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>> JAROSLAW PONDER: So good morning, ladies and gentlemen at the ITU Forum on the 5G Strategies, Policies and the Implementation. Today is the second day of the exciting forum consisting of several sessions taking a look at the policies, the strategies, but also the aspects of dynamics of the implementation of the 5G across our region. In

addition to this, we'll be also today taking a look at the challenging aspects of the 5G and exciting discussions around the EMF and related aspects.

But before going into this discussion, we have great pleasure and honor to welcome today Mr. Jeremy Godfrey, who is the vice president of the Body of European Regulators for Electronic Communications. So welcome to this meeting, and I'm handing over the floor to Mr. Godfrey to deliver the keynote speech of today. The floor is yours.

>> JEREMY GODFREY: Thank you very much. One thing before I begin, I find it very difficult to speak when I'm just talking to a load of names. So it would be great if everybody who has a birthday this month or next month can turn on their camera. So I can get a little bit of eye contact to see whether or not I'm boring people. Thank you very much.

Thank you. Brilliant.

I would like to talk about 5G in a post-COVID world and talk about what the priorities for that world will be, and what role telecoms and 5G would have in the world, and how we might get there.

So talking about a post-COVID world and I'm optimistic that we'll have one of those quite soon, that it won't be the same as the preCOVID world. I think one of the things that's taught us is that connectivity -- we in the industry all know how important connectivity is, but in the sector we know about it, but I think the world is certainly going to be a world in which it is more connected, telecommunications has a bigger role and there's a greater emphasis on universal coverage and -- and access.

It's going to need to be a more resilient world, not just in terms of the resilience of telecommunications networks, but I think the shock of the -- to the system of the pandemic is something that is going to make policymakers be very keen that we are as well prepared as we can be for whatever comes next. It may well not be another pandemic, or it might be a different type of pandemic, but I think making sure the world is resilience against shocks is something that will be on people's minds.

We'll be a more sustainable world. I think the -- the emphasis on -- on climate change and on

making sure that we protect the planet has, I think, again been underlined by COVID. People say if COVID is a shock, just wait until you see what happens with climate change. I think in the recovery, in the rebuilding after COVID, it will be very much a green recovery and a green rebuilding.

And then the last thing I will put a question mark against it, because I'm not 100% sure, and I'm certainly not 100% sure it's a good thing. It may be a less globalized world. It's partly due to resilience that in the globalized world we had, it's been something that's enabled the pandemic to spread so quickly around the world. But obviously there are geopolitical issues around globalization. I wouldn't necessarily say I think it's a good thing for us to be less globalized but there's certainly risks that regions will want to be more self-sufficient as well.

What does that mean for telecoms? I'm going to maybe paint a picture of what I think it might be like in -- well, I can't really say the date, but it's probably after 2025 and before 2030. So sometime in the latter half of the decade. I think we will want to see adequate broadband universally available. I think up with of the lessons of the pandemic is networks have performed very well. It doesn't matter how well the networks perform if you are someone who is using a house which doesn't have a good enough connection to the network, then you are -- then those people have been excluded from working from home, from learning from home, from shopping from home, from socializing from home.

So I think coverage is certainly going to be an issue that we are going to need to crack in the next -- in the rest of this decade.

Secondly, I think we'll see lots of industries making a big use of data and connected data for us is -- for sustainability and for efficiency. That can be farming. It can be building management. It can be transportation. It can be manufacturing, all of those industries can reduce their environmental footprint and operate more efficiently through the use of -- the clever use of data in realtime.

And, of course, healthcare is an industry which also is set to make major use of data. I would say not as healthcare, but healthcare and public health.

Of course, all of this will need to be underpinned by widespread, secure, and resilient networks and applications that run on those networks.

And there will need to be a lot of innovation between now and over that period in order to bring that about, but I believe it's innovation and there will need to be investment.

To talk about how we unlock that innovation. I just want to cast my mind back and cast your minds back to the days of 3G. And when 3G networks were first deployed, there was a lot of worry that they were -- that they were going to be a failure, and the usage of 3G didn't pick up until we had devices that were capable of making use of the network and we had services on it.

Really 3G success was I think -- you can say the turning point, which was the launch of the 3G phone and that really unlocked all the usage. For this ecosystem to be a success, we need networks, devices and services to be developed in parallel. So I will talk about them separately, but I want you to remember that -- I will come back to -- the interconnectedness of those three things.

So for networks, of course, we heard lots of people talking yesterday about spectrum. Spectrum is -- is absolutely necessary for 5G networks to be deployed. There are other regulatory and development issues that need to be done for the deployment of the 5G and BEREC has done work in trying to inventory those issues. Not solve them but make sure we have a comprehensive list of all of them.

We published earlier this year something we called the 5G radar which is a map of those issues, how important they are, what type of issue they are, and how quickly they need to be addressed. And those are things like roaming.

So for example, you know, even in today's world, even in -- within the EU where we have roam like at home, we still don't have a rule that says if you have 4G service at home, you can get 4G service when you roam. When we move to world of 5G network slices, making sure that you get -- you can access a network slice with similar characteristics when you are roaming, that's another whole -- April issue which will be incredibly important for IoT services when the

devices are moving across borders.

So amongst the other issues we see there are wholesale access to networks, will be a big issue for some vertical applications. A reduction in the deployment barriers, whether that is -- that is local permits and so forth, making sure that there is adequate backhaul and numbering and so forth.

And then leading on to one of the topics of today, dealing with EMF disinformation. I want to pay tribute to GMSA, which had a seminar with EMF, issues that haven't had the same currency like the impact on insects and birds and -- and trees.

While I want to actually talk about an elephant in the room, when it comes to networks. There's no business case for small cell deployment. For 703.6 and macro cells open 5G, I don't think we have a problem. The use cases enhance mobile broadband. It's a well understood use case. The demand for data continues to grow. They need to invest to provide greater capacity and higher speeds. It's -- it will very soon become inevitable the cheapest way is to deploy 5G and with things like Dynamic Spectrum Sharing, it's easier to migrate 4G to 5G in a smooth way. I don't see a problem there.

When its to small cells and 26 gig, speaker after speaker yesterday said there's no demand for 26 gigahertz. That's why the spectrum isn't being assigned, but no demand actually means no business case. In fact, free spectrum would be too expensive at 26 gigahertz. I remember hearing last year about -- in Hong Kong where they gave away -- they tried give away millimeter wave spectrum, coupled with very intense coverage requirements. A couple of the MNOs took up, but Hutchinson said we don't want to take on the obligation to deploy this network so extensively at the moment. We don't see any revenue coming from it. We'll wait and we're sure that there will be plenty of spectrum available when necessary.

So, you know, networks don't get built by private capital unless there's a prospect for of a return. So we need -- I think if we really think that wide spread small cell networks will be important to society, we need to think about how to overcome this problem that in the absence of applications, there's not much incentive to deploy the networks. But, of course, in

the absence of the networks, there's not much incentive to deploy the application -- to develop the applications either.

There's a bit of a vicious circle. I can see three possible things we could do. One is we can just accept it will be slow. We wait for organic growth. Things get deployed in small corners and gradually the spiral of growth takes off. That's, I think, what we saw in 3G.

Another couple of things we might do, and if this is -- if this is something which we really think that societies, resilience and sustainability is going to depend on new applications, is we could use a continent wide deployment of small cell networks. I think it has to be continent wide. It has to be enough scale and enough certainty that it unlocks the innovation of the deployment by the private sector to make use the network. So people really -- I don't think it's enough for ministers or policymakers or Prime Ministers or heads of government, to have conferences and set a target and say, we're going to have this by -- by a certain date. People don't believe that they will be met.

I think -- and it won't be met, because of the business case problems. So I think -- I think -- I think if we really think it's necessary, giving certainty about the rollout of networks through public subsidy can achieve that, but it's a huge gamble with public money. You know, to believe that that would unlock the applications and that it's worth doing.

A second thing the public sector could do is actually make use of innovative public sector use cases. So they could work on the demand side rather than on the supply side. So a lot of use cases that you can imagine for 5G are things like smart cities, which would be deployed by public bodies or environmental management, deployed by public bodies. Those kinds of services, if there was, again, a continent-wide commitment there may be enough certainty for demand in small cell networks that you could unlock the investment in them.

It will be slow, unless some bold public move is made. I have to say this is not me speaking on behalf of BEREC. This is a very personal view and definitely getting into the policy side rather than the

regulatory side of things.

In terms of use cases, I think also -- I said I would come back to the devices and services. I have talked about how they are linked to the rollout of networks. Of course, they are useful things to do, experimenting with use cases and I think we heard about a number of conferences and initiatives where use cases can be showcased and shared. I think academia industry collaboration could be very important in this.

And finally, I think we need to worry about bottlenecks, and about new bottlenecks and there's a lot of talk about platform regulation and -- and digital regulation. There, I think we need to -- on the one hand we have to be weary of bottlenecks and weary about regulating new industries too early if we make innovation jump through a lot of regulatory hoops, that can actually slow things down. So it's a difficult balance to strike and -- and -- but it's a balance that will need to be struck.

So finally, let me just talk about some of the things that are already happening and some of the things that might happen. So in terms of resilience and security, of course, within the EU, there was the famous Recommendation 2335 of last year which has been taken forward by lots of Member States governments on 5G security. We have recently seen, again, from the EU a recommendation about a toolbox to reduce the deployment costs of 5G and -- and very high capacity networks.

For BEREC in 2021, we have three things in the work plan. So there's sharing the -- the inventory I talked about of 5G issues, sharing 5G experiences amongst regulatory authorities, and also taking forward collaboration with other stakeholders on how to deal with misinformation about the EMF health effects, which follows up on the statement we recently issued jointly with the radio spectrum policy group on that topic.

More broadly, of course, had the -- the discussions within the EU about the digital services act and platform regulation, discussions about AI regulation, those will be very important over the next few years in -- in either enabling or if they are done wrong, inhibiting the innovation we are looking for.

And two other things, the EU has -- has recently announced its recovery fund. 37% of the recovery fund is to be spent on green initiatives and 20% on digital.

I think some of these initiatives I have been talking about can come under either heading and -- and the size of the recovery fund has been -- has been determined, the precise -- precisely what it's to be spent on hasn't been.

A couple of ideas that might be considered, maybe one small cell city-scaled deployment in each Member States might -- a commitment to that might create a development platform that would -- that would give people confidence no innovate on the services and the devices. Maybe some common work on public sector use cases. So I think that fund could be very, very useful if spent in the right way in stimulating and unlocking the vicious cycle a talked about earlier.

And finally, I want to say this is not just about the EU, and come back to the ITU, and the purpose of this is an EU-regional approach. I think collaboration across Europe, between the EU and the other European states can also be extremely useful. That can be about things like spectrum coordination, so that -- which has been a barrier to getting spectrum assigned in some -- in some places. It can be about a joint approach on EMF. It can be about some of the other regulatory and policy issues I talked about. In BEREC, we have had a fruitful collaboration with the eastern partnership regulators and the eastern Mediterranean regulators, and for me personally, in the course of last year, the chance to work with the eastern partnership regulators and attend a couple of their plenaries was a real treasure for me.

And I can assure that our colleagues elsewhere in Europe on the eastern Europe and possibly non-EU members next door to Ireland, that we will continue to collaborate on these issues in the years to come. And, Jaroslaw, I think I have gone slightly over my time but thank you very much and I will hand the floor back to you.

>> JAROSLAW PONDER: Thank you very much. And Mr. Godfrey, it's a great pleasure to listen to you and to hear all of these items which you mentioned

fostering the unlocking the innovation in the 5G ecosystem, at the regional and also national levels and I think this was something which inspires a lot of our speakers of the next session, who are struggling on a daily bases with the challenges related to the 5G implementations. So all the recommendations we noted very well, and we will reflect them with your permission in our outcome report, as the possible way forward for the discussing this in the context of the implementation. But while thanking you for the keynote speech, I would raise the round of applause in normal circumstances, but I now just say thank you for this.

And now, it's my great pleasure to hand over to my colleague Istvan Bozsoki, who is the head of our department dealing with infrastructure, spectrum and broadcasting. And to moderate the first session of the day, focusing on the implementation. So Mr. Bozsoki, the floor is yours.

>> ISTVAN BOZSOKI: Good morning. Sorry if sometimes I'm not looking at the screen. I have a large screen and sometimes I'm looking there just to follow everybody properly. So thank you very much, Jeremy for this very keynote speech. It's not directly the subject of this conference but I want to add also that we are working together with UNICEF, because we are work also on the school connectivity which is an important issue in the case of pandemic.

So this is the giga project. It's considered also important just to let you know.

So session 4 is dealing with the 5G implementation: Private sector developments and commercialization. And for this session, our goal is to check, what are the main business and technology challenges to 5G implementation in particular with regard to investments and business models. We would also like to see what the best innovative approach is to 5G implementations are.

We have eight speakers in this session, and it's because we have maybe 10 minutes to deliver their presentation. I know that sometimes it will be a big challenge because I saw some sizes of the presentations, but I'm sure that we have to manage it, even before one minute, and I will warn the speaker that the time is coming to -- close to the end.

We have one speaker from the ITU, our deputy director of the Telecommunications Standardization Bureau, Mr. Reinhard Scholl. We have two speakers from satellite operators, two from the teleco operators hasn't three hardware producer. So I wish to invite Mr. Reinhard Scholl to deliver his presentation. As I mentioned he's the deputy director of the TSB of the ITU. Reinhard, the floor is yours.

>> REINHARD SCHOLL: Thank you, Istvan. Good morning to everyone.

So I will talk about the work that ITU is doing on machine learning in 5G networks.

Next slide, please.

So applying machine learning in networks is quite different from applying machine learning in, say, image recognition. If you go to the next slide, please.

So in image recognition, you have the luxury of, you know, time and large computing resources to train your AI models, but in communications, this is quite different. There are very many different time scales that play a role. Some parameters may change on a yearly basis, like a subscription, or others change on a monthly, weekly or hourly or daily basis. And the lower you go in the communications stack, and the more dynamic and uncertain the environment becomes. Some parameters may change on a millisecond time basis or even faster.

So that means would you have to retrain your AI models on the millisecond basis. So that's a big challenge. So if you have in communication in the networks, just less computing resources available and the environment is just noisy and very dynamic the I what you go in the stack.

Then the big question these days is on data, how you get the data. So which data is available in the network. Are they -- how reliable are they? Can you trust the data? How good is the quality of the training data?

And then also there's a lot of domain knowledge available. So the question is: You know, how are you combine the domain knowledge with the machine learning models.

Next slide, please.

So ITU has been active in machine learning and

communication networks for some time. So they have machine learning communication networks. We have about 10 standards available right now, which form a toolkit.

And if you go to the next slide. We started out with use cases. So we have a standard or a document which lists all of those use cases. We tried to put some order on the use cases like you see here on the slide. We have classified them according to -- there was a little bit too early, but that's okay.

So we had -- yeah, we put some order into the use cases. And then we developed an architecture framework for machine learning in the networks. So that offers a common language that can be actually be used by all networks. It doesn't have to be a 5G network. It's available to 4G networks or WiFi networks or any future network. And some of the concepts that we elaborated is the concept of a sandbox. So a sandbox is simply an isolated environment where you can test -- where you can clean and test your model before you deploy it in the network. And as I have mentioned depending on the time scale. This training and testing must have to be done on very small time scale like millisecond timelines. And then we have machine learning pipeline, it's forming the machine learning application. And then we have the machine learning orchestrator, which is the brain of the architecture.

So we have some standards. Everything is available and free for download.

So if you go to the next slide, please.

So we wanted to see how our tool set works in practice. So we have launched. We are running this year a challenge that we call the AI/ML challenge 5G challenge. It's a competition. When we started that, you know, we had no idea how it would be going. This is a big adventure for us.

The way it turned out is as follows. We have a number of problem statements. It's a problem that the network operator has to solve in its network, and we received the significant number of problem statements from various what we call hosts and you see the hosts listed here. So the hosts are either universities or companies. I think the majority is actually universities that provided the different problem

statements. So in the end we have about a bit over 20 problem statements that were mature enough to be launched in the challenge.

Next slide, please.

We are happy to acknowledge support and so we have sponsorship of support from the regulators, from the Telecommunications Regulatory Authority of the United Arab Emirates and we have sponsorship support from Cisco and from ZTE and we have support from promotion partners, the Linux foundation AI and SG innovate and the Next Generation Mobile alliance.

We have 500 participants from 60 countries participating. It's roughly 50/50 students versus professionals. So China plays a little bit of a different role. Their problems include real people. China is not included in the 500 and China has more participants than we have.

Next slide, please.

So there's no competition without data. That's always the big question of what kind of data are you able to get? So we have four different categories of data, so to speak. So for some of the problem statements, there were no data made available so people may have to use their own data, generate they are own data. We have problem statements where we have synthetic data and, you know, some of the companies told us that their synthetic data are as good -- basically indistinguishable from good data.

We actually have real data from a network operator anonymized, but real data that is being used.

Next slide, please.

That's roughly the timeline of this challenge. So in the first half of the year, we selected the elaborated problem statements, so from July until now. The professionals and the students are working on the problems and then we have what we call a grand challenge finale, where the best solutions will be able to make a prize. So we have prize money of about 20,000 Francs. We provide mentoring to students.

Next one, please.

So here is the list of the problem statements. So on the right-hand side column, you see the various universities and companies that have been supplying the problem statements and between you also see the -- yeah, what the problem statements are about. So we

have a very detailed document that goes into the depth of these statements that is publicly available on the website. If you go into the search engine, you will be able to find that. These are the problem statements from China. We had problem statements coming from China, and they have all real network data and we are working with China to see how when we plan the next version of the challenge, we can make the data available to participants outside of China.

In one, please. Just to give a -- a little bit of depth into one of the problem statements or one of the problem statements that was supplied to us by it Turkcell is the radio link failure prediction. So the weather impacts the cell. So Turkcell made available weather data and network data. There's no contact information and Turkcell also deleted information that may be competitors may like to know, but otherwise it's real data.

So the challenge is for the participants to understand how the weather influences the radio link and the failure of the radio link. So that's one example. Next one, please. We also have a webinar that accompanies our challenge. So we have had maybe two dozen talks given by distinguished university professors or engineers from companies. So every week we have one or two talks you are welcome to listen to them and they are stored and recorded and available.

And we also plan in ITU news in a magazine that will come out the end of the November that summarizes ITU's work on the machine learning and 5G network, and in particular we focus on the challenge. And the next one.

So you are welcome to participate in this discussion and particularly the webinar series would be of great interest to you. And last slide, we invite you to stay tuned because we are planning on announcing soon the competition that we will be running in 2021.

Thank you.

>> ISTVAN BOZSOKI: Thank you, Reinhard. It's great that you are from standardization because you finished in the standard time. Thank you very much.

I think we are waiting for questions from the participants but you wish to ask the questions at all the presents, because then everybody has the same

timeline to prepare and then we can ask the questions.

So the next speaker is madam Donna Murphy. And she's from the Inmarsat. You can find everybody's CV on the website but just a few words about her that she's the chair of the United States International Telecommunication Union association board and serves as focal point to the ITU UNESCO and a board members of the United States telecommunications training institute and she has a lot of other functions and roles.

Donna, the floor is yours, if you are available.

>> JULIAN McNEILL: I'm sorry to chip in, but I think Donna is having some problems connecting. So we are trying to solve this.

>> ISTVAN BOZSOKI: Can we, in this case, Alexander, are you available? Because in this case, we will switch back to the original order. So Alexander Geurtz, if I pronounce your name correctly, is the Vice President of Segment Market Management, Fixed Data at SES Network in Luxembourg. He has over 25 years of experience in satellite and mobile communication from the strategic business and technical perspectives.

So Alexander, the floor is yours.

>> ALEXANDER GEURTZ: Yes, thank you, Istvan. I think for the slides, we can move immediately to number two. What I would like to do is to provide a bit of an overview of what -- whether the satellite industry in general and SES, the company I work for in particular, where we see -- where we help telecom operators and other customers worldwide, governments, et cetera, so get connectivity all around the globe, southwest the path to 5G and where we play in that context. So to start off maybe for the audience, a built of a summary of all the applications that satellite covers, we -- when we look at that and you may have seen this in various publications, it's actually a very broad range of applications, as well as geographical coverage. We provide services and we can help to develop and accelerate services in urban areas, in more rural and remote areas, both for broadcasting and telecommunications.

And not only to say fixed environments, but certainly also to mobility whether it's in shipping, oil and gas, and sustainable energy, et cetera,

et cetera. So it's really a broad range of applications and use cases that we cover. And it's based on the key features for satellite that are really differentiating us from other ways and help us compliment those other ways of reaching customers, and that the ubiquity. We are everywhere.

The mobility, the fact that you can easily connect mobile platforms, the ability to broadcast to get the same kind of data to different users in a very cost-effective way, and resilience. The fact that we can very quickly reconfigure and set up and restore connectivity. And as part of the 5G work, we have been very active in making sure that not only is there a role for satellite, but that we also adopt and adapt the technologies that 5G brings for the benefit of the satellite industry and therefore, for the broader telecommunications industry.

And how that flows, I would like to show along the lines of a couple of examples. If we go to the next slide. Already today, we are helping customers to get backhaul for 4G networks in many places around the world.

Here you have an example where we work with a Latin ISP to develop mobile backhaul to a rural area of a very hard to reach. We do that by low latency is satellite network that we own and separate. And where we can provide very high data rates to those sites. For which we use the 28 gigahertz band worldwide.

Another example on the following slide is in the Pacific Islands, areas that previously were not reached by fiber and therefore had no means to connect suddenly got enormous bandwidth allowing them to deploy, 2G, 3G and 4G services, with a combination of our network satellite networks including the low latency sort of called O3B network. That's an example for the Pacific Island.

Whether it's an example for rural areas on a land-based -- on a continental application and this was another example in the Pacific islands.

So yet another example is on the following slide, in a slightly -- in the following slide, please.

On a -- in a place that is very deserted, yet very important. And where we help deploy public safety solutions. So not just simple communications for people, but actually critical public safety

applications. Are.

We deliver the connectivity to the place and then the terrestrial connectivity onward via mobile networks. And a similar example on the following continent, the following slide is for an MNO that we work with in Africa, places that previously couldn't reach and where we provide them with access and, sorry, the ability to deploy the terrestrial networks in a wide and hard to reach area. So really critical communications for such an area.

Another example is on the following slide, and it's fairly recent, where the population of Greenland can now, through satellites, through C-Band satellites connect at high data rate as well. This will -- this service will start shortly. We just announced that a couple of weeks ago.

So this will help to build the digital divide that exists in countries like that with very complex topologies.

Finally, part of the examples on the following slides, we were also working with another operator in Africa to provide very resilient communications. So those examples are all for 2G, 3G, and 4G. What does that say about 5G, and what is our view and perspective on 5G.

We started looking at where we think we can play. And when you look at the following slides -- actually, we -- (No audio).

>> I think we have some technical issues. We don't have our panelist anymore.

>> ISTVAN BOZSOKI: Good that you say because I was worrying that it was my computer.

>> JUAN MANUEL CAMBEIRO: No, isn't. It's my computer too.

>> ISTVAN BOZSOKI: Can you try to get him back.

>> ALEXANDER GEURTZ: Something reset. I don't know what happened.

So on this slide --

>> ISTVAN BOZSOKI: Maybe if you can go back a little bit to the DRC, because I think we lost you sometimes there.

>> ALEXANDER GEURTZ: Oh, all right. Okay. Sorry.

>> ISTVAN BOZSOKI: One slide back, Evgeniia.

>> ALEXANDER GEURTZ: I don't know what happened.

That was another example where we partner with an MEO to ensure connectivity and critical communications in hard-to-reach area where we provide resilience to compliment other ways of connectivity that they have. So then I try to bridge these examples of what do we do in 5G. If you go to the next slide we realized that looking at 5G, our role in this can build on the very same examples and differentiators as in other generations. The ubiquity, mobility and broadcast, et cetera.

So we see four broad areas, one being for us in trunking which is similar to the Pacific Islands. And one this backhauling which is what we showed in some of these African examples, for instance, in Peru, and communications on the move. I'm sure Donna will say a few words about that as well, to connect ships, et cetera, and also ultimately to the home possibly with small cell deployment. I think there were some questions around that from the see note speaker this morning.

>> ISTVAN BOZSOKI: Alexander, you have one and a half minutes still.

>> ALEXANDER GEURTZ: Yeah. So sorry I had to repeat something. If you go to the next slide.

So we also -- and click through those couple of elements in there. So when you go when we started looking at 5G, we realized we had to build on those technologies and we actually, together with partners worked to even sure all of the various technologies are useful for and integrated for satellite as well.

And we also worked as you can see from the next slide, on -- you have to click through to the next slide, please.

Keep clicking to the next slide, please.

One more. One more. Yep.

So we worked with several partners to develop an end-to-end facility. In fact, many of the manufacturers and operators at this panel also were involved in that. So that allowed us to incorporation the technologies. Then another element that's very important on the next slide is to -- the next slide, please.

Is we integrate satellite into an overall cloud and edge architecture. And what we do, we are working with Microsoft and others on this, to ensure that we

can do network slicing and all the satellite networks and that you can have a very flexible cloud edge architecture everywhere in the world.

So this customers, we can decide how much of the edge capability they want to deploy where and the satellite can provide a flexible environment in connecting them.

On the next slide, and that concludes the presentation. I want to emphasize the investments that we are doing that can help to deploy 5G and accelerate 5G anywhere in the world. We were leveraging our satellite fleet. We are adding many network capabilities to ensure that they integrate seamlessly with the telco world, with respect to the tools, and we're adding a massive amount of capacity to that to help deploy those networks.

So from our perspective, we are really making investments in satellite networks not just in space, but also on the ground to ensure that we can help 5G rollout and support customers and operators needs and developments. Thank you.

>> ISTVAN BOZSOKI: Thank you very much, Alexander. I let you speak a little bit more because still it seems we cannot connect. So that is your -- you are represent the satellite part. So you could speak a little bit more on your activities.

So the next speaker, if we cannot come back to Donna, is who I'm going is Juan Manuel Cambeiro. These will be solved in the near midterm. So now Juan Manuel, the floor is yours.

>> JUAN MANUEL CAMBEIRO: Thank you very much, Istvan and thank you all for having me here today.

My name is Juan Manuel Cambeiro, and my unit works in doing 5G use cases in collaboration with customers. So in the last two years and a half, and we have undertaken 60 some projects. So pretty much everything I will share with you is what we learned from our customers.

When I say our customers, 98% of them are enterprise or industry customers and it is the segment where we believe 5G aims to.

If you don't mind, I would like to share my screen, because I rather like to thank you very much. Sorry asking that.

>> ISTVAN BOZSOKI: No problem.

>> JUAN MANUEL CAMBEIRO: I share. There you go. And let's put this in presentation mode. Can you confirm me, please, you can see the presentation all right?

>> ISTVAN BOZSOKI: Yes, I see something. Maybe it's your screen.

>> JUAN MANUEL CAMBEIRO: It should be the slide.

>> ISTVAN BOZSOKI: Yes. Because it's the same screen that we saw before, but now it's from your computer.

>> JUAN MANUEL CAMBEIRO: Oh, okay. Thank you very much.

So the first thing I would like to set very clear is that there is an initial that makes people believe that 5G is a technology in search for a use case which is our concern, is that it is actually quite the opposite, right?

If you think about it, especially for the enterprise segment, we have been telling them the same network as in the mass market. The difference is the services we put on top it, but there's no specific or professional connectivity really in mobile networks, like we do in fixed noble networks.

There's necessities from our customers that we have never been able to meet. With err struggling -- we are struggling to meet those networks with the current state of the technology. What we are trying to fill the gaps and trying it to satisfy our customers. We say technology that nowadays is not able to. So the next slide is one that we use quite usually to explain to our customers where 5G is coming from. So if you see at the right-hand side on the right of the screen, you see what most Member States know about 5G, about high bandwidth, and low latency, and high density, et cetera.

If you look at the left of the screen, that's where you really can't see what's been pushing for 5G. So there is this average trend that mass market people tend to see, which is okay, we have 3G, 4G, 5G, is more bandwidth and more immediate communications so that is that.

But in reality, we have very many other needs going parallel that we were not able to fully satisfy up until now. For instance, if you see the first line here, which is in industrial quality of service. So

customers have been asking for years enterprise to deliver mobile connectivity with a guarantee capacity of service so that we are going to guarantee the quality and the capacity, no matter what is happening on the public network?

Right. I have the case six years ago we have a project with a PSA car manufacturing plant. And in front of the manufacturing plant, they had a football stadium. This meant that once every two weeks, the mobile network got really saturated by people sending videos and pieces of the game via WhatsApp. And we are going to massively use wireless communications, we can't use public networks the way they are designed today. That's why we were forced in 4G to roll out the private LTE networks, right? But this is one of those needs that 5G will have to fully satisfy and guarantee the quality of service for our customers is embed in the very design of 5G. So we have to develop private 4G networks which I believe is a delivery. This is the only solution we have.

The other trend for 5G is the second line you see here which is the Internet of Things. The Internet of Things has several qualities that really mandates that we need 5G first one is that massive.

We are delivering 30,000 to 40,000 per manufacture for industry, per manufacturing plant. We are talking about billions of connected cars. We are talking about billions of devices and each one of them, they have very different needs, right?

Current technologies are maximized to offer just one type of service which is pretty much broadband and person-to-person communications, but in the massive of IoT, we have different needs. For instance, we have devices that have to be configured to consume very little lottery. We will develop 30,000 sensors and we need devices very simple and devices that last the battery for ten years at least. That's why we have to deploy protocols like N row IoT, and 5G is not ready yet for this challenge, is that you think of it. We're changing the product. We are people using the Internet, which is downloading information and a massive IoT. So.

So current networks are not able to deal with the massive connectivity and diverse necessity. So 5G, again, has been designed to support this and then we

have several other needs that you are familiar with, which is the connect the car, and in the end billions of cars talking to each other in low latency for a safer traffic experience and there's no way that the networks can support this.

At the very end, you have security forces of the state, which has been always demanding that whenever there is an emergency, I want to have a guarantee of capacity in the network. All of this, you would agree with me if you deal with the enterprise customer, that is several year old needs that we are waiting for 5G to deliver.

But the thick is that, however, 5G is still years to mature. It's still two years until to be really useful. To are my like, it's too much mass market oriented. So if you think of it much of the frequency licenses we have in Europe, the 3.5 gigahertz, it's a frequency that's pretty much focused on downloading speeds and really we don't have a need for downloading YouTube videos more rapidly. What we need is we need full 4K, massive information from cameras or uploading information, right?

So this kind of approach is what is hampering 5G right now. We are in the 15 milliseconds and we will get to 5 milliseconds in one to two years. The only devices we have on the mark today are pretty much SmartPhones but for the use cases, we see in the market which our customers are demanding, we need enterprise 5G which are still starting to appear.

So if this is the maturity of the market, why are we having so much connectivity with our customers. If you want to take full benefit of the 5G possibilities, you have to adapt your business. It is not self-evident. If you want to have wireless critical communications to make your manufacturing chain more flexible with this trials, with these prototypes, they are checking if this is feasible, but to take profit off it, they have to make their manufacturing change feasible, flexible, which they are not.

If you want to fix delivery chain, if you want moving vehicles and reconfiguring your manufacturing plan according to the needs and the optimized configuration for every moment, it means you have to do it a lot to change your business processes, to change how you relate with the supply chain and how

your workers work and how you perform the different tasks in the company. If you want the benefit of 5G possibilities in two years' time, you start -- you need to start to adapt your business processes now. That's -- that's the reason we have so much activity now. And coming back a bit to what we said before about the necessary for the huge uplink. Mr. God Friday said there -- God free said there's no demand for this. We see the 3.6 gigahertz, which has been licensed in Europe is not enough by far for all the uplink that we need in the different use cases so pretty much industry we are trying to deploy. For the millimetric land. That's where we see the huge capacity that we need.

As I know, we are short of time. I end this brief introduction with the four most active. There's studies around and consensus about which industries will benefit the most. This is just what we found. These are the four verticals that already have a very, very clear idea and that would be ready to use 5G as soon as it is versal, mature and ready -- it is universal, mature and ready.

Of course, you miss here, smart cities and e-health and education. What we are seeing is that those verticals still need some time to go in digital, for their -- one is the V2X which is vehicle to everything, communications, very active vertical. And I don't mean vehicle information only for the cars on the street. I mean for instance for communications in the industry, communications of develop, and personal and on foot in order to get a more coordinated and safer traffic to have collision prevention, it's an algorithm that's developed quite fast. The rerouting of autonomous-guided vehicles in the street to make sure they always get the ultimate routes and the coordination of traffic so this is one of the active verticals.

>> ISTVAN BOZSOKI: You are on your last minute.

>> JUAN MANUEL CAMBEIRO: Okay. The second is industry and logistics, by far the most active from substituting every cabling they have in the industry and which all the benefits of time and flexibility that gets I think mean there's a plethora of use cases. TV, media and events, it's a clear use case so for news and journalism, you stream video use using

5G, which offers more flexibility.

And then we have a vertical of tourism and entertainment with cloud gaming and a vertical that is growing really fast from an industry which is software simultaneous translation for the latency. This is a summary of where most of our items are falling into. And that's pretty much my introduction.

>> ISTVAN BOZSOKI: Thank you very much. It's maybe not the future. It's already the present, the needs are present there. So the next speaker was already mentioned. Not Turkcell was mentioned in the presentation of Reinhard. So we have madam Elif Yenihan Kaya. She's the director of Turkcell, and performed many engineering roles in operations and planning the mobile network and from 2015, September to now, they has been the head of access network capabilities. Elif, the floor is yours, please.

>> ELIF YENIHAN KAYA: Thank you very much, Istvan.

I would like to say hello to everyone. Next slide, please. I would like to start my presentation with the complexity, different aspects of complexity of 5G. First of all, we all know that it has been academically quite a complex job to establish 5 good.

And in the network deployment phase we see that we have several complexities because of the options, the permutations and combinations of implementation of 5G network.

But apart from these complexities, there's a different aspect of complexity of 5G, I believe.

Next, please.

So it's the commercial complexity I would like to underline. We all know that in the past ten years, the operators, market globally remained flat. But on the other hand, the Internet companies, they had on a dramatic increase in their value and market caps.

So what enabled it is the broadband networks and the evolution in the broadband networks in the last ten years. But I believe that 5G will bring a different wave maybe a chance for telecom operators to make the game change at this point. So it will bring up new business value as it was before in the last ten years. To it's -- we may have the chance to catch that business value with this new technology. So this is the critical point I believe when we go ahead for

the use cases. Next, please. Next please, yeah.

So where do we see the revenue growth in 5G. What do we need? First of all, we need to enrich the business. How do we enrich the business? My presentation will have similarities with Juan's presentations, Telefonica's presentations. We need to understand the requirements. So these are industries that he with don't know yet. We are not the experts I mean in these industries but we need to understand their requirements so we can solve them. So we have a challenging position in this area, and I -- and when we have customer contact with my corporate customers, I understand that they have today's needs that I can solve with existing technologies and also they have promising needs that can be implemented into the 5G work. So this is a very critical part. That's where we are focusing on at the moment.

Next, please.

And zero touch networks. So zero touch network is an optimized, AI-controlled self-optimizing network we call it. At the moment, we have SDN in our network, but it will be taking many more steps to the future and it's really when we talk about the complexity, this item is really a necessity for the network providers, and also we see that it's the customer requirement at the edge. So the customer also requires zero touch. So this is another part that we are focusing on.

The next part is the tailor made network design yes, we can serve with the network that has capacity pool for everyone, or we can implement different networks for different requirements but these two options do not fit in any more. So we need to have a tailor made network design for each and every industry for customer. So what does this bring in it brings the network slicing, the quality of options and taking them ahead. One more and we believe an existing strong network and the revolution of this strong network into 5G is also a very critical step.

Next, please. I will try to explain it in a bit, and I will not go into the details. I believe that the wide spectrum, the existing spectrum and the future spectrum is critical. Gigabit speeds that we are serving today and in the future, maybe 5-fold, 10-fold of them. 5G for speech, and existing network

infrastructure enabled is critical because we are gaining experience in that area towards the massive IoT, and the fixed wireless service is let's say expressed as a use case for 5G, but we are also serving it in our existing LTE network and it's a huge step towards 5G networks.

Next, please.

So which areas will we evolve? Fixed wireless access is one area. Next slide, please as they come one by one.

Yes, that's okay. So evolution from will superbox. We have 500,000 subscribers but the evolution towards 5G will be critical for us, because it will enable us to have quick and easier access to our fixed subscribers. This is one focus area for us, and has mobile broadband. We have the gigabit speeds at the moment in our network, but we will be 5-fold, 10-fold of it serving, s. It's critical for future use cases. I will mention about them.

Critical missions such as communications I have already addressed and lastly the latency. This is an area that we are focusing on at the moment for new services and we have an R&D. We have some R&D use cases for focusing our latency capabilities.

Next, please.

So what have we done so far?

We have -- we have had several deployments. I want to mention some of them. So 5G drone, 5G connected drone, 5G controlled drone is a critical agenda item for us. It's a vehicle, again, and we see huge potential there.

The second item I would like to mention about the virtual reality use cases, we have had some of them also showcased them. So this will be another critical area.

And you see remote diagnostics. We have also trialed this use case. So it seems to be a promising use case, and also live broadcasts, we have trialed. So the live broadcast option over 5G will make a huge difference we can see.

Next, please.

So I mentioned about the R&D approach. From August 2018, we have started our 5G R&D focus in Turkcell. And the materials we are concentrating on. We are concentrating on AI and machine learning

technologies for telco, SON and automation. And cellular vehicle communications. We have some local production achievements in our country and we are supporting them with our R&D. And also drone communications is another hot point for us. Industry 4.0, industry use cases as I have mentioned.

Nonterrestrial networks is another study item in our R&D focus, I would like to underline it. And, of course, open networks is another focus area for us.

Next, please.

So we see that these are -- these we have started with phase one, assessing and researching the technologies.

Next, please.

And now we see that we are evolving to phase two and phase three in some of them, with the service focus. So cellular V2X has gained incredible focus in our country and we are giving it extra focus because we have a special project with a local car.

Network slicing and edge computing, we have projects here, ongoing live projects. And one more item that I would like to mention here is the private networks. And beforehand maybe two or three years ago, we haven't considered it in detail, but now, when we connect to the customers and take their requirements, we see that private networks is really a critical agenda item, and very close -- I mean, not far behind or far ahead like the cellular V2X, but this year or next year's subject.

And also drone communications is reaching up to production phase. Industry IoT use cases, as I mentioned.

Next please.

>> ISTVAN BOZSOKI: You have one and a half minutes remaining.

>> ELIF YENIHAN KAYA: Okay. I'm concluding. I would like to underline some challenges also. We have the challenges in terms of infrastructure, because very high energy consumption is necessary for 5G. We have to redesign. Next please.

The operator specific use cases. I mentioned about several use cases but concentrating on use cases that will make a specific break out, or breakthrough is critical, I believe.

Next, please.

Of course, spectrum prices is another challenge, a huge challenge in our agenda. Next, please.

And the coverage, of course, 5G is not a coverage based technology. So we will deploy where it is necessary. And finally, next, please. Next slide.

Can we go forward, please.

We have talked -- one back.

We have talked about all of these. So success of 5G is directly related with the focus and interest that the operator is giving into it. So we need to have disruptive use cases specific for the country. Operators should be encouraged by the regulators, of course, because it's another huge investment for the operators. And I believe, I'm sure that Turkcell will maintain the technology leadership in 5G in the coming years.

Thank you very much for listening to me.

>> ISTVAN BOZSOKI: Thank you very much. And I think the questions are coming after the -- just to repeat, the questions are coming after all the presentations so participants still have a chance to add questions to the chat.

Now we finish the operators session. So now let's move to the hardware producer. The first speaker is from Erika Ms. Silvana Apicella. She is our next speaker.

>> SILVANA APICELLA: Do you see me? Do you hear me?

>> ISTVAN BOZSOKI: Yes. Please proceed.

>> SILVANA APICELLA: Okay. Thank you, Istvan for the opportunity. Thank you very much. I'm Silvana Apicella and I'm leading the network evolution in Southern Europe.

As we see 5G after the first 18 month after the first commercial launches. There are around 100 commercial networks around the world. That's not old numbers more or less, and those are spread over 44 countries.

We have already 200 different types of terminals, supporting 5G and if we look to the leading countries, and if we look to South Korea, we see already very quick uptake of 5G. We have 8.7 million. It's not an absolute number which is interesting. It's mainly the -- the 5G, that's a penetration. It's roughly 25% of all operations there.

An what is also entering to note is that the traffic for 5G -- for 5G users has grown a lot compared to 4G and we see the number 2.6 times more traffic is being generated by 5G users. What is also interesting to note and this may be the focus of my presentation, is that many operators have already started to make a tailored offer for enterprise for industries based on private networks and vertical use cases.

And that is an entering part.

Let's go to the next slide.

If we see some numbers around the 5G for industries, when I say industry, that means for the private sector in general, that's where also my -- previous speaker were referring were most of interest of 5G is. We can see it from four different angles. If we consider, which is the business potential for communication service provider, the industry digitalization, we have 700 billion USD in the next ten years.

And if we ask to ourself which is the status of the cellular IoT, we have actual currently 2 billion connections, mainly based on the previous technology, and we do forecast that in the next five years, we will get up to 5.2 billion connections and most of that will be 5G.

And then the third angle. How many enterprise or industry they are thinking or evaluating to implement their own network based on 5G?

And that's an Ericsson number. We are trialing with almost -- with more, sorry, than 100 enterprise and companies on how to implement their private network over 5G. And then another perspective, which are the most interesting use case, most interesting use case, and we have more than 50 reference of different projects and partnerships with our customers, with the mobile operators and the device manufacturer and with academia and so forth.

Let's look to the first point, business potential. Please, next slide.

700 million is the business potential for those communication service providers that wants to address the digitalization of industry, and if we look to, let's say, the revenue, that the next ten years will come from the traditional offering based on voice and

data connectivity to both individuals and business, we see a very flattish trend, 0.75% is the revenue growth in the next ten years, which is not so exciting.

But if we think to the business that could be generated -- we are not addressing the industry. We see a complex different number. It's 12% and this 12% should correspond to roughly 35% of additional revenue on the top of the traditional revenue. And part of this revenue can be addressed by 5G, thanks to what has been said to now, high speed, quality of service, latency is, reliability and accurate positioning as well. Please, next slide.

Let's look at the cellular IoT, the connection based on mobile technology, as there are many different use case and multiple industry, we -- we in Ericsson, we group them in four categories. And as the previous speaker was mentioning, massive IoT, broadband IoT, they are possible to do this kind of connection with existing technology and by you're, 5G, the new access will improve the use case.

Where it starts to -- where we start to have a difference, meaning that only 5G can implement the use case is when it comes to critical IoT, because in addition to high data rate, there are additional requirement that could be requested, and those are ultra low latency, and ultra reliable data delivery and bounded latencies. And then we have steel automation which is built on the critical IoT and you see 5G network integrated in the industrial protocols and with industrial architecture, like time sensitive networking. And in addition we have very strong synchronization.

These categories should map most of different use case of the different industries.

Please, next slide.

>> ISTVAN BOZSOKI: You have around 5 minutes more.

>> SILVANA APICELLA: Okay. Yeah. Yeah. Yeah. We stand at maximum broadband IoT and broadband IoT. There's still standardization that's going on. Please, next slide.

But why -- an enterprise -- an industry -- an industry should choose to rely on 5 -- on cellular technology to implement -- I mean to digitalize their own processes. They are essentially five reasons for

doing that. We are talking about mobile technology and that's -- that's very flexible deployment, we could have private networks and cellular implemented in a fully -- meaning all the capability are it at the enterprise premises or the other way around, fully integrating mobile network.

And then the second reason is because capacity coverage and mobility is what is -- is intrinsic in mobile technology, and then we refer already to the latency is and that's not something off the shelf today. That's something that we are all working upon. And then for security reasons and then finally, maybe the most important one, because this technology are future proof and what is also interesting is to see that we have alliance and association coming from the industry, which are joining the 3GPP initiative. Meaning that GPP will implement those requirement in a strict coordination of those organizations.

Please, next slide. But which could be the spectrum for -- for the industry? And we have several choices, as you know very well. In the picture, you see there we have the list -- I mean the depicted countries where the discussion about dedicated spectrum to industry has already started or has already been assigned. That's not the only solution. There are also other solutions. We are not going to debate the pros and cons because for all of them, there are pros and cons. The open thing we want to bring to your attention, this next animation.

When it comes to local, assigned -- sorry to dedicated assigned frequency to industry, two main criteria should preferably apply. One is the local assigning, let's say, a wide coverage location to industry could lead to an under utilization of the spectrum resources, and the other one is the real estate, meaning that the owner or the tenant of the real estate should have a kind of priority in such a way -- if they are not using other parties and other parties meaning the mobile operator could use them in a short-term basis.

Please, next slide.

Just to depict how the different, let's say private networks could be deployed, partially into the public and the private domain of fulling the public network, or the public domain. Please go to the next

slide. As we said, the critical communication maybe it's compromising area. And here additional challenges are coming into the scene because if we are talking about critical connectivity, meaning that all the network component of the networks needs to be very close to where the services is deployed, and that's possible according to the coverage needs of the application itself.

If we are talking about a manufacturing, meaning a local area, there is a quick solution, which could be let's put everything to enterprise domain or in the deep edge of the mobile operator. But as soon as the requirement is told to cover a wide area, it's a little bit more challenging, because that would be required to go really in the deep edge and that would be very costly for operator, and just making a link to what Jeremy was saying, is where, let's say, the business case is not so easy to get there.

Please, next slide.

This is the list of the industry collaboration we are having around the world. Mainly our customers, mobile operator, but also with the device manufacturer, with academia, with governments, and please, next slide. My last slide. I have to be on time.

I put the reference to some Ericsson studies in this -- in these studies is a kind of, let's say, list of suggestion we give mainly to our customer, mobile operators on how to address big opportunity which comes from industry digitalization, and then I put a list of, let's say, some interesting use case, critical communication case, which are the most challenging ones.

Thank you very much for the attention.

>> ISTVAN BOZSOKI: Thank you, Silvana, I think you were in the time.

>> SILVANA APICELLA: Sorry. I was rushing.

>> ISTVAN BOZSOKI: We have limited time. And now it seems that Donna Bethea-Murphy is back to us. Are you there, Donna? Donna, can you hear me?

>> ISTVAN BOZSOKI: Yes, please the floor is you. Try to manage eight minutes because we already used a bit of time for the other satellite presentation, just to cover satellite issues.

>> DONNA BETHEA-MURPHY: Okay.

>> ISTVAN BOZSOKI: Thank you very much.

>> DONNA BETHEA-MURPHY: Thank you for inviting me to speak today and the ITU for putting this important panel on. This is especially important as we all move to digital platforms by the pandemic. So next slide, please.

Everyone here has -- before me has spoken about 5G, about what the ecosystem looks like, and in this picture, I think that we are looking more at what an urban community looks like. We are going to add in the idea of what the 5G ecosystem will look like as we also add in more rural areas.

But I think that the applications are endless as has been discussed by the previous speakers and I think that it is important to see that 5G is going to be always on ubiquitous service with the wide range of devices. And I think it's important that for the user that this is seen as seamless and satellite is one of the networks that will work hand in hand with the mobile networks, the fixed wireless access networks and the fiber networks.

Next slide.

I think we have already discussed this also earlier today, where some of the use cases involve enhanced mobile broadband, massive machine-type communications and you have reliable and low latency communications.

Next slide.

Why is satellite essential to 5G and emerging networks? I think my next -- I think my slides are slightly out of order but on the next slide, as we show the inherent -- oh, no. That's okay.

The inherent architecture of a satellite due to its coverage, its security and its ubiquity allows for high-quality robust capabilities, of flexibility because of the coverage. You do haven't to move a tower around or move a table. So it allows for rapid deployment and different frequency bands. Global coverage, which is -- is maybe as my colleague mentioned is good for broadcasting and many different applications where you want to push one to many or even receive many to one. It's portable, as we discussed before, and the networks are secure because you can choose to not go within the public network, and they are reliable use today.

My company specifically was originally designed to provide safety communications, both in the air and the sea, and we -- satellites in general, and many of the users today, we work together with Ericsson and many of the other providers to -- to secure terrestrial infrastructure and backhaul.

Next slide, please.

So let's get down to some of the use cases, specific ones that are starting to roll out today. You know, I think the whole reason that the -- we're meeting today and that 5G has become a big issue is really the UN's SDGs, sustainable development goals and improving something like architecture in agriculture. It will allow us to feed more people, specifically being able to use data to measure water supplies and where the ground is dry, what the water levels look like, where your assets are because when you get into large swaths of area like farmland, you can't always have a tower everywhere. You can't always have a -- a fixed line. I think the idea is to use all of these networks together to provide increased efficiency and to reduce cost because we're looking at finite assets, and we are -- our network, and other networks are already being used for this.

Next slide.

This is an example in Australia, where we have been rolled out all over the country to do the very thing I have discussed. The -- the important thing here that it can allow -- that adding satellites into this IoT network can allow for immediate dispersal of requirements at a drop of a hat. Next slide.

Interesting, some of the other use cases that I had in here originally, seem to have not made it in, but that's okay. I think many of our previous speakers have talked about them. You know, smart rail and -- and utilities, but I think that the applications are endless and being rolled out now and I think that we are creating architecture that is open enough to include them. What is an important point is as we look at 5G, the coverage areas are getting smaller and smaller due to the frequency bands. So it's important that as we -- as 5G really opens up different industries and different utilities, that we realize that it's important to leave no one behind and extending the coverage, extending the edge, extending

where we can tend a broadcast signal is important in making sure that we don't leave anyone behind in the digital divide.

Thank you.

And I think I have given you a couple of minutes back, chairman.

>> ISTVAN BOZSOKI: Thank you very much, Donna. Even I can say that you are a hero, because are you from US now? Are you speaking from the US?

>> DONNA BETHEA-MURPHY: I am. I am.

>> ISTVAN BOZSOKI: Yeah, because I don't know whether you haven't slept yet or you woke up very early, but thank you very much for this. Sharing your experiences and thoughts. Thank you very much.

And now we go back to the hardware producer. We have from Nokia Bell Labs Ms. Francesca Sartori.

>> FRANCESCA SARTORI: Good morning, everyone.

>> ISTVAN BOZSOKI: She's principal solution architect. The floor is yours.

>> FRANCESCA SARTORI: Okay. Excellent. So you can -- good morning, first of all, and then you can start with the first slide. That is a -- that is a video.

It should start.

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>> Well, wires only go so far.

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>> FRANCESCA SARTORI: Okay. Thanks so much. You can go to the next slide. Every time I see this video, I'm really fascinated of how many different scenarios and environments that 5G is going to open. It's really very interesting for a person coming from telco, we are talking about the connectivity and the consumer. That was mainly the initial and the first focus.

Now, with a new technology, with a new generation coming, we are opening the door to multiple scenarios. That's very interesting. I would say that telecommunications becomes an enabler for the other segments, the other vertical to become more profitably optimized.

So as I said, there are and also the previous speakers have highlighted how many different scenarios and use cases there is the possibility in the year to come, but there's some elements that are in common.

So for example, the multiplicity, let's say, of how many different deployment areas we have, so indoor, outdoor, private, commercial, or consumer, national, local, the multiple areas that we need to make sure that we are able to support properly with the right solutions. At the same time, we have an additional list of -- group of performances that are becoming various sanctions and very key element for the final outcome. So not only the throughput that we have been talking for many years in the private technologies, but now we need to make sure that we have the predictability, the synchronicity, the security, the safety, all of these elements are cross-sector, cross use cases.

In a way, all the different enterprises are targeting this new performances.

And on top of this, it needs to be easy. So we can't ask to all the other industries to become an expert on telecommunication, and so we need to facilitate the life when we want to introduce this telecommunications, these additional enablers in their processes.

These three elements -- so multiple options, additional performances, and easy -- feasibility. I don't know how to call it. That is a really cross segment and that we were learning in the last year. So when we talk about our customer and our customer, that are the three major pillars that need to be really available everywhere.

So you can go to the next slide.

And just to make a little bit more explanation open this point, we did a deep analysis of different segments and the latest subsegment to understand, okay, let's try to group it. Let's try to understand if there are anything that we can create common solutions, and we have identified different parameters. Here is an example, four of them, which are the major services they are targeting, the number of base stations and in the area that they need to cover, they need to perform, and the key features.

As you see, just to mention three different segments. So manufacturing, airport, and public safety, we have different view, different segmentation. You see, you may have -- the manufacturer, they want to -- they are focused on

campus area. So limited portion of the coverage, but you may have public safety that is nationwide. Or you may have airport that has multiple services because they can have local area for consumer, and their workers but at the same time they need to have, for example, very demanding critical communication.

So you see within the same -- the same four parameter, we have different level of needs. And even within the same segment, for example, manufacturing, we went in the subsegment, and also there, there are different level of requirements and they can vary for smaller and larger number of bay stations. So this is very -- the level of complexity, that is on top of the classical implementation, that we need to consider when we are extending the telecommunication in other environments that is new for the sector.

But next slide, please.

As we already said, are we ready? Yes, we are almost ready. As you know, the 3GPP is the body that's delivering the specifications and as has been in the past, the specifications are released in waves, let's say. First of 5G released is R15. That's already happened. We are using it for the existing 5G, the commercial 5G, and this, the main focus was a consumer and the connectivity, but it also understandable is a baseline. So when we need to create the fundamental of the new technology.

Then with the introduction of the standalone, so the portion of the 5G that doesn't need LTE, and the new releases of R16 have just been frozen the and the R17, which hopefully they will be written next year. Those -- these additional waves, we will cover and we will set up their right ingredients for this extreme or extra performance like the synchronicity, the predictability and all others that are on top of the classical connectivity.

Of course, this is something that as -- it is not slowing down. It's a normal delivery time, but as we have already heard before, in the previous presenters, there are some who want to get there, as soon as it's available. And we need to integrate it in the other industrial protocols. That's another element that we need to learn to together.

So, of course, having this in the new waves, the sigh effect is on the devices, as has been mentioned.

This is one of the key ingredients for the end to end delivery. And we need to make sure that the delivery of the devices will be in line. It doesn't work. The use cases have not been able to be delivered.

And other ingredients that we need to add of this deployment is the next slide. And we have already mentioned. So I go faster here. Here is the spectrum. We have already covered in many different other mentions. So the process is ongoing. As you see, there are different colors because there are different levels of allocation and spectrum and allocation, and different approaches. There are only licenses or only with the service provider or even allocated locally for enterprises. There are different ways to interrupt to allocate the spectrum, this is one of the key elements and fee factors for enabling and facilitating the take of the 5G in the industries.

>> ISTVAN BOZSOKI: Your last minute.

>> FRANCESCA SARTORI: Yes. So we can go faster.

I want to just show you, please go ahead.

Okay. So this is easy to -- we can also go direct in the next one so you can click it automatically. Yeah.

The important factor is we are not talking about only radio, core end devices and frequency. These are first elements. There's much more. We have the transportation. We haven't touched the fiber optics and the physical layer, because without that, it would be difficult to deliver all the duty performance that we were talking about. And on top of that, we need to consider the security, the analytics and automation. And there's many other applications on top of the end-to-end for the infrastructure to be included.

So the Lego blocks really a lot and what we need to work is with our partners and our customer to make sure that we can find the right optimization in order to deliver for what is needed for the single use cases.

So the next one.

Let's go.

Exactly. These are interesting cases. You see it's already happening. Some customers decided to start with the 4G, and then to upgrade the infrastructure to 5G. And they want to start' little

bit earlier, just to learn how it works, right? It's not maybe matter of performances, rather than to understand how to integrate different technologies in their processes and other like these examples are already starting with the 5G. So there are different, just to make an example with Lufthansa, Techneek and with Toyota, we are introducing the 5G in their manufacturing processing. So we are helping them to the digitalization, and with the Deutsche, we are training next year. So that be there interesting.

You see different -- completely different environments, completely different sectors, but what is across the sector is exactly the performances, the easability and how ease e it is to introduce in their systems and really the capability to extend the overall use causes from the classical static way and the flexible approach.

>> ISTVAN BOZSOKI: I'm sorry. We finish.

>> FRANCESCA SARTORI: I finish. I finish.

>> ISTVAN BOZSOKI: Thank you very much. And now the last speaker from Huawei Mr. Zaheen Khan. Are you here?

>> ZAHEEN KHAN: Yes, I'm here.

>> ISTVAN BOZSOKI: Sore I don't introduce you, your CV is in -- please, the floor is yours.

>> ZAHEEN KHAN: Not problem. I understand.

Yes. So good morning, ladies and gentlemen. My name is Zaheen Khan from Huawei as you know from -- I think you have seen the CV on the website.

So today my topic is inspiring 5G B2B together. So before I talk, I would like to say thanks to the ITU team for giving me the opportunity to speak and ITU 5G regional forum. Today my presentation topic is very precise and to the point for B2B so this is one of the Logans we are using, like business-to-business and I'm just focusing on the enterprise domain for the new business case and, you know, the finding what we are doing so far.

So next slide, please.

So actually, I will not go into the details so the other speakers previous to my presentation already explain that. But the standards and the alliances are empowering 5G B2B business. And we are incorporating -- you can see AG ACIA and 5G AA and they are incorporating a lot with the 5G standards and

putting a lot of proposals. You can see the reliable 16 is frozen and we are working with our customers for launching the massive MIMO enhancements into the networks.

We are very closely working for the industrial digitalization. For example, like nonpublic networks which is very hot topics for the private networks and the private line solutions here in west Europe and particularly in Germany.

And we have release 17, which will be covering a lot of new features, providing on the 5G.

So next slide, please.

Okay. So here actually, I would say, like, the 5G is now getting the center of attention, and then 5G is covering a lot of 5G B2B domains here in Europe. And you can say that we have the different kind of partitions here like chipset, industrial OE, infrastructure, and industrial application. We have been working with the release 15.

And now after the frozen of the release 16s, we have the 5G industrial OEMs. 47 industry models and 14 commercial. So we expected to have by 2021, like these models costs would be around \$20 roughly estimated. And if you see, like, 5G infrastructure site, which is, you know, one of the very strong competency and then the capability that we. Have the first SLA 5GB2B and when I talk about the SLA service level, and we are trying to provide under the umbrella. 5G. So actually 5G is not only the connectivity technologies, it might be -- there will be some questions around this topic. We need to guarantee the monitoring bandwidth and the uploading and the downloading bandwidth and so by providing 5G, we are covering some kind of SLA and we already have the first commercial 5G to B quality. And now we have 5G PLC control, so less than 20 milliseconds. These are the very important factors.

You know, this is the pillar the 5G, but actually, I'm going next step ahead, like what are the findings we are doing here. So these are very good and promising reserves we have. And in Europe, we have 141 trials and 51 industry 4.0, and by 2019, 16 trials for the industry for 4.0. So next slide, please.

Okay. So now, actually, the 5G, when we look at

the 5G is not as -- as I mentioned, the connectivity is beyond the connectivity. And then while we that you can about the beyond the connectivity, we are combining the 5G plus line and the VPN connections. So it means we are replacing the traditional providers or like the media which is running on the enterprise side, and we are combining the ICT plus OT, plus 5G industrial applications.

So on the right-hand side, you can see that we have different use cases for the value-added industrial applications, what we have done and we are doing right now. We have the logistics where we have the PLCs. We have also like the industry 5G for the digital and for the predictive maintenance we are doing and also the production quality. So all at once, like 5G is addressing all of these problems for the -- you know, for the initial cost and the operation all together in the one platform. So next, please.

Okay. Now, actually, these are the very important facts and figures, while you are doing the market investigations. So we have typical 5G industry applications, all being integrated rapidly which we have done -- I mean, in China and also in Europe, and as you can see, on the first case, at the left-hand side, with the 5G AR expert and the initial requirement for this was like the uplink, you know, to check the remotely, what is happening on the plan and then test the data repeatedly and check the latency. The initial requirement in this year was 80 megabit per second. The next phase, where we have 2021 where we are -- sorry.

Yeah. So we have like machine vision. So if somebody wants, they can also go on to the side, we already have the 5G machine vision use case, which we have quality control in China and we have 560 megabit per second. And then the 5G AGVs. Not all the AGVs need to connect for the 5G. But we have the precise use case requirements to use 5G as AGVs and then later on the PLCs. So actually, if you see like the 5G at the beginning -- I mean, 5G could be very hard code to decode, in terms of the industry 4.0, but if you combine all of these use cases under the umbrella of the 5G, I think many companies already improve the directions that they are going to move on the 5G,

while the low latency and how it reports an resized SLA. So I think these are all the factors to be addressed. The 5G. So I give you the vertical example on the right-hand side, these are the -- you know, the PLC based. So they deployed the camera and the PLCs from the factory by the remote connections from the special kind of cameras and then connected these cameras to the CPE, the industrial CPE and then monitor these big cranes by using the 5G.

So this is up with of the typical use case which we have worked and also, you know, the AGVs. And you can see the AG Vs are already working. We can see that 5G could be a good answer and then, you know, accelerating 5G to the local partner and then special end-to-end reliability.

Next, please.

Okay.

So building 5G into the new power source better ecosystem, there are different components you can see, but don't look 5G as standalone technology while we are talking 5G B2B. We need the cloud -- while I select for the cloud and the AI because most of the industries as the requirement, they have the intra cloud and the AI capabilities while addressing the 5G B2B. We have the system integrators and vendors need to strengthen the network capabilities and provide the unique SLA and industrial customers also need to have the deep integration into the digitalization. So according to you are investigation, we found like industry customers are lack of the 5G and the technology and the information and so we are also -- the regulators also need to do that.

Next slide.

>> ISTVAN BOZSOKI: You have the last minute.

>> ZAHEEN KHAN: That's why I'm so fast. And you can see, like, Huawei is being integrated for the 5G to B. We have the 5G networks and the modules, cloud, AI, cloud control and OEM devices. So we are already working with the developer standards and we are contributing continuously to the industry and also the business alliances as we are also closely working was said, in regards to promote and promote the 5G to B use cases. The next slide.

Okay. Thank you very much.

I don't know if I have been so fast. I many

apologies because of the time, I'm last and I think I have the pressure from the organizer to finish. So that's from my side and then I will be happy to answer any questions, even though these are not in my presentation.

>> ISTVAN BOZSOKI: Thank you very much, Zaheen. And luckily, that's why we wanted to have first order presentations because everybody could have the proper time slot for presenting and this was my idea.

Fortunately, we have just four minutes left. So first, I wish to thank to all of you for your excellent presentations. And now, I see that maybe we can go until 12:20. So I don't know if there is any questions from the audience, because I saw just one at this moment, and it's to the satellite operators, that what do satellite operators consider about using 3,800, 4,200 megahertz band locally for private networks. So I don't know if Donna or Alexander. Donna, do you want to reply to this question?

>> DONNA BETHEA-MURPHY: Sure. I will take it.

I think that it -- everything depends on specific -- what the specific technical characteristics are when we are discussing. If you are talking about a college campus indoor use, I can't see where there would be a -- an issue. So I -- of course there, can always be compatibility when you are looking at a private network with any other -- any other type of communication. It all depends on what do you mean by local.

In the US we are looking at private networks that cover the whole United States, and I think that that looks like a different scenario. So --

>> ISTVAN BOZSOKI: Thank you very much.

>> DONNA BETHEA-MURPHY: I don't know in Alexander wants to make a comment?

>> ALEXANDER GEURTZ: Yes, I may just add that that's obviously a frequency that we are using in many parts of the world for critical user links. So any such -- you know, terrestrial use would have to be scrutinized on that basis.

>> ISTVAN BOZSOKI: Thanks, Alexander. And I have just one question, because I don't see more in the chats. So what enormative approaches could have developing into 5G ecosystem to ensure broad deployment?

I don't know, Reinhard, do you want to rely to this? And maybe others?

>> REINHARD SCHOLL: Thank you. Thank you, Istvan. I think in the private network sector, there's room for innovation. So private networks meaning networks made by SMEs or universities or my hospitals or also by bigger companies that have various sites.

I mean, there is many vendors offer software for core networks, and private networks and they have a core network. They have radio access network. So while many vendors offer software for core networks, they are not -- there is not too much competition in the radio access network area.

So the efforts underway of virtualizing it with open interfaces and I think this innovation will -- or if this has been done, it will lead to more innovation and competition the RAN area and I think that's an important area to look at.

>> ISTVAN BOZSOKI: Any of the other speakers want to reply to maybe the same question.

>> ZAHEEN KHAN: I will take the liberty.

>> ISTVAN BOZSOKI: Please do.

>> ZAHEEN KHAN: So actually, according to our experience and working here in Europe, we have different. One, we are going from the public sectors while for like universities and like institute and some start-ups, we are working on. This and also we are investigating and investing on these 5G hubs, you know, which are really good potentials in order to improve the ecosystem. You know, we are closely working of the OEM and the chipset provider. These are the golden keys. You have this spectrum, but if you don't have the devices, it will be very hard to go into the commercial.

So one of the main targets for us to look at these chipset and also to validate and integrate to the industry. So we already incorporating and providing that integrations process to the 5G to Bs and we are in line. And there's some NDA which we are doing and hopefully by 2021 we will have some kind of promising results in this domain.

And also, you know, we are already working of the overlap where we are asking for the partners and Huawei is part of some third-party initiatives where

we are contributing to deploy in ecosystem. That's from my side.

>> ISTVAN BOZSOKI: Yes.

>> JUAN MANUEL CAMBEIRO: May I add something?

>> ISTVAN BOZSOKI: Yes, please.

>> JUAN MANUEL CAMBEIRO: In line with what we have been discussing today, I believe the way forward for 5G, at least as of now, is really to concentrate on the enterprising use cases where we believe there is a value, but for that to happen, I believe we have to realize all the ecosystem, that this is the case, as Zaheen said, before. We have the devices, the ecosystem, they have to realize that it's on the enterprise and not the mass market. They have to work on enterprises as well. I believe that's a way where we will find most of the value of 5G, and make the industry more competitive. I think that's the key at least the way I see it as of today.

>> ISTVAN BOZSOKI: Thank you, Juan.

I think I don't see any comments in --

>> DONNA BETHEA-MURPHY: I will make just a quick question.

>> ISTVAN BOZSOKI: Sorry. You have the priority. You are so far.

>> DONNA BETHEA-MURPHY: Thanks. I think that as we are all sitting around waiting for the killer app that will cause everyone to -- to sort of flock to 5G, that public/private partnerships are important. I also think as one of the previous speakers just said, that looking -- looking at different use cases and putting in all of the trials, doing many trials. We just did one with media tech that will be included in the next 3GPP standards meeting. And I think that, you know, while we're waiting on this super app or this killer app that's going to come, I think that it's important that the public/private partnership there.

I also think as the last speaker said, that it's important -- this is an ecosystem of ecosystems or a network of -- sorry an ecosystem of networks and I think it is important that everyone has the appropriate spectrum to be able to operate and that is mobile wireless, that is satellite, that is, you know, IoT devices and I think, you know, working together we can get there, but I think it -- especially in the

current pandemic, it will be a little bit of a challenge with respect to capital investment.

>> ISTVAN BOZSOKI: Thank you, Donna. I think there may be more comments. I have to finish it now. Thanks to the ITU, the satellite industry, the telcos and hardware producers.

And also wish to thank my ITU colleagues who worked in organizing the meeting and thanks for the IT moderator who helped us running the slides. Exception I don't need to thank for the interpreters because we had it just in English. So thank you very much. I wish you a good lunch and then don't forget at 1:00, we will have a session on the EMF issues of the 5G. So thank you very much and I'm happy to moderate this session. Thank you very much, and have a nice day. Bye-bye.

>> Bye-bye.

>> Thank you.

>> Bye-bye.

>> Thank you.

>> Bye.

>> JULIAN McNEILL: As Istvan mentioned, we are having a 40-minute break at the moment. And just for the speakers of the next session on the EMF, we're starting at 13:00 sharp. So if you can connect maybe five minutes before, if you are still there, just give you some time.

Thank you.

>> ISTVAN BOZSOKI: Thanks, Julian.

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