

Qualcomm
Analyst Day
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Presenters

Mauricio Lopez-Hodoyan, Vice President of Investor Relations

Steve Mollenkopf, Chief Executive Officer

James Thompson, Executive Vice President of Engineering, and Chief Technology Officer

Alex Rogers, Executive Vice President and President, Qualcomm Technology Licensing

Cristiano Amon, President

Akash Palkhiwala, Executive Vice President and Chief Financial Officer

Moderator

Ladies and gentlemen, please welcome Qualcomm president, Cristiano Amon.

Cristiano Amon

Good morning, everyone. Just ask you to be patient with me. I lost my voice going party after the earnings call. No, actually, even though I wanted to go party, but we're busy working on the RF front-end. So, I'm just recovering from a cold. I'm going to try to do my best. Hopefully, you can hear me okay.

Have a good set of information to tell you today. We're excited to have this analyst day. We haven't had it in a long time. And hopefully, we'll give you an idea how we're thinking about the company in the future. Everything that we have been busy and focused on the past two years putting together and preparing and looking into this transformation not only of the industry of 5G, but really a transformation of Qualcomm. And when we look of the opportunities ahead, it's really one of the great set of opportunities we had in the history of our company, as Steve outlined.

And I will break the presentation today in three parts; how we're executing in our core business and what are the opportunities coming to us from 5G in the smart phone transition, then how we're building on our adjacent platform and business, which is part of the company growth and diversification of our revenues. And then, we're going to give you an overview also on some of the long-term bats when vesting right now to thinking also what we're going to be doing beyond 5G.

I will start the first part of the presentation about 5G. And anything, I ask you to be patient with me because there's so many things I want you to understand about this transition. You hear a lot about 5G in general and how broad it is, how fast it is, and then what it takes to be a leader in 5G. And hope--my job will be probably walk you through each one of those steps.

So, first, I'm going to start with 2019 this year that is ending right now just to show a comparison. We really like to show that comparison because I remember in the 4G transition, we had four operators to launch, which was the three operators in Korea, one operator--one operator in the United States with Verizon Wireless. Three OEMs; LG, Samsung, and HTC. And at the time, granted it was the--right before the smart phone transition--I had everybody under Blackberry sending messages saying who needs 100 megabits per second. There's really no use case for this.

When we look at 5G, the reality is completely different. As of right now, there are 40 operators that launch. There's over 40 OEMs. And those operators that indicated that they're building 5G have about 2.4 billion subscribers that they current serve. So, the potential for a faster transition is much higher. I also want to point out a couple of things that you can see on this map. Geography, such as China and Europe, unlike the 4G transition, they're now coming online at the same time. So, that will change also the dynamics and the scale of the transition.

And if you look at the mobile ecosystem today, China has a big component of the mobile ecosystem. That's going to accelerate the transition as well. But, the point is when we look at the scale, it's also to highlight how 5G is going to be deployed. So, you look in 2019, you have mmWave in the United States. But, by 2020, a couple of other things happen. More markets and operators come with 5G, but also mmWave happens in markets such as South Korea and Japan. And with that, we're going to start to see the real deployment of how 5G was designed to be implemented.

But, if we keep going, by 2021, we'll see mmWave now coming to a number of other markets, highlight Italy and Germany, Hong Kong, Singapore. And as of today, we're working with China mobile on 100 verticals for industrial applications, many of which are mmWave. So, our expectation is by 2021, all the developing economies will have mmWave as well. So, that's how we think about the expansion of 5G around the globe. It's fair to expect by 2020, you're going to have all metropolitan areas with 5G coverage. A list with the mid-band or Sub-6 as well as reform bands. That's going to be part of the conversation today. And then, 2021, you see mmWave expanding beyond Japan, Korea, and the United States markets.

I also remind you--I'd like to go back in history. I actually had the opportunity to work (inaudible) on the Japanese PHS system, the cordless telephone system. Japan, for example, the base stations are--for PHS were 100 meters apart with fiber backbone. That is perfect. It's like LEGO build out for mmWaves. So, expect to see the rollout of mmWave to actually be quite successful in (inaudible) markets such as Japan and Korea.

So, with that, I want to tell you how we think 5G networks are going to be built. And there is a lot of confusion in the industry today when there's reference to 5G Sub-6 or mmWave. This is not like CDMA and WCDMA. Those are not like different choices that operators are making. 5G's been designed. So, you have a combination of all of those spectrum that you have available for you. So, the way you should think about it is you're going to have those new

spectrum that been allocated. The mid-band in the case of 3.5. That's going to get deployed on top of existing macro sites. That's what we call the Sub-6. Then, the high band mmWave gets deployed as well.

And then, the existing 4G spectrum gets reformed to 5G with a feature called dynamic spectrum sharing. And dynamic spectrum sharing is going to be a feature that we're going to hear a lot as we go through 2020, as you allow the reforming. And unlike the densification of the network in 4G that happen for capacity, mmWave, which does require neo sites, or a more dense network, is really for not only capacity but performance. Some of the new use cases will require mmWave. But, let me just walk you through the--some metrics how the networks get deployed. And then, I want to walk you through the phase approach.

So, if you look how easy it is to deploy some of those technologies--and I want to use this opportunity to challenge the thought process that mmWave is really difficult to deploy. If you look at a city like San Francisco, existing cell sites--because remember, many of the dense areas have been through a process of 4G capacity build and that creates more sites. So, if you look at existing sites in San Francisco, you can basically get mmWave coverage with about 65 percent reliability, which is pretty good, especially it's been a technology that's designed for the dense areas.

And then, when you apply, for example, in the case of Germany, Frankfurt existing sites, you apply the new band of Sub-6, you have 78 percent. Once you start reforming the spectrum with dynamic spectrum sharing, then you get to 96 percent coverage reliability. And the way you should be thinking about this is every operator that is deploying 5G will make use of all of their spectrum assets to reforming with DSS, plus the new bands, and deployed mmWave when that spectrum becomes available. So, we're really excited about the ability to do this.

And when you look at mmWave in itself, the performance is really what makes mmWave shine. So, there's some stats. Now, we have Signals Research, its third party assessment of mmWave. And I wanted to have that information here because the couple things that were said about mmWave that you don't have the ability to have an all day battery life. Fourteen hours of use--users of mmWave, meaning power and thermal requirements, 10X, the peak performance of LTE. And then, you get non-line of sights with 200 plus megabits per second. So, it's a significant improvement in technology in the enhanced mobile broadband. But, in the bandwidth and the latency will really allow new use cases.

In certain use cases in the smart phone will not be possible without mmWave. And I have some examples for you in terms of compelling U.S. cases. One thing that we've been saying since the beginning of this 5G transition, in the same way that 4G changed the music industry--I'm sure nobody here, if there is, it'll be an exception, take CDs to their car today. And people just stream music. No matter where you are, you have enough 4G coverage and performance to stream music. That's going to be the issue of video. But, not only with the ability to consume

video streaming in high resolution, but the ability to upload video is going to change video creation.

It's not farfetched for you to imagine that today YouTubers will be broadcasters. It's a big change for the broadcasting industry. I especially--when you think about sporting events, but high density venue, how you're going to consume media, and how you're going to generate media, you need mmWave. You need that for bandwidth.

The other use case that I like to display--I think all thanks to Epic Games' Fortnite, the industry understood the mobile gaming is a much larger addressable market than console. And the invent of cloud based gaming, mmWave will allow you to actually--and especially form factory changes with bigger screen devices, like foldable devices, we're starting to see in the case of Republic of Gamers and the Tencent device that we work with Tencent in China, special devices for gaming. But, mmWave will enable for you to play mainstream console gamings into mobile device.

The transformation of the enterprise is a big one. It's going to be a big topic of this conversation, especially as we think about new business, but mmWave in an enterprise alongside Wi-Fi 6, indoor build out not only will enable a lot of the industrial cases and you can only do it--manufacturing robot, for example, you cannot do it with Sub-6 in terms of amount of data, in the latency, in the mission critical requirements. But, also, the ability to remove data from hard drives and move it to the cloud, mmWave, bandwidth, and latency allow you to actually move storage to the cloud, really feeding into the strategy of many of the big cloud companies, like Microsoft Azure, as you think of the potential of one drive and other services going forward.

So, mmWave is an essential part of 5G. It is happening and it's going to happen across multiple geographies and it's going to be fundamental to drive new services.

So, with that, I want to go over a build out and it won't take a long time to do, but I have two purposes in walking you through this build out of 5G networks. One is to show 5G networks are being built right now in a phase approach. The other one is to also raise awareness about what competitive leadership means. A lot of people say I have a 5G chip. I've seen that in the 4G era. When we started with 4G, there's a lot of people have chips. And for some reason, they never get to commercialize and scale because the feature set keeps changing. It keeps changing very fast. And this is what we really focus on when we think about the build out of networks.

So, you have an LTE network today and you're starting building in 2019 5G. You have this alphabet soup of NSA, SA, FDD, TDD. You start building the higher bands of 5G using the existing 4G cores in a non-standalone mode. The next step. As you start to bring some of the mid bands and you basically have a lower 5G bands, also lower bands with FDD, and you use technology called DSS to reform. And it really works like magic because both systems use FDMA modulation. You can actually deploy an existing site of 5G bay station or NOB. And the devices

will coexist so operators don't have to clear the spectrum. So, they can start building 5G on existing 4G spectrum and those systems will coexist with DSS.

Then, the next step, you upgrade the core of the network into an assay and then you start to bring capabilities like carrier aggregation, which basically make use of all of your spectrum assets that you have in 4G, plus the 5G. So, you can have wider channels as well as extent coverage.

So, successful rollouts of 5G technology, you need all of the above. And especially when you think about the chipset and device development. The device--as we build the device system ahead of the network, you need to have a chipset capability that has all of those features. They're going to be required and especially they'll be required in 2020 as you need to bring the reform spectrum with DSS and you need to bring the care aggregation so you have the ability to use existing spectrums.

So, that's how the networks are going to be built. That's--we've been through the '19 phase. Twenty, you're going to hear a lot about coverage build out using existing spectrum, hear a lot about DSS. And that's why we're excited about the speed of the 5G ramp in our position in this space.

So, with that, I will shift the conversation to where we are in the market. And the way I look at this is the 5G acceleration was very important milestone for Qualcomm. Unlike 3G or 4G, we got the devices ahead of the network. And as devices already head of the network, the best 4G phone can you buy today even if you don't have service is a 5G phone. So, devices move on, especially on the Android ecosystem.

We are being consistent and conservative in our sizing of the market. I think we said on the last earnings call because we've been calling the market down as we get to the tail end of 4G, we're assuming that some of the drivers in the market remain constant. However, when you analyze that, I think that builds a lot of confidence in the 5G roll out because replacement rates are low today. You have three plus year old 4G phones. When we did the 3G to 4G migration, phones in some markets were just two years old. You have about three, some case some market, four, even five.

Unlimited data plans. As soon as an operator launches 5G, unlimited data plans goes into 5G. That's the lower cost per bit to deliver data. Works on the operator economics. The device already switch. So, the 5G devices in the high and premium tier, those are the ones range in all of the operator, especially in all developed economies. And we do have new experiences in the service coming with 5G.

Consumers also responding. Korea has been an enormous success. I think succeeded all expectations. In China, with the projection of 1 million NOB base stations by the end of '20. The 10 million subscribers are now 15 on the prelaunch. And the projection to go in China alone,

150 million subscribers by 2020. Those give us indication that we're going to have a successful roll out of 5G.

And I want to point to this slide--I like to point to the Samsung roadmap, especially on the Android ecosystem is the number one player. And you can see that the device ecosystem already move regardless of the time that it takes to build coverage. You can see not only the Galaxy Note 10 5G, you see the A series below that, the A90 as well as the Fold, which is their flagship product. All of those already moved to 5G. And that's the consequence of having the devices ahead of the network and the benefit the operators are going to have in terms of build coverage that they can rely on features such as DSS.

And as we get to the end of this first session, one important topic to highlight is the changes coming with 5G. Every generation of wireless, we saw changes, changes in form factor devices, kind of early to predict, but we do see signs of changes in the form factor as screens get a little bigger and video--and gaming become mainstream for consumers. But, we have completely changes on how we think, for example, in the case for 4G, how to think about computing, mobile computing.

The way to think about the changes coming with 5G is--a simple way to describe 5G for mobile device is 5G is going to connect with the hyper scale cloud companies 100 percent of the time in a reliable manner. So, that will change the capabilities of the applications. The capability of the applications are going to be less bound by the OS in the storage, in the processing power you have in your device. So, if you look at the China domestic mobile market and you look at the super apps, like WeChat, we see the potential for that to happen in 5G. You're going to be always connected to the cloud. You have unlimited storage and on demand computing.

So, what we're going to see in the 5G area will be a consolidation of the applications given by the power and scale of the hyper scale cloud, less dependence on the OS. So, the concentration that we have on the OS with the app stores and all of the long tail of apps that will remain, but we're really going to see the separation between the--more and more of the casual apps and the apps that are going to drive the user experience as basically the cloud in your device are 100 percent connected in a reliable manner. And that creates a lot of opportunities for innovation and for things to change.

I'll point to one detail. We celebrated pretty hard at Qualcomm, even though we got unnoticed by the market. In the 5G transition, unlike 4G, Android operational systems now give developers the metric. Before, on the 4G area, it's whether you have or you don't have an internet connection. Doesn't even--in some cases, doesn't even make a distinction between cellular and Wi-Fi. Now, an application developer know what your bandwidth and what's your latency that you have. That allows you for you to change behavior of applications based on the barrier, creating value for the connectivity, but also improving performance.

So, we're just at the beginning of the curve and we're excited about the opportunities that we're going to have for transformation even in the mobile space. And I think it's fair to say--if you just look at what happened every generation of wireless, one thing we know, it's--you can never take anything for granted in mobile. It always changes. We're happy to be a constant in each one of those transitions as OEM change position in the market. And that's because we invest early in leadership.

The last slide on this session before we go into execution of our mobile business is for us it's not about building a chip. It's not building a chip. And I will say we have a 5G chip. It's really about building an ecosystem. And that's the approach that we took within 5G. You saw Qualcomm in every single pilot and trial about 5G with every operator and every infrastructure vendor. The platform of choice was Qualcomm.

Every single development of infrastructure in the labs, how the infrastructure gets developed, the other side of the radio is Qualcomm. We have basically work across all geographies with all industries. We have been the platform of choice for this technology to be developed. And that will give us all around leadership in the 5G transition.

So, starting with the--all of development platforms across modem in the front-end to building chips and to building devices in working with service providers. So, we're very proud of what we're able to accomplish through a lot of hard work in '17 and '18 to celebrate this technology. The launch in '19 has been a busy year bringing this to market and now ready to really achieve scale of this ecosystem in 2020.

And with that, I want to tell you how we're thinking about execution on the core with the opportunity we have with 5G. So, the first thing is a big expansion of our SAM. As in addition to what we're doing in the core chipset, we add RF front-end. So, we see the ability to grow our SAM and mobile. We've been looking for growth in mobile now for a while and we're very excited with this 5G transition. And basically, between '19 to '22, we can have compounded annual growth rate of double digit in mobile.

And the execution to drive that is going very well. We have talk about the number of designs that we have; 230 is not a small number and 230 will repeat of the 230 designs that we have, no exceptions for the 5G content. Not the legacy 4G. For the 5G content is Qualcomm RF front-end end to end.

We look at our designs, they're broken in three categories, 5G smart phones driving not only our existing customers, the China ecosystem into the flagship devices in the high tier, also driving 5G into other industries. And with embedded modules, they're going to industrial, going to automotive, going to computer. And also driving a lot of the designs for mobile fixed wireless access on the carrier case for mobile broadband and some other designs that go into new applications, which I'll single that out in the next slide.

So, we're very proud of that. And the reason I want to bring the separate slide to you is there are a lot of discussion about 5G beyond phones. Phones is going to drive a lot of the volume in the growth of the company in '20. The easiest thing is to go upgrade the smart phones.

But, when you think about 5G beyond phones, we became the platform of choice for all of those companies. Many of those companies and services, you need a reliable solution and you need a global solution. And as a consequence, we have over 30 technology suppliers that are designed specifically for the other industries. Industry IOT, automotive enterprise, fixed wireless and compute, as well as mixed reality devices. All of those promises of 5G going into other industries.

I mentioned the project that we have, for example, in China of 100 different verticals experimenting as 5G use cases. The good thing about being early and have a mature platform with generations ahead of our competition that we became the platform of choice for those use cases. And that will create opportunity for the business beyond mobile.

And as we look to scale 5G, we've been building a comprehensive roadmap. So, we started in the first half of 2019 with our first Snapdragon X50 modem. We are right now working on the second generation X55 Snapdragon modem. You're going to see a lot of details in the coming weeks as it's going to be driving a lot of the new set of devices throughout the end of the year, the beginning of 2020. But, in 2020, you're going to see 5G across our entire portfolio of products. So, not only the 8 series, the 7 series, the 6 series integrated and beyond, you see us driving as fast as possible the entire device ecosystem to 5G.

And there is--as you heard from Jim Thompson, there's no question that the benchmark for mobile SOCs is Snapdragon. People ask me sometimes and I think the question came up in the conversation yesterday, we have been leading in a number of technologies and I won't list them all, but Jim highlighted a few, like camera and AI and graphics. And when people ask us how well are we differentiated in those areas and our leadership meetings (sp), when you apply mobile SOC into a high definition head mounted display for virtual reality devices, the technology needs to perform because those--you don't have the--when you're fully immersed in VR, motion-to-photon matters or you'll get nauseated. The ability for you to exercise your GPU really matters. And that's why Snapdragon has been the only choice that you've seen in head to mount display where there's Microsoft HoloLens or is the Facebook Oculus Quest. It's just because we have the leading performance.

And we expect that to continue, especially for the capabilities that will drive 5G use cases. So, we'll continue to be pushing AI. Or, as a key feature under Snapdragon AI engine. Gaming. The promise of mobile gaming. And use cases, it's very high as we can really expand the addressable market of gaming with cloud based gaming as well as having the lead camera.

And as we talk about Snapdragon and digital and we talk about execution of mobile, it leads us to the conversation on front-end. And our strategy is working. As Jim outlined, we took the

necessary steps to make sure we'll have every single piece of technology and we have the ability at the component level to have equal or better performance than the competition, but also innovate substantially at the system level. It's been a multi-year investment for the company. We completed the acquisition, a very important asset that was filters from (inaudible) TDK. We had invested in this business to increase performance so we could accurately exceed the benchmark of FBAR in terms of filter performance. And we have had success in 5G.

So, what I'll show you is not all of them, but third party report, I think IHS teardown came. Devices in teardown and you can see where we are. It's in addition to modem and transceiver. Some of those devices, you can see. Power amplifier are (inaudible) PAs in those devices. Diversity modules, envelope trackers, filters, antenna tuner, and in the case of mmWave, our antenna module. So, it's a comprehensive mode to antenna. It touch every single part.

And my favorite slide is the next slide. The Galaxy Fold is being launched by Samsung Sub-6 mobile with Qualcomm in all geographies not yet with mmWave. So, Sub-6, you don't require-- you require a lot of advanced technology. It's not as complex as mmWave. And they chose the Qualcomm front-end components for the Fold Sub-6.

And you can see a lot of the components that we have. We have 5G PA module. We have that DRx diversity modules, envelope trackers. We also have the 4G diversity modules, antenna tuners, aperture tuners, filters, duplexers, and extractors. So, that's an example of what our execution has been. We're excited about that. Akash will give you a little bit more color. But, we feel that we took the right approach of make sure we had a highly differentiated solution across how we think about our test platforms. Car solution is tested and certified, how it performs better than the competition at the individual component level. And we have system level features because in the 5G era, it's not enough to basically to be thinking of the modem digital only. Successful companies in the 5G era will be address modem to antenna because the complexity in our effort is very high and it's a Qualcomm size problem to solve.

So, with that, I'll shift to the next part of our presentation, talking about how we're executing beyond mobile. And I want to remind you of what our strategy has been. This is a strategy that was put in place for about two years as we chose how to diversify your business and how to generate growth beyond mobile. The easiest way to describe this strategy is to look at this diagram. And RF front-end is a great example of that.

We have a strong channel. Our channel in mobile--our Snapdragon channel is a very strong channel. It's a channel that spans not only from the Snapdragon relationship with the OEMs, but across the entire ecosystem, from carriers, from application developers, and from standards.

So, in that channel we continue to push the technology boundaries and we invest in a lot of new technologies as we continue to expand content. That's where you saw our expansion towards our front end. Our expansion into new areas, for example, as biometrics.

Then on the right side we look of industry serving disrupt by mobile. The scale of mobile is enormous. And those industries get disrupted by mobile, automotive is a good example, we can go create that channel and tailor made our products in a highly leveraged R&D way so we can execute and generate growth in our industries. And with that, we have been expanding our SAM and well positioned to address large opportunities for the company with incremental investments. Basically, building scale on our large R&D that drives both our licensing business and our product business.

And, I have one diagram that hopefully explains where we are heading and how to position the different investments in business that we have set up in the company now. So, if everything starts with--with the phone and with the Snapdragon SOC as highlighted by Jim Thompson's presentation. That will drive it in the case of mobile our 5G leadership and the 5G transition that will hope to grow and generate a lot of earnings for the company in the mobile market which is our core business.

As we push new technologies into that channel going from you know, the--the left to right at the bottom of the diagram you see how we continue to create ad content from what we successfully did with WiFi/Bluetooth, going to the front end, biometrics and integrated modules.

Then, going up from the mobile platform we apply that to automotive, compute and IOT business. And, we're making some new bets leveraging the technology for the evolution of the data center, the Edge data center which has some new parameters a total cost of ownership per watts as well as evolving our automotive business to autonomies. So, that's how we structure ourselves, how we are leveraging R&D and making you know, investments that allow many of those bets to grow accretive to QCT and diversify our business while we maintain leadership and mobile.

And in building on each one of those I will start with the automotive as we look at the ardenancies. And automotive is one that we are very proud has been success story for Qualcomm. And, in addition to add that seem to our semiconductor business we see that we have a roadmap to get there.

Start with the consolidation of multiple ECUs in the car with a high value SOC. So, we started with our telematics and we have an opportunity with our telematics to add also connectivity on WiFi and Bluetooth that is evolving to cellular V2X. Cellular V2X is making good progress being standardized recently in Europe is now in a good position with the SRC. It has been you know in China it has been standardized, it has been deployed. That changes safety on cars and create new opportunities to evolve in the telematics.

The digital cockpit transformation with infotainment was also a very good opportunity for Qualcomm as eliminate not only multiple discreet systems into the car but allow modern cars to deal with the fact that consumers are driving, looking at their phones, you have a much change experience as you rethink about the digital cockpit in the era of the connected car. We have been quite successful there with Snapdragon.

And, from there we--we see opportunities to go two different places. As we develop safety requirements especially as we do mission critical dashboard we are building our a dash platform and also cloud device management building on the automotive. So, we are in the automotive business to stay. Has been a successful story for Qualcomm and this one in particular we are going to give it a little bit more metrics for us to see how we are doing and how this business is going to evolve over time.

In our scorecard, it is really all of the designs that we have received for a platform in automotive. In telematics we are going to be now in 2020 the number one in premium next generation infotainment. 18 automakers working with our Qualcomm platform in our pipeline is now 6.5 billion. So, we had increase the pipeline of design wins within our automotive segment. The other--the other seg--segment is compute. I--I know there is a lot of skepticism because there has been one that has not yet happened before competition and the (inaudible) pace. But we feel very good about where we are right now which is about the ability to create not a second class Window's PC.

And, the evolution of mobile in the evolution of computing and productivity which has been changing because of mobile devices create a real opportunity for us to grow into this market. Anything for Qualcomm is growth since we don't participate in the market today we have done successfully, a partnership with Microsoft. And, the point that I want to make and it is just not unique to Microsoft. But if you believe in the digital transformation of IT with the enterprise cloud. If you look maybe of the drivers of growth in Azure, it will see a connected PC on the other side.

As you move your entire enterprise data to the cloud as you move everything to Office 365, as you manage PCs like you manage mobile devices with Intune, as you move your hard drive to the cloud you need a connected computing experience. And the next transformation of the enterprise with the hyperscaler cloud is going to create an opportunity for more value of a connected PC experience and that creates an opportunity for Qualcomm. And, I would like to summarize that with--with our partnership on Microsoft. You can see in this picture is the new Microsoft Surface X. There is no back up plan in this one. It is just Qualcomm Surface. There is no X86 version.

We have a custom Snapdragon that will work with Microsoft and is branded Microsoft SK1, Microsoft has taken responsibility for the whole experience form the application compatibility of the device all the way to the chip. And the PC industry has turned this page into the

connected PC. We feel that the ability to create the Fin like category we now match performance with the Core i5 and we exceed in some of the applications that make use of GPU and the other capabilities especially AI that we have in--into our processor--we are working to basically, embed connectivity and make it seamless for connectivity to be activated in those devices and align ourselves with the message of digital transformation of the modern enterprise IT.

And in our score card here is a number of designs that we secure today. You can see now we had multiple commercial launches of integrated enterprise ready platforms being built--one by Samsung, one by Microsoft. There is going to be more coming. And, it is already switching to 5G when Delonovo(sp) announced 5G PC. So, this one it is a good opportunity for Qualcomm. We can grow another Samsung type volume in this opportunity with prematerial devices very accretive to our earnings and we are optimistic about the PC transition this time.

Though, as we get to the last part of our conversation of Jason's. I want you to bring you to the IOT. IOT is really about 8 segments for Qualcomm. And it is--it is a good business the way you need to think about this business is a business that we have been leveraging our technology and products into many other industries--be able not only to diversify QCT but generate growth. It is growing in double digits.

And it is very accretive to QCT margins as well. And, it's another expansion of SAM for the company leveraging our technology. And I'll--and I'll highlight just a few things as the first four segments it's connectivity, small cell fixed wireless and industrial IOT. Couple of interesting data points. 11,000 customers. So, during the past two years as you know, we did not complete the acquisition of NXP, but the company move on and--and been active work on how to create a channel so we can repurpose our technology in--into many different segments. And we are very happy to tell you today that we now have 11,000 customers. For a company that in highly concentrated mobile space, which is highly concentrated--we have 10s of customers with a B2B engagement. Now, over the past two years now we do business directly with 11,000 customers which is a big gain in scale in an efficient manner that allow us to--to continue to build on this business.

You know, a lot of the earnings power of the company in the coming years will come from this 5G transition but this business as we continue to grow this business highly leveraged on R&D after the 5G transition, is completed we will be a significant business for the company to get over some of the long-term bets. And, we are very pleased at what we accomplished in this category that we call IOT today.

A few highlights on connectivity, WiFi 6 is a big transition for Qualcomm. We have the first certified WiFi 6 products and the--both the access point and in the mobile devices. We are very happy with our position in retail and in enterprise. And, we started to see WiFi 6 matches come into the market, fixed wireless 5G CPE is a--is a new area. 5G creates an opportunity for many

operators. We announce our high power CPE for range in rural areas that create opportunities for operators into our business case.

Small cell it is--it is something that we see a lot of traction right now and I want to highlight this. This has a lot of strategic value. Base stations are--they don't have as much units as we have in the phone market. But they are very important especially on the strategic side for mode and leadership and the creation of some of the demand for devices. So, two areas worth mentioning.

One is, a lot of the private 5G industrial networks and enterprise networks countries like Germany pioneer with the allocation of dedicated spectrum for private 5G build outs have been followed by other geographies. We see our small cells being selected to build private networks in partnership with existing companies.

We also design our small cells in all of the big infrastructure vendors with exception of 1. And, there is this transformation or transition is a better word of the industry to flexible RAN architectures and open RAN the very first open RAN public network has been built in the industry is Rakuten in Japan has been built with the Qualcomm small cells for 5G.

In industrial IOT we see that you know an opportunity very defensible business, global business across industrial handhelds, retail transformation, robotics and surveillance camera. So those are the four first segments. The other four segments of this IOT is what are we doing in wearables across watches and trackers, voice and music, think about the--the technology we can provide the technology on the Android ecosystem that can compete with the Apple air pods is our high fidelity, high performance ear buds and we are starting to see some OEM's now designing together with the smartphone, within very happy with the R&D that we did in this area. Also, we have consumer IOT in mixed reality devices.

And beyond that, we are making some long-term bets for the company. And--and I want to highlight two. First, it continues to expand our SAM. And you see the opportunity here for cloud edge AI and for autonomy.

So, to start with the cloud edge AI. So, the way for you to think about the cloud today you have all device AI, I think Jim Thompson and his presentation talk a lot about that. And you have the cloud. 5G not only brings those two together, but also moves the cloud closer.

If you look, companies have been well positioned I think for example, YouTube with other CDNs for video put them in a very good position for Google to provide gaming streaming. You are also going to see as a lot of the IT infrastructure goes to the cloud you are going to see the build out of the Edge clouds and it is going to be a necessity from industrial and consumer applications.

As we look at the opportunity of expansion of the SAM within the data center we have been working to develop this product, which we announced in as the cloud AI 100, is really

addressing you know, those industries for an optimized design, high performance and low power for the automotive industry, the data center, the 5G Edge and 5G infrastructure. So, we see now four type of applications. Application in infrastructure as you look to virtualize some of the RAN in some of the controllers. You see this as a very good opportunity to replace CPUs and FPGAs. We see opportunities within the data center for inference processing. We see opportunities for high efficient and complication in the automotive sector, especially for autonomy. And, we see this for 5G Edge with mobile operators and cloud providers.

That's the card that we are now shipping to many of our customers they have been evaluating our data center product as built on 7 nanometer is designed really to handle inferencing workloads and we feel we are very well positioned--especially as you think about the equation of performance per watt.

And, (inaudible) is the existing incumbent. It's over 2X the performance and 2X the performance per watt. Especially, as you think of total cost per ownership so you can see one of--of the benchmarks of our PCI card versus competitor PCI card. So, we are very excited about that. That is a long-term bet for the company but it shows the power of the technology and the IP that we create for mobile. How can that scale to many industries and allow the company to generate growth in a highly leveraged manner?

The other bet that I want to share with you today autonomy. When you think autonomy there is the larger portion of the market is really you know, highway autopilot. And in thinking about going you know, level three, three plus, level four. And, we have a basket of technologies going from multiple processing elements and sensors. Plus, the ability to have you know, an SOC that twill meet safety standards which is part of our development for infotainment business. So, we are making a lot of progress.

The initial feedback has been great. Unfortunately, there is not so much I can announce this but highly encourage you to watch what we are going to do at CES. I think you are going to see substantial progress in how we had turned our autonomy research into progress and now how that is going to turn into design. So, there is another new bet for the company we are very excited about it.

And, as we get to the end of my presentation, we talk a lot about 5G being transformative for many industry. It goes beyond phones. And, as it transforms many of those industries it really creates a very big tailwind for many of those Qualcomm adjacent and growth bets. So, it fees in each one of those creating new use cases across automotive, across compute, across ROT segment and some of the long-term bets basically making what we do more valuable, more defensible and accelerate the opportunity for growth.

We also have more news to come in the first week of December, in our Tech Summit, we are going to announce our new family of Snapdragon products. Our next flagship with 5G modem will be announced and you are going to see those and devices coming in 2020. And, in CES you

hear a lot about what we are doing in ADAS. Really excited about this opportunity we have had for the company. It is one of the best opportunities we had in the history of Qualcomm.

And, what I want you to take away when you think of this analyst day and what we are doing with our product business is we now hedge our bets on 5G. Doesn't matter who wins. If Apple wins, if Samsung wins, if a China (inaudible) wins we are well positioned. We have a global customer footprint for 5G with multi year agreements across multiple customers. So, we feel very confident about our position in 5G.

5G is accelerating across 6 DSS which is going to push the boundaries of performance and capabilities on models and as well as mmWave. Modem to antenna is real. Performance is significant when you design as a system. And the designs that you see on the front end I understand that is an area that many of you will face with skepticism but we are very happy we accomplish today. You know, we have conservative targets but we feel very good about the potential and we are going to continue to make progress in our technology design and model NRF as one in the 5G era.

We have become the platform of choice for other industries as 5G goes beyond phones and are well positioned to expand and diversify and have a much more diversified company after the 5G transition.

It's really a significant opportunity ahead. Thank you for your time. Thank you for being here with us today. Thank you very much.