon, another one for Sprint, and so on. Or you could use Wi-Fi.

The problem today with deploying Wi-Fi in front of an LTE core is that the carrier can't get control over the SLAs, and they don't get visibility into what their subscribers are doing. They don't like that because they want to be able to have these things in their business. It's sort of what their business is built on. With Wi-Fi 6 and a 5G core, you can bond those two things together. You can bond Wi-Fi 6 to the 5G core and you can then, using the equivalent of an evolved packet core in 5G, you can then use Wi-Fi as a very integrated front end to 5G and you can get all those things.

We're already starting to talk with carriers about this notion of, hey if you're deploying something inside of a building, you want in-building coverage, don't use a DAS, don't use small cells, use Wi-Fi instead because you get what you want and even better and it's much more cost effective. Or, you can even work with your customers that already have the Wi-Fi systems and somehow figure out a way to work with them, to leverage that investment that's already there. We see this as a trend that's not talked about that much now, but we're seeing it a lot in our customer conversations. We think it's going to be a big thing going forward.

Dave Bolan, Core Industry Analyst, Dell'Oro Group

Jeff, I agree with you that I think the - there's no greenfield 5G network that's going to pop up every day, or tomorrow and everyone's going to be on 5G. It's going to be a transition. The best way to transition to that is going to be something that's there today. Wi-Fi is definitely there today. In fact, if you look at the ecosystem for 5G, it's still going to take some time for the standards, the components, the chip sets, all to come together into then an affordable package that will show up in our devices that we can use. It is - I think it is a journey, but that said, at some point in the future, having the

core being converged, it's certainly going to make it easier for the provider of whatever service type it is, whatever access type it is, to be able to use both.

Jeff Lipton, Vice President of Strategy and Corporate Development, Aruba-HPE
Yeah, I think that's right. I'm glad you brought up that point. The ecosystem for 5G will obviously materialise. It's one of the biggest ecosystems in the world. It's not going to be everything for everything. For example, when you hear certain carriers say, well we're going to go inside the enterprise and we're going to use 5G; maybe you don't need your Wi-Fi. Okay, that sounds good. How do I connect my printer? Well you got to then put a 5G modem on the printer. What does that cost? I don't know, about $100 per. Then I have to have a service plan for that. Do I - we have, I don't know, hundreds of printers in our building alone. Do I really want to do that?

There - again, there's this sort of notion that Wi-Fi is good for everything, or 5G is good for everything. In reality, nothing is good for everything and you have to look at the economics, and what you want to do, and figure out the best way to do it. I think the nice thing is that this system is starting to bring the IEEE technologies and the 3GPP technologies together.

Dave Bolan, Core Industry Analyst, Dell'Oro Group

One of the promises that I hear about 5G is not necessarily going after where Wi-Fi is already, it's going where ethernet is already. Maybe having the robustness, the reliability, the latency that a wired ethernet would have. Now a factory can disconnect and go 5G wireless. They're saying 5G will have the bandwidth, the reliability and the latency that industrial robotics application might need. That's one of the target applications I hear about in 5G. Also talking about service level agreements. I think a lot of this was envisioned before Wi-Fi 6 came along. I think Wi-Fi 6 has a lot of promise as well with bandwidth and latency as well. Is that true Jeff?

Jeff Lipton, Vice President of Strategy and Corporate Development, Aruba-HPE
Yeah. Like I mentioned before, if you look at throughput connection density, determinism, and I should also mention that we're deploying Wi-Fi 6 in a number of very largescale manufacturing facilities. For example, some of the largest car manufacturers in the world. They're using it for just that. Right now, we're the leader in - shipments wise in Wi-Fi 6. We were early to market and we're doing very well in that transition. I mean, it's working out really well. I also want to mention that you mentioned stadiums a little bit before. That's also a vertical in the market where we do really well.

We've announced that we're - we did Chase Centre; we did 49ers stadium as well. The 49ers stadium, when it was built, it was sort of cutting edge. People weren't - it was the first type of it's - that type of application. They started to put Wi-Fi under the seats to get the type of guest experience that they really need. We're doing that in Case now. That's sort of viewed as state of the art in stadiums right now. You can do a lot of these

things with Wi-Fi 6. We have probably tens of stadiums, including the newest and most state of the art ones, that we're doing that in.

Dave Bolan, Core Industry Analyst, Dell'Oro Group

Great. That's nice to know. Kelly, what is Versa Networks go to market strategy? Do you interface with the service providers or the infrastructure providers that are building out - that are supplying to the service providers? Where do you engage in the supply chain?

Kelly Ahuja, CEO, Versa Networks

Today we have about - yeah, thank you for that. Today, we have about 100 service provides that we work with. That's our customer base today, that actually take our technology, embrace it inside their network and offer it as a managed services to their enterprises. That's what we're doing today. In addition, we're also working with partners and some of those include IBM, Dell, Riverbed, for example, on the enterprise side. We're also partnering with some of the radio vendors that are building up the 5G infrastructure.

We actually are - the reason why we're doing that is because some of our service providers that are looking at 5G are going to their infrastructure providers and saying hey, I think this technology has an implication on how I need to build my network. By the way, here's someone that I'm building my network with. Can you go talk to them? They're actually bringing us together and we're engaged in use case definitions, figuring out what problem need to get solved, and actually doing lab configurations and trials with them on that.

Dave Bolan, Core Industry Analyst, Dell'Oro Group

Okay, thank you for the clarification.

Audience Q&A

Jan Guldentops, BA Test Labs

Jan Guldentops, BA Test Labs. I'm European and I don't know anything about the US market. If I see the introduction, is 5G in trouble? Is the deployment only on a handbrake right now?

(Unknown)

So, is 5G in trouble with the - you could say the minimalistic launches that we've seen to date. It's pretty much the same all over the world. Everybody's gone 5G non-standalone, with the exception of a couple of countries. Switzerland being one who has

pretty much ubiquitous coverage by two service providers; and Korea with three service providers. They pretty much have blanketed their two respective counties.

There's no reason why anyone else couldn't have done that as well. It's just - is it a matter of CapEx that's available to the people, timing on where people have evolved in working with it, in the infrastructure catching up? Because you really couldn't do anything until the 5G handsets came up. Do you have a follow up question?

Dave Bolan, Core Industry Analyst, Dell'Oro Group

We've got to remember what happened in the 5G world. They wanted to accelerate the deployment for 5G and that's what we have in 2019, is 5G NSA. That was before the 5G standards where you could say it was kind of complete and they wanted to go to 2020, was the real launch for 5G, which is what we'll see. Like I said, by the end of this - end of 2020, we'll have blanket coverage in the United States and the same thing will happen in Europe as well in 2020. The real momentum will happen in 2020. These are just stepping stones. Question over here?

(Unknown)

Thank you. I have a question; because of the 5G is coming soon and the IoT's market has become more and more bigger and the MBLT's technology - MBLT's agenda is evolution to use the 5G. So, I want to know the - in the past, Wi-Fi is just one choice of the IoT you know and, in the future, we use 5G, [unclear] IoT market and where is Wi-Fi's position? The Wi-Fi 6 is coming. Where is the difference of the 5G and Wi-Fi 6? Maybe the Wi-Fi 6 and the 5G have the same use case, like the factory use case, like the supermarket, also like the home house user case. I need to - you can talk about these things.

(Jeff Lipton, Vice President of Strategy and Corporate Development, Aruba-HPE)

So, I - I'm sorry, I didn't catch the whole question. I think I caught part of this question so please re-ask if necessary. I think one of them was in the industrial user cases and factories, what's going to happen between 5G and what's going to happen with Wi-Fi? I think you'll see them both play their roles. One thing you didn't talk about here is this notion of private cellular networks. When you talk about - you mentioned latency for cellular networks; when you're talking about the macro-network, the 5G network, you really can't achieve the latency numbers if they're advertising.

Because the reason is, you have to go from the RAN network and then you have to traverse the core and then back. So, the latency that you need to get, you're not going to be anywhere near you would be with ethernet and that's if the network doesn't drop out you, which it drops me about five times on the way to work every day. If you're talking about a private network, I think that's where you start to see the benefit of this latency and things like that. You may not be able to hand off to the macro-network but we are seeing some customers that are beginning to talk about private networks for critical communication.

Some people are doing it on Wi-Fi 6 because of some of the new determinism elements that we've put in there and some customers want to look at things like, CBRS, which would be LTE today over CBRS but some day in the future it'll be 5G over CBRS. Again, I think it's the combination of things and you'll see a combination of customer preferences but it's not all black and white.

(Kelly Ahuja, CEO, Versa Networks)

I was going to add to that, which is at the end of the day, all the - the world has gone to IoT, not moving; it's gone to IoT. There are several things that you have to consider when it comes to access technology. It's the cost of the footprint, the power footprint, the thermal footprint, because these things have to fit into many things. I think Jeff said it earlier, which is, you're going to see all different types of access technologies to connect things to the network. That could include today, Zigbee, Bluetooth, Wi-Fi-, Wi-Fi 6, five - 4G, 5G, everything else but at the end of the day, will get used - will be a function of the cost and performance and the integration into that device and at the end of the day, it'll all be connected across a combined core, which is what 5G is working on.

Dave Bolan, Core Industry Analyst, Dell'Oro Group

I think it's important to understand that the 5G standard was designed to handle one million IoT devices per square kilometre, so they're expecting high-density usage and a lot of growth in IoT. Is there another question?

Manek Dubash, NetEvents

We don't - sorry, we don't have time for another question. We're out of time.

Dave Bolan, Core Industry Analyst, Dell'Oro Group

Okay, we're out of time? Okay. Thank you very much. We'll be around if anybody wants to have follow up questions. Thank you much, panellists, we appreciate it.