

Juniper Networks Inc to Host Tech Talk on 5G

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PRESENTATION

Operator

Greetings, and welcome to the Juniper Networks Tech Talk conference call. (Operator Instructions) As a reminder, this conference is being recorded.

I'd now like to turn the conference over to your host, Jess Lubert. Thank you, you may begin.

Jess Ian Lubert, Juniper Networks, Inc. - VP of IR

Thank you, operator. Welcome to Juniper's 5G Tech Talk. Joining me today will be Kevin Hutchins, Juniper's SVP of Strategy and Corporate Development. Today's call may contain forward-looking statements. Actual results may differ materially from these forward-looking statements as a result of various risk factors, including those found in our most recent 10-K and 10-Q documents and in other documents that we file with the SEC from time to time. All statements made during this call are made only as of today. Juniper undertakes no obligation to update any forward-looking statements.

There will be a Q&A session following this call, where we will poll live questions from the audience as well as the webcast. You can also e-mail jlubert@juniper.net, if you would like to ask a question and remain anonymous.

With that, I will turn the call over to Kevin.

Kevin Hutchins, Juniper Networks, Inc. - SVP of Strategy and Product Line Management

Thanks, Jess, and thanks, everyone, for joining this morning. I appreciate the opportunity to share our view of the 5G market opportunity and how Juniper will participate and benefit. I'm going to take about 30 minutes roughly to go through the materials, and then we'll open it up and go through all of your questions.

In short, our view of the 5G cycle is that it's a continuation of the upgrade of the service provider network to essentially increase over-the-air bandwidth to subscribers. But the 5G upgrade cycle will -- we think is going to play out over the next 4 to 5 years, and potentially has the opportunity to be a much larger transition, as service providers transform their network to, first, generate a more reasonable ROI from their 5G investments. And then also to exploit their advantage and high-bandwidth last-mile connectivity and also the possibility of delivering ubiquitous edge computing to capture adjacent and merging revenue streams that can offset their declining RPU in their core business. Unlike prior mobile upgrades, we believe that the 5G cycle is much more about the network, which creates incremental opportunity for Juniper.

So we're going to move on then to the next slide. So 5G is discussed quite a bit. For many of you, you might have been at Mobile World Congress last week in Southern California, and as there is with any technology transition, there can be some hype. So the first reasonable question to ask is, why will service providers invest in upgrades to 5G? Our view is pretty simple and it's -- I think, it's shared by many of our customers and peers alike. The main driver for 5G capacity. Traffic growth is continuing to grow overall by nearly 25% per year. Mobile traffic, in particular, is projected to increase more dramatically, almost by a factor of 3 over the next 3 years. Much of this increase is driven by growth in mobile device used for things like video streaming, gaming and greater use in enterprises as well. The increased traffic in this shift -- more demand for mobile networks is, of course, going to put pressure on the existing networks and drive capacity upgrades or risk losing subscribers. Capacity is I think what's compelling the investment, but the other factor is that the pressure to invest is coming from what looks like an increasingly competitive market for fixed-mobile consumer and business subscribers. Many of the service providers and folks that are competing in this space are leveraging the move to 5G, to higher bandwidth services and more attractive bundles as a way of marketing to attract new subscribers. And this landscape of competition continues to evolve, including a lot of nontraditional competitors, such as the cable providers starting to move more directly into the mobile space and cloud service providers who have the network infrastructure to start offering over-the-top services as well, you've got a number of folks playing for the same dollars.

The last factor, and this has been discussed widely in the market as well is, the first main use case, and it's really building off the same drivers as the need for enhanced capacity, is to offer a better broadband service, right, for mobility and for the mobile subscriber. However, the service providers are also looking at once they have increased over-the-air bandwidth, especially as it becomes more comparable to what's available in fixed connections as well as the ability to offer lower latency in their services, it opens up the opportunity to capture incremental streams of revenue. Most of these incremental use cases, frankly, are less gated by the increase in bandwidth and instead are really gated by the ability to transform the network to handle those connections reliably and cost effectively, so that they can pursue those new services at scale and generate the necessary ROI. There's a number of different estimates on how some of these incremental use cases will contribute to service provider revenues, but I think, by and large, most people believe that there are a number of use cases that will be significant by the time get out towards 2025.

If we go to the next slide, once we get into talking about why we believe the 5G investment will happen, the next question that we would ask is, what really is 5G and how is it going to work. The 5G requirements are about really significantly expanding the capabilities and performance of the mobile network and the targets are pretty demanding, right? Anywhere from a 1 to 2 order of magnitude increase in the data rates to the end users, sort of getting into the 1 to 10 gigabit per second range per connection. 2 to 3 orders of magnitude increase in capacity. 10 to 100x increase in the number of connected devices. And even more so, as we start to move into the IoT domain, and then of course, a significant reduction in latency overall, down to around a 1 millisecond of round-trip delay.

As we noted, and we believe most others have acknowledged as well, the transition of these target we expect to be evolutionary and will take several years. But the more interesting about this is really the design drivers that are going to be needed in order to enable this kind of improvement. Obviously, a big part of this will be focused on the radio, as it was during the LTE cycle but in this cycle, it's really going to be more of a focus on channel aggregation, reuse of spectrum, and then the introduction of additional spectral bands, especially higher bands to drive incremental available bandwidth. So while that's a big factor, one of the bigger drivers that we are hearing from our customers as well as from -- our own analysis would suggest, it's going to really be about densification of access. And this is really about dividing and increasing the number of cells, both the macro cells and overlays with small cells, in order to provide more bandwidth density in the market. Small cells, including those that are using millimeter wave technology may also be overlaid further to increase bandwidth availability, especially in areas where there is higher population density and especially in the case of millimeter wave, where attenuation can be managed.

To support the increased density, it's also -- you just -- you don't get it for free so you have to go and increase the amount of connectivity for backhaul and fronthaul to get traffic to and from these access points. The additional connections are going to be at higher bandwidth and that's going to drive incremental and upgrade investments through the metro aggregation and core network, the edge network and then of course the IP core network to support that kind of traffic growth. In addition, cell densification is also been going to drive some decisions about the service architecture of the mobile network, really pushing the service providers towards virtualization, or what's also called NFV for Network Function Virtualization. While smaller cells increase the available bandwidth per connection, they can also make the variability in the connections, and handoffs and services within an individual cell much greater. And so this is going to make provisioning the network a much more onerous task. It could be addressed and the service providers could continue to address that through legacy architectures that are leveraging appliance-based service platforms but that's going to become much more costly and will drive the service providers to over provision those various services components in order to support peak demand. And as we know, many of those components are also pretty difficult to reprogram as demand changes. And so, in order to get flexibility as well as more cost-effective deployment of those services to support densification, we believe that virtualization is going to be a critical requirement to -- really to scale to support the number of cells. And then also to enable the spin up and auto scaling of services to cost-effectively support the increase in the number of sessions and connections, and even more so as we move into the machine and machine communication domain with IoT. Virtualization also is going to enable the migration of some of those advanced services away from proprietary integrated appliances onto a common IP based network and telco Cloud architecture, which we'll get into in just a moment, which we think is one of the key drivers of the future economics and ROI associated with 5G.

So moving on to the next slide. The prior slide described the design drivers and the network transformation required to deliver 5G. This slide is really intended to double-click on the economic drivers. As we already noted, traffic, particularly in the mobile network, continues to grow at a significant pace. Over the next 3 years, as I said, it's forecasted to more than triple. Unfortunately, the financial implications of this growth in traffic is challenging for many of the service providers, where revenues are forecasted to remain flat for the foreseeable future. This is driven by a number of factors, including unlimited data plans, quad plan bundles, which drive -- dramatically drive up traffic but make it more difficult to raise ARPU due to continued pressure from local and global competitors. With revenue slack, the service providers are really under continuous pressure to maintain a reduced CapEx and/or OpEx. And so this makes it difficult for them to make the necessary investments in 5G, including spectrum acquisition, cell densification, additional backhaul, fronthaul lines imports and capacity upgrades necessary, unless they can figure out a way to really make that business case work. And as we sort of alluded to already, we feel like this kind of puts a number of the service providers in a difficult position, and in order to do this and maintain pace with their competitors, they are going to have to figure out a way to make the investments anyway. So one of the key things of our thesis around 5G is that to get to the ROI, which, in terms of these investments is going to be critical, the service providers are going to have to rethink the way that they're going to build their networks and transform in moving forward to enable that enhanced ROI. So that's really where we get into the next slide, where we try to get into this a little bit more. This picture provides a high-level view of the transformed service provider network that enables 5G and reduces CapEx and OpEx to generate that near-term ROI, while enabling flexibility to leverage those investments to pursue new and adjacent revenue streams at a lower marginal investment level over the long term.

There's a lot going on in this picture, so let me see if I can orient you a little bit, and then we can discuss the 4 major elements of the end-to-end network transformation and how Juniper is specifically positioned to lead each one. So we put the numbers on the slide to try to make it easier to follow what's going on here. And if we just sort of start with the first one. As I mentioned before, virtualization is critical to collapsing multiple services onto a converged IP-based network. In our simple view, virtualization allows us to move really, much more complex functions, which in a lot of cases today are delivered with proprietary and legacy standalone networks, and move that into just an application running on the network. An example for this is, if you are following the transformations that are going on in cable, the move from legacy cable architectures to the distributed access architecture under DOCSIS 3.1, is really a great example of the power virtualization to take advantage of the continuation of the service, while also taking advantage of existing IP-based networks to deliver enhanced service to the subscriber. In this case, providing gigabit service to the home. Traditional cable architectures were built on a proprietary network of coax and CMTS that was delivered in the head end, with the distributed access architecture, the services transformed into an access node, which converts ethernet to coax but -- while maintaining the existing coax-installed plan. And then, a virtualized headend or a virtualized CMPS or virtualized CCAP that provides the services. All of the traffic, in between, runs over a standard IP-based network that has significantly greater scale bandwidth and reliability.

In our view of 5G, multiple services will be virtualized, like I just described, including the mobile services, enterprise services for delivering broadband or SD-WAN, the fixed residential services as well as IoT. The other part of this is that we believe in -- it's part of the virtualization that these services will be run out of what's called a CUPS-based architecture. CUPS is an acronym that stands for Control User Plane Separation and in a CUPS architecture, the control plane of each of these virtualized services may be run from a distributed telco cloud platform and that platform could either be purpose-built, running in the network of the service provider or it could be running in a public cloud or in both. And this really enables the spin-up autoscaling in service chaining training to cost-effectively support the change in number of sessions and connections in demand for specific services, like we described before. So it really allows the service provider to take advantage of cloud-based architectures to provide scale out capability with regards to the control plane. To minimize the latency and service disruption, while maximizing the economic benefits, these telco clouds are going to be deployed in the edge of the network and will be designed for easy handoffs and failover. And as part of this, the corresponding data plane or user plane as part of the CUPS architecture, can either be deployed running in software in these distributed edge clouds, especially for services that have lower bandwidth requirements or can be virtualized as a user plane running on a CUPS-based router, like the MX 5G that we'll talk about in just a minute.

Virtualization adds the ability to really, like I said, remove specific service requirements from what previously has been proprietary components of the network. And so this gets then to number 2, which is the ability to then start the bring multiple services together onto a converged IP-based network. And this is really central to the architecture on economic thesis for 5G and delivering that enhanced return on investment that the service providers will need. With a common IP-based network that extends end-to-end from the access point back to the app or to the point of service delivery, the service providers can take advantage of a couple of

critical things. The first is, IP is really the best technology for delivering multiple services, stat-mux with high reliability, security and isolation. It also allows elimination of proprietary or purpose-built networks. And then, brings into the running of these services, a number of innovations that have already been put in place and are standardized now for delivering performance, reliability and things like network slicing and isolation of services. By moving onto a common IP-based network, it really delivers significant scale economies for the service provider, both in terms of CapEx and OpEx, and that allows them really to get at that ROI. With virtualization and a common IP-based network, while this significantly reduces the cost of building and maintaining the network, it also adds significant complexity to the operations of the network. And so, this is where we really get into number 3, which is services are disaggregated and virtualized in a scale-up model, there are many, many more elements and -- that are going to be running in the network. And many of those elements are going to be -- they're going to be running in environments that are not currently tooled or supported within the legacy environment. And further, the performance requirements in the 5G network are too demanding to rely on the existing legacy operations and configuration tools. So in our view, number 3 is really about bringing a cloud-native, platform-based approach to providing a common management plane and analytics plane, with rich APIs that simplify the monitoring of the network, the services within the network, the configuration and automation of those services. And then, of course, the troubleshooting and remediation of potential problems.

The last, here on -- really one of the keys to transforming to the service provider future network, is #4, and that's security. Security has always been a critical requirement in the mobile network but it's even more so for the end-to-end 5G architecture in order to maintain compliance service isolation and protect critical infrastructure from breaches and infiltration. While security is a component of this overall solution, the transformation of the network is going to have to move towards a combination of different technologies, including security built directly into the transport layer so that on an end-to-end basis, you're maintaining encryption as well as the ability to isolate and protect between different services. And then of course, inspection at different points within the network, because particularly in 5G, we're expanding the number of ingress and egress points. And so, we're going to get into each one of these in just a slightly increased level of detail and talk a little bit about specifically what Juniper is doing in each of these.

So let's move onto the next slide. So this is where we double-click a little bit more on virtualization. As I noted, this is one of the key transformations of the 5G network. The current service provider networks are under tremendous requirements to maintain their availability and reliability with respect to things like drops and interruptions of service. As noted with the requirements outlined earlier in the discussion, the demand is going to become even more stringent, as we move to 5G. And so, our view is that in order to make 5G work, we're going to -- the virtualization architecture is really going to have to move increasingly towards CUPS. CUPS is an architectural separation of the controlling user plane. So for example, if you think about the EPC, this is really about separating the controlling user plane for the S- and P-gateway, using something called the Sx interface. This follows -- if you're a follower of Juniper, one of the things that you'll recognize is, this is actually very similar to one of the major innovations that Juniper initially brought to routing, which is the separation of the control and user plane, such that you could independently scale and innovate within those functions to drive greater performance, reliability and scalability. And moving to a CUPS architecture, this does a few things. So it allows the user plane to be distributed and deployed and scaled independently from the control plane, as I noted. It allows it to either run within an existing telco cloud environment, so it can run as a soft-user plane for lower bandwidth type applications, or it can run in a hardware form factor, like the MX 5G, which I'll talk about in just a minute. Multiple user plane instances can be scaled, based on their workloads, interface status or subscriber capacity demands. And obviously, you can build in logic to support failover such that you can increase reliability dramatically. This also allows you to flexibly put the user plane physically in the right location to maximize the performance, such as at the edge of the network or co-located at the ran site or at a nearby aggregation side. On the control plane side, the control plane is -- can be run centrally in a telco or a hybrid cloud architecture. And again, this really allows you to move towards leveraging cloud-based architectural solutions to maximize scalability as well as the performance characteristics that are necessary to deliver these services.

Juniper is well positioned to lead in virtualization and transformation of our service provider customers. You may have seen, we just recently announced our next generation Contrail Edge Cloud. This is based on the leading deployed software-defined networking solution for cloud and mobile automation. The Contrail Edge Cloud is a complete hardened solution for virtualization and hybrid telco cloud, we've more than 35 Tier 1 and Tier 2 deployments in production. We've optimized our solution to support the converged 5G network, including complete visibility, leveraging AppFormix, which was an acquisition we did a few years ago as well as partnerships, both with leading VNF providers that are key to delivering the mobile services as well as Red Hat for compute and storage. We've also obviously, deployed a number of our own VNFs that are critical to supporting the mobile use case. We've been in the market supporting NFV with Contrail and a number of these partners for now a few years, and with the early advantage we've been able to learn a great deal about the requirements for delivering virtual services that can be delivered with performance latency, reliability and scalability needed for 5G. And so, a lot of that has been captured and built into this next generation version of the Contrail Edge Cloud. And I think, this positions us extremely well as more and more of our customers begin to move their telco cloud deployments from early-phase design efforts into large-scale productions to support 5G.

We also recently announced the MX 5G. As many of you know, the MX is one of the most successful service provider routing products and it's deployed in nearly every service provider in the world. More than a year ago, we introduced node virtualization and network slicing capability on the MX. This is now in deployment at a number of Tier 1 service providers. You may have seen the press release from us that included Verizon, where we're -- this product was specifically used to deliver what they called their multiservice edge, and allowed them to collapse a number of services onto a single node and manage that very flexibly and scalably. Node virtualization and network slicing are critical technologies to enable the convergence of multiple services onto a common IP network. And so, we feel like having that out in the market and deployed is giving us a significant advantage towards delivering this value proposition for our service provider customers. With the MX 5G announcement, we also introduced the ability to use the MX 5G in a CUPS-based architecture. And so service providers can now, with a software update, upgrade their installed MXs to run as a 3GPP user plane. This greatly simplifies the transition of virtualization that I was describing. It allows the service providers to leverage their existing investments as well as minimize any near-term OSS/BSS integration risk and it provides all of the critical user plane functions, such as routing, header manipulations, QoS, et cetera, that's really needed to run the 5G network with performance, scale and reliability. Leveraging node virtualization as well, the MX 5G can be deployed as a next-generation converge core for mobile EPC, for residential or fixed broadband gateway as well as residential gateway, SD-WAN and IoT user planes, all on the same platform. And the last bit here is the MX 5G capability, while it does make the installed platforms immediately more valuable in 5G, it also is available -- the functionality is also available in our recently launched series of MX10K products, including the MX10003, which leverages the Universal Chassis architecture to significantly reduce the complexity and total ownership cost for service providers across the entire 5G network.

So that's -- a little bit more. The next slide gets a little bit more into some of these different platforms and why we're well positioned as well around the converged IP network. I'm going to try to just speed this up to make sure that I don't take up all of our time on the slide. But the net of this is that with virtualization, it really allows the opening up to a converged IP network. IP is really the best technology, as I said before, for statistical multiplexing of all of these multiple services. And really, Juniper's strength overall as a company is IP-based networking, especially with our One Junos operating system. All of our platforms are based on One Junos

which is a -- it's a proven programmable feature-rich OS that delivers performance, scale and reliability for carrier and cloud-grade applications. It also now, as I mentioned, delivers node virtualization, network slicing and control plane separation capabilities. And most of this is already in deployment today with a hardened programmable, well-defined APIs, the feature capabilities. The Junos-based platforms are very well positioned to help service providers move into the architecture that we articulated here before and deliver that return on investment.

We are continuing to build out -- we have a number of the platforms that are ready to go already, specifically in edge, aggregation and core roles in the 5G network. We are continuing to build out the remainder of our portfolio, especially in the access and aggregation portion of the network, and we're -- in all of our platforms, we're leveraging the benefits of common hardware, timing and synchronization, built-in transport-level security as well as streaming telemetry to enable full visibility, programmability, effective handoffs as well as security.

And then last but not least, and we'll get into this here on the next slide, is really about leveraging Contrail to build out that platform for management that I described before. The complexity that's going to be required is really going to move us away from a world where each individual element of the network is managed using command-line interface or a simple set of tools or even worse, has to be continually integrated and reprovisioned through the OSS/BSS layer. And -- so our view is that moving to a cloud-based architecture for managing and monitoring the 5G network is critical, to provide a clear abstraction and set of APIs that support the management plane, set of automation tools or bots as well as telemetry and analytics, so that you can run and optimize the network at a much lower cost and meet the stringent SLAs is really key. The -- we've been working on this platform, it's really leveraging upon the multi-cloud technology from Contrail Enterprise Multicloud and AppFormix. It's meant to be a standard abstraction layer for configuration management and automation. This is really one of the most timely -- time consuming and costly issues for the service providers as they transform their networks. And so it provides a really accelerating type capability, as we move into 5G. It also provides the ability to collect and normalize all of the telemetry coming from the physical and virtual layers that are built into the network, and then allow those to be blown down into key alerts, recommended actions to troubleshoot, remediate problems and then optimize the performance of the network.

In the 5G world, while we'll continue to see a lot of manual intervention by operators, there's going to be so many elements that are going to be moving at any one time. Increasingly, we're going to have to move towards a world where telemetry could be used to automatically take actions and really go towards what we've termed the self-driving network. The -- it's -- the complexity and the security risks are just going to have to be there to both augment, and in some cases replace operator actions where time and performance are critical.

Last couple of slides here, just on the security side real quick. Security compliance, protection of data, protection of critical infrastructure are really key in 5G. As I noted, when we move towards virtualization, we move towards leveraging the public cloud in certain instances, there's just a -- and with IoT devices also being introduced, there is a significant increase in the number of ingress and egress points. And so transport-level security, policy-based encryption as well as the ability to provide truly high-performance, high-session scale security throughout the network is really key.

With our recently upgraded SRX5K platform and the SPC3 line card, it provides best-in-class performance for mobile use cases as well as our virtual SRX and containerized SRX for deployment throughout the network. So we believe that we're bringing a number of the key components to support this overall use case.

So I've talked about our vision of the 5G network, how it transforms specifically to support 5G requirements as well as the return on investment requirements and the operating requirements that the service providers need. As I've said, our view is that the network is key to making 5G actually work. And also, as many people have said, when you move towards this type of network design, it becomes an incredible platform for innovation, which then enables new use cases. So we've talked about that. Now I guess the question is, or the 2 other big questions that you're probably then wanting to know is how big are these opportunities for Juniper and when will they play out. So this slide really gets into the former question. And in our view, the transformation creates significant incremental opportunities in 2 ways.

First, through upgrades within our core markets. So as I noted, there is going to be increase in the bandwidth that's being delivered, going to multi-gig level service to the subscriber, both in the fixed and the mobile networks, and this is going to translate into increased bandwidth and upgrades in aggregation, edge and core networks to support that. The other piece of this is with virtualization and the move towards converging multiple services onto a common IP network. It also gives Juniper a much expanded opportunity to pursue a greater proportion of the overall 5G solution. And that is really articulated here.

We really see this as overall a \$50 billion market opportunity for us in 2020 by going after all of the components, especially now with our extended partnership with Ericsson and other partners to go after the full end-to-end solution that's necessary to deliver on -- to 5G.

And then the last slide, with regards to timing, we noted that 5G is going to play out over a number of years. Our view is, the investments in 5G-ready IP-based networks has already really begun, where service providers are making investments to upgrade their metro networks as well as their aggregation in core networks today. They are making those with the intent of making them 5G-ready. And I think we're going to continue to see that play out over the next few years. The additional connectivity that's also going to be required at higher bandwidths to connect more access points with cell densification as well as the introduction of small cells. That's eventually going to drive even more incremental and upgrade investments through the metro aggregation in core and edge and IP core as well.

In terms of the move towards 5G, a number of folks have made announcements. I think there were a number of new announcements that came out last week at Mobile World Congress. The initial 5G upgrade investments have really started, but are expected really to start picking up in earnest in 2019 and into 2020, especially in the low to mid-bands. And then, as spectrum and chipsets become available to support additional spectrum, including millimeter wave to augment bandwidth especially in dense population zones. We expect that to start playing out into 2020 and beyond.

On the telco cloud and CUPS side, we have a number of design wins already. We have production and deployments today with a number of service providers. We do expect though that this is still in the beginning of this transition, and we think that this is going to pick up in 2019 and 2020 as the service providers really begin to transform the networks in earnest in order to be ready for 5G, the radio upgrades and the need to drive a greater network transformation to free up more investment capital.

And then lastly, on the incremental use cases, some of these will come out sooner. I know Verizon just announced that they're going to try to get fixed wireless into production on a limited basis. We definitely think that IoT is starting to get a little bit of traction but in terms of these maturing and becoming more widely available, our anticipation right now is towards the end of 2019 and into 2020 before that starts to take off. So hopefully that gave you a view of the way we see 5G and how not only are we participating

but why we think we've got a great opportunity going forward. And I'm going to stop and then we'll use the remainder of the time for any questions that you might have. But thanks for listening.

QUESTIONS AND ANSWERS

Answer – Operator: (Operator Instructions) Our first question is from Rod Hall from Goldman Sachs.

Answer – Balaji Krishnamurthy: This is Balaji on behalf of Rod Hall. I wanted to probe a little bit on your TAM slide. So I think you're saying that you'll be going from \$10 billion to \$15 billion TAM to almost \$50 billion into next couple of years. Maybe if you could comment on the product area gaps that you may have, especially in access aggregation. How do you plan on plugging that? Would that be internal development? Or are your current product is sufficient to expand into that area as well?

Answer – Kevin Hutchins: Yes. Thanks, Balaji. That's a great question. So it's a great realm a combination. We've been making investments to expand our portfolio and make it more ready and usable in the access and aggregation space. So for example, our MX10003 while it has applications in edge and core applications, pairing applications as well, it's well designed for aggregation use cases in the 5G network. We're building on that with an upgraded ACX portfolio. So one of the areas that we're investing in. And this is also an area where we're doing a lot of joint work with partners including our expanded Ericsson partnership. And so part of the thesis of that partnership is especially in the access domain, our knowledge of the market and our ability to really understand the critical requirements there and how it ties more closely together to the radio architecture is key. And so being able to work more directly with leading partners like Ericsson there is really important. So we're making those investments, and you'll see platforms continue to rollout over the next 4 quarters or so to really support all of those use cases and get more access to that TAM.

The other part to the TAM, in terms of things like telco cloud and the converge core, we're continuing to add those use cases to existing platforms. And so I think that's an area where we are making investments, but we do have a lot of product in the market today. For example, in telco cloud, we've got -- we already have Contrail, we just announced our next-generation Contrail Edge Cloud. For the infrastructure for the telco cloud, we were just recently named as the leader in Gartner Magic Quadrant for data center. So we're continuing to build out more extensive portfolio, leading portfolio in data center. And then we're expanding as well partnerships that we have to make sure that we can deliver a full integrated and hundred solution to support those use cases. So it's a mixture of both. We have a lot but we're also continuing to aggressively invest -- they're both -- on our own and through partnerships.

Answer – Operator: Our next question is from Tim Long from BMO Capital Markets.

Analyst: Timothy Patrick Long, BMO Capital Markets Equity Research - Senior Equity Analyst

Question – Timothy Patrick Long: Just a question somewhat related. When you're looking at the investment that -- in the network architecture changes and evolutions that telcos are going to be undergoing here, could you talk a little bit about how much they view as really related to 5G and how much of this is just a densification and advancement of the network that's still appropriate for 4G purposes? So I just kind of want a sense of this. Could this still be a successful migration for Juniper even if, let's say, the RAN part -- the RAN access takes many more years to really get going?

Answer – Kevin Hutchins: Yes. No, I think you're asking the right question. And as we noted, our view is, this really is going to play out in an evolutionary way. So the -- I think, the service provider's trying to manage their CapEx and make sure that they can deliver a clear return on their business case are going to move in a measured way. What I would say though is that the bandwidth requirements to even move evolutionary are going to drive, and already are driving, upgrades overall in the bandwidth in backhaul, fronthaul, and then correspondingly, in the aggregation edge and core as well. So at a minimum, that's going to continue to be an area of investment and opportunity. And it's definitely an area where I think, not only with the Ericsson partnership but even just with -- if you look at our fixed customers that are focusing more on residential and enterprise business, they also are moving to upgrade their service. So those opportunities, I think, are going to play out here no matter what. But I think, in order for the service providers to continue to stay competitive as well as to get access to these more advanced revenue streams, they are going to continue to look for opportunities to transform. And again, they already are, they're already investing in telco cloud, virtualization and security. It's just a question of how far and how fast are they going to go. And -- so we believe that there is going to be an opportunity here even if it plays out over time and is evolutionary.

Answer – Operator: (Operator Instructions) And there are no further questions over the phone. Jess, were there any questions online?

Answer – Jess Ian Lubert: Yes, we have several questions online. First one is on the Ericsson partnership. What is new about the relationship? Why did Ericsson pick Juniper over Cisco? And discuss the opportunities this partnership is likely to open for Juniper as 5G deployments begin.

Answer – Kevin Hutchins: Okay. It's a great question. So we're very excited about expanding our relationship with Ericsson. What's new about this is that we've had a relationship with Ericsson for a number of years. This really was focusing on delivering a full end-to-end integrated mobile solution that allows service providers to more easily evolve towards 5G. And one of the core components of this particular partnership that we announced is bringing that end-to-end IP-based network solution based on a single operating system, which is Junos into the market. So this is everything from access fronthaul, backhaul, through the aggregation network as well as into the Edge and the core. And this is really on a best of both capability. So this is leveraging Ericsson's real strength in the radio network and the investments that they've been making with their understanding of the way the radio network's going to transform in the fronthaul, backhaul portion of the network with their Router 6000, and -- as well as then the strength that Juniper has in terms of a best of breed portfolio in ACX, MX and PTX for the WAN 10-, 100- and 400-gig optical transport including things like node virtualization telemetry and then as we move towards CUPS, it also encompasses the investments that we've made in mobile security. This is an area that we've, again, worked with Ericsson on for a long time but obviously that's expanding as a part of this. And then bringing that all together with a unified management and control basically single pane of glass to make that as easy for our service provider customers as we can.

I think we've already announced one of our first deals at Swisscom. There was a press release specifically around this. And I think, it just shows that clear value proposition, building on the end-to-end portfolio and being able to offer a seamlessly managed and orchestrated, a less complex overall high-performing network for 5G and helping those customers really drive that transformation. With regards to how it's different from Cisco, I wouldn't want to necessarily entirely speculate on all of those factors. The one thing I would say is that Ericsson and Juniper have been great partners for a number of years. We complement each other tremendously well. We engaged and have engaged well with customers for a long time. And I think we bring the strength of our 2 different

portfolios and our combined capabilities to bear on the needs of the customer for 5G. So I think it's a very exciting opportunity and a way for us to drive this transformation even faster for the service providers.

Answer – Jess Ian Lubert: Next question is, how do you feel your 5G portfolio stacks up relative to Nokia, Huawei and Cisco and what they can bring to market? What are your key strengths and what are your weaknesses?

Answer – Kevin Hutchins: Yes, I think all of our peers in the market are obviously very competitive. And so we absolutely respect what they're doing. I think with our partnerships, I just talked about Ericsson, obviously, we have other critical partnerships as well, including Samsung, NEC. We have partnerships with Red Hat. So we've been very conscientiously building out on the right relationships in the market in order to deliver a full suite of solution on an end-to-end basis to deliver the vision that I just articulated. So I think being able to bring that full end-to-end solution is going to be key but the other key piece, and I think this is the other big areas of strength that we have is, first of all, we're really pursuing this as a best of breed in each competent. So we're not just offering an integrated solution but really, on any one element, we bring the best performance, the best investment protection, the best scalability, the best programmability. A lot of that is driven because we have One Junos across the portfolio. The strength of Junos whether it's running on our platforms or our partner's platform is really key. In terms of API-based programmability, automation and the ability then to really deliver some of this advanced functionality such as node virtualization, network slicing and CUPS, which are going to be key to getting to virtualization and the convergence onto a single IP-based network.

The other is Contrail, AppFormix and the platform capability. We've been in this space for a while, like I said, we've got the leading software-defined networking solution specifically for NFV. And I think that gives us a lot of opportunities to really help our customers be much more effective. But I would also go a little bit further, I mean, bringing on Bikash Koley as our CTO from Google and really giving him the range to then take that and combine that together with his knowledge of how you build large-scale cloud-based architectures that can really drive the management of these types of network solutions that are much larger scale. I think it's key as well. So we feel like we've got all of the right elements. I think our main weaknesses here are just going to be continuing to complete the elements of our portfolio and then having the right relationships to go and engage further in the market. And of course, we're going to be putting a lot of energy into getting those done here over the next several quarters.

So we've still got work to do, but I think we're starting with most of the right elements to get this done, and we're excited about our ability to lead here.

Answer – Jess Ian Lubert: The next analyst has 2 questions. Are telcos consolidating vendors ahead of 5G? And the second one is, Juniper has historically not been a big player in backhaul. Will that change with 5G?

Answer – Kevin Hutchins: So we haven't really seen necessarily a consolidation of vendors per se. I think service providers will definitely try to build an architecture that gives them choices and the best economics. But our view is that we're going to have to invest to win each of these components of the network as the service provider moves in that direction, and we're going to have to demonstrate how our overall solution creates additional synergistic value for service providers as well. So no matter how they play this out, we're going to -- we're going to want to compete on that basis. With regards to backhaul, our goal is -- here is to really be able to deliver this architecture and value to our customers. And so we are putting more investment into the access and aggregation portion of the network. I think on a relative basis, it will still be smaller than our core and edge business for some time. But we do expect it to get larger. There's a lot of investment going into that space overall right now. And so we definitely want to participate and capture more of that opportunity.

Answer – Jess Ian Lubert: Our next question. Besides Ericsson, who are your third-party RAN partners? And to what extent do they have to open up the RAN software to make this promise a reality?

Answer – Kevin Hutchins: Yes, so our other big RAN partner is Samsung. We've been partners with both Samsung and Ericsson now for quite some time. We -- as I mentioned, we do also have other partnerships that are important to the 5G architecture including NEC as well. So I don't want -- and affirm -- so I don't want to lose sight of those. But in terms of actually creating the interfaces to the RAN, I think the initial architecture here is really more about working collaboratively with them to make sure that the access and backhaul portfolio has the right interfaces. And then as customers are ready to go to the next-generation RAN architectures, we want to be working closely together with those providers in order to offer the customers more value as well.

Answer – Jess Ian Lubert: So our last question. It seems that solutions like Contrail and other software capabilities, like node slicing and CUPS will become more important moving forward. What does this mean for the margin profile to your solutions? And is 5G likely to present a headwind or a tailwind for margins?

Answer – Kevin Hutchins: Yes, it might be a little too early for me to give a view on margins per se. We have an opportunity at our upcoming Investor Day to talk a little bit more about that perspective. I do think with regards to Contrail and CUPS, that it will -- there is an opportunity for us to increase the amount of software as a percentage of our overall sales. And also, at the same time, obviously, drive more opportunities for our customers to then build on top of that. So Contrail is not just about the SDM layer, but also delivering a platform that can drive automation and telemetry. And so there's opportunities to increase that with third-party relationships as well. So overall, we definitely think there is greater opportunities to increase the amount of software content that we're delivering to our customers.

Answer – Jess Ian Lubert: And we just had one more question come in. Can you please speak to the risk that your service provider customers mix down as cloud did in the past year, especially with next-generation merchant chip sets coming soon such as Jericho II?

Answer – Kevin Hutchins: Sorry, Jess, just can you just repeat the question real quick?

Answer – Jess Ian Lubert: Yes, so can you please speak to the risk that your service provider customers mix down as cloud did in the past year, especially with next-generation merchant chip set launch is coming such as Jericho II?

Answer – Kevin Hutchins: All right, okay. I understand. So I think there's 2 components to that question. The first is that we -- the transition that happened in the cloud market was one where we took the opportunity to get the right product into the customers' hands in order for them to be able to see the full value of their investment over time. I think it's the same story here. We're building the right products and enhancing the value of those products specifically for the customers. And I think we're not resting on things that we built in the past. When you look at things like the introduction of the MX10000 series platforms and the ability to be -- to bring, sort of, cloud economics, if you will, with the rich programmability and the types of capabilities that those platforms offer customers. I definitely think we're being aggressive with regards to how we go and invest in our portfolio. That said, we are -- this isn't really a view of our capabilities versus merchant. Actually, we're -- we also use a lot of merchant within the platforms and our

solution. And our view has always been that we will use the best components to deliver the right solution to our customers. And so as Jericho 2 comes out, we will definitely be looking at that and seeing how that could add more value into our solutions. And where we think we can differentiate and add more value, either through programmability, scalability, functionality for things like CUPS, and that will rely on custom silicon, we will do that as well. Because ultimately this is about giving the customers the best overall solution and then leveraging that differentiation to expand our overall share of the market. So we think that our strategy positions us well to do that.

Answer – Jess Ian Lubert: Thank you, everyone, for your time and your great questions.

Answer – Kevin Hutchins: Thank you, everybody.

Answer – Operator: This concludes today's teleconference. You may disconnect your lines at this time. Thank you for your participation.

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