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**ELECTRONIC LODGEMENT**

Dear Sir or Madam

**Telstra 5G update – transcript**

I attach a copy of the transcript from Telstra's 5G update, held on Wednesday 5 December 2018, for release to the market.

Yours faithfully

**Sue Laver**  
Company Secretary

## Telstra 5G Update, 5 December 2018 – Transcript

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Robyn: Well welcome everyone to today's 5G update for investors, and thank you all for being here in person and for those who have joined us via the webcast. I'm Robyn Denholm, I'm Telstra's Chief Financial Officer and Head of Strategy and I'd like to begin today by acknowledging the traditional owners of the land that we meet on, the Gadigal People of the Eora Nation, and I pay my respects to their elders past, present and emerging. I'm really excited about today's event. It's been a long time in terms of a cross-company set of initiatives to actually get us to the point that we are today, and I couldn't be prouder of the team in terms of what we're going to show you today.

You will hear both about our achievements to date and also about the plans for the future. Today's also a great opportunity for you to hear from our new members of the leadership team - Nikos Katinakis, Michael Ackland, Michael Ebeid and Christian von Reventlow are all here on the agenda. And so let me briefly walk through the agenda for you for the rest of today. Andy will give us an update on T22, and an overview of Telstra's 5G leadership. Nikos will cover the technology that is empowering 5G and the benefits that it will bring. Michael Ackland and Michael Ebeid will talk you through some of the most interesting use cases that we see for 5G. And Christian will paint a picture of the long-term growth opportunities and the implications for our industry. And then the six of us will come back on stage for a Q&A session. You will have the opportunity to experience 5G and IoT in more depth at our showcases located in the foyer. Some of you may have already seen some of the showcases and I hope that you were excited by what you saw.

Before I invite Andy to the stage to set the scene for today's discussion, I want to briefly provide some comments on the trends that we're seeing within our business. Despite the increased competitive industry and intensity which is expected to continue throughout FY19, the guidance for FY19 which we provided to the market in September remains unchanged. Following on from the strong postpaid handheld subscriber growth reported in the last quarter of FY18 we've seen continued good subscriber momentum. And our productivity initiatives continue to reduce our core fixed costs.

I also want to provide you some colour on the profile of our free cash flow on a guidance basis, the first half versus the second half across FY19 and why it will be different compared to previous years. In recent years we have reported about a third of our full year free cash flow in the first half of the year. However for FY19 we're expecting free cash flow at the half to be a smaller proportion of the full year number. The two principal drivers are capex and a working capital increase mainly due to inventory. Capex remains within the full year FY19 envelope. However we've brought forward more of this investment to the first half. For context we typically spend around 50% of our full year of capex in the first half. This year we expect to be spending closer to 60% in half one. We therefore expect our second half capex spend to be lower than our first half. In terms of working capital we recognise that we have some work to do in the second half. Our restructuring costs in half one are largely in line with our expectations and we continue to look for opportunity to pull forward restructuring activity and cost where it makes sense.

While I have provided some comments on our free cash flow profile, the focus of today is on 5G and what it means for Telstra and our customers. We look forward to providing more detail on our trading performance at our half year results in February. And with those comments let me welcome Andy to the stage.

Andy: Thanks very much Robyn and good afternoon and welcome everybody. Firstly can I just say thank you for investing the time with us today, I know your time is busy and we are rapidly approaching the end of the year, but it is a real pleasure to see so many of you here live today. And as Robyn said we're also livestreaming as well and I know many other people are tuned in as well.

Today we're making good on a commitment that I made when we announced our T22 strategy in June and that is to give you the opportunity to do a bit of a deep dive on 5G. As Robyn has set out today you're going to have the opportunity to really immerse yourself in the world of 5G and the significant opportunities it provides. We will also be taking you through our 5G strategy to take advantage of the new technology which we believe is going to provide growth in the future. Now obviously we're at the early stages of 5G and the technology will definitely continue to evolve as there is ongoing innovation in every part of the ecosystem, whether that be with operators such as Telstra, the radio access equipment manufacturers, the chipset manufacturers, and also of course in the whole device's ecosystem.

I'd also say that there are lots of myths and falsehoods around the technology and today we're going to actually help you better understand and navigate your way through these to understand just exactly what 5G is capable of and why it is different from 4G. Now the telco industry is at a tough stage in its cycle right now because most operators have fully rolled out 4G and competition on price has absolutely increased. This is exacerbated in Australia by where we're at in relation to the roll out of the nbn and the significantly negative impact that that is having on the whole of the industry.

Against this background therefore 5G heralds a new opportunity for growth, particularly for those that will be the leaders in this new technology as indeed Telstra clearly is. Before we get started on 5G however I want to provide you with an update on our T22 strategy, and I also want to take a moment to remind you of the rationale and context behind the strategy.

We identified more than two years ago the need to invest and create the platforms that we believe that we would need for the future. That is why we announced up to three billion dollars of incremental investment over the three years to June 2019. We are very well progressed with this work and we have made significant progress in digitising the whole of our network and ensuring that we are 5G ready. We have also invested in replacing our core IT systems and by this I'm including the whole of our CRM systems, our customer relationship management systems - indeed we have actually transferred 90 million records of customers onto a new CRM platform with Salesforce. We're replacing our billing systems, our order management systems, our customer interface systems, and all of these systems are being built on a new technology stack in the Cloud with an extensive ecosystem of APIs.

Now as you've heard me say previously in a company the size and scale of Telstra this is no small undertaking. The size and complexity of our network systems, products and processes is enormous. Our networks and systems support more than 16 million customers, we undertake 40 million operations every single day, we operate more than 100,000 computer servers on our premises. The number of interactions that we have with our customers that are recorded in our systems is in the hundreds of millions a year. The number of transactions on our network is in the hundreds of billions.

That is why this program of investment has been very, very substantial and it is why that it has taken time. And it is also why quite frankly that Telstra, like many incumbent companies facing digital disruption, has put this sort of investment off for too long. The good news is therefore we are two years in and we are very well progressed. We are well progressed with the program that creates the platform that will enable us to take advantage of the opportunities from new technology such as 5G and provide the functionality to radically simplify and automate our business and deliver a very different customer experience in the future.

The reason that this decision taken in 2016 to transform our networks and systems has been so important is because of how very difficult the economical implications of the nbn and the flow-on impact on the competitive dynamics in the industry have become. That is why in June this year we also made the decision to be much more aggressive in the transformation of the business through the T22 strategy leveraging these investments. Let me be clear the T22 initiatives would just not have been possible had we not made these investments. And in picking our timing for T22 of course we had to balance the critical need to transform on the one hand against the legacy in our systems, products and processes that have been built up over decades. We also had to recognise that we would potentially lose up to 500 million in annual fees and charges designed out of our products in the new world.

T22 therefore is not without risk but simply we believed that we had reached a tipping point, a point where we needed to be prepared to disrupt ourselves rather than wait to be disrupted. And the investment program that we have been deploying has given us the platforms to be able to support that. Since we launched T22 in June we've already delivered a number of key early milestones. For our customers we have removed excess data charges for our new consumer mobile plans which gives them greater cost certainty and eliminates a major pain point. We already have around a quarter of a million customers enjoying Peace of Mind Data.

We have also offered customers more choice creating a home or mobile package. This was in our second delivery in October. Customers can now select their base mobile or home broadband plan and add entertainment such as Kayo, the new Foxtel sport streaming service, and an expanded range of technology and accessories with no upfront charges. This is a critically important element to achieving one of the things that we promised in the T22 announcement which is to make sure that customers are not paying for services that they do not want. It is also critically important in creating the framework and the structure that ultimately will enable us to reduce the number of consumer and small business plans from 1,800 to 20 whilst at the same time giving our customers more choice.

With technology opening up new opportunities for small businesses on a daily basis next week we will have another major milestone in our T22 program when we will be announcing major enhancements to the support we provide to the small business segment. It includes new solutions and services designed to add more flexibility, reliability, value, cost certainty and expert services and advice. In Enterprise, Connected Workplace, our first solution delivered on our new B2B digital stack launches next week. In addition we have also launched our Track and Monitor IoT solution that gives our customers automated mapped visibility of their moving assets at scale.

We have also stood up InfraCo, our standalone infrastructure business unit to drive improved performance and create optionality for the future. We're on track to segment report InfraCo at the half year results and for the business unit to be fully operational by the end of this financial year. In October we implemented our new end-to-end functional structure and operating model. This elevated our focus on product innovation with a new product and technology function and internal efficiency and effectiveness with a new global business services function.

It also enabled us to welcome into the team some new talent, who you're going to hear from today - Christian von Reventlow who's heading up our Product and Technology, Nikos Katinakis who's heading up Networks and IT, and of course Michael Ebeid who's heading up our Enterprise business. And I'm delighted how they've made such an impact in the team in these early days.

We're also well under way in simplifying and flattening the structure. We've already reduced one to two layers of management in many parts of the business. When I updated the market at the AGM in October I advised that we had announced at that stage 2,600 FTE and contractor roles that would be leaving the business. Since then we have made further announcements taking the total number of roles announced to almost 3,000 and of those 2,000 have already left the business.

The combination of our investments and our T22 strategy are also enabling us to make a real difference to our customers. Since 2017 we have reduced the number of calls to our call centres by more than 25 per cent - that's 10 million calls a year. We have reduced the number of complaints to the ombudsman in the industry by one third, and we have increased episode NPS across our consumer and small businesses customers by 13 points. Now there's no doubt that it's been a tough operating environment over the last two years but we are starting to see some positive results from the efforts that we've been investing.

Furthermore whilst it's probably going to continue to be tough over the next 12 months I believe that there are reasons to be optimistic about the telecommunications industry in the future. One reason is I believe that ultimately the nbn operating environment will improve, particularly once the roll out is complete. The current wholesale price for nbn is absolutely unsustainable and it is leading to operators starting to exit the business and will ultimately lead to higher prices for consumers. As you have heard me say before, this is something that will have to be addressed if the nbn and the industry is ever to be viable and sustainable, and I think it's axiomatic that that absolutely has to happen.

The second reason to be optimistic is what we have invited you here today to discuss, and that is the new technology that is coming, 5G. 5G is going to be transformative for the industry and will offer new opportunities for revenue growth. Firstly as 5G rolls out, as with 4G, I expect customers to be willing to pay more to access this new technology. Secondly 5G will enable new revenue streams that just simply do not exist today. And this of course is on top of the immediate capital efficiency that 5G will deliver by reducing the cost per bit of data travelling over the network.

In each of the previous moves to a new generation of mobile technology Telstra has been bold and led the market. Our strong investment has given us first mover advantage and ensured that we could offer our customers Australia's best mobile network on the newest and best technology. This approach has consistently delivered

financial benefits for our shareholders as we have seen more customers, more devices and more traffic move on to the Telstra mobile network. And we believe this will be the case with 5G too and we are already very well positioned to be the leader in Australia. Across the afternoon we will cover 5G from a technical perspective, look at some of the near-term use cases, and the benefits for customers, as well as some of the longer-term growth opportunities, and the implications of our industry.

But before we start, I wanted to explain what makes 5G different from previous changes in mobile technology. In many ways 5G is more than just an evolution of mobile network technology. The true power of 5G lies in the fact that it is arriving at the same time that other technologies are maturing. These include software defined networking, the internet of things, cloud computing, machine learning, artificial intelligence, edge compute. And it's the unique convergence of technologies which is that which makes 5G far more revolutionary than the earlier shifts in mobile technology. It also opens us a range of new market opportunities for telcos that you're going to hear about more from, from Michael, Michael and Christian later.

In the meantime just a few areas where 5G will be different. Firstly latency. Latency on 5G will be one thirtieth of what we experience on 4G. This opens up opportunities in markets where milliseconds count. Areas such as automotive, healthcare, transport, mining, oil and gas, and virtually all forms of robotics and virtual and augmented reality. There will also be big gains in capacity through spectral and network efficiency. 5G features such as massive MIMO and beam-forming will allow us to make better use of our spectrum assets and deliver customers a faster more reliable mobile experience. They will also open up new spectrum bands and allow us to deal with the continued growth of data travelling over our network whilst holding total costs flat to ensure that the cost per bit decrease. Edge computing and software defined networking will mean that the true power of our mobile network is also closer to our customers' devices and that will make network more flexible and responsive.

Nikos is going to take you through some of the technical aspects of what makes 5G different, how 5G works so it can better actually help you understand and appreciate the impact it will have. However as with 4G we do not expect all of the 5G capabilities to arrive at once. In fact we expect to see three horizons in the development and deployment of 5G.

Horizon one is where customers will be able to benefit almost immediately from the incremental improvements to speed and latency, albeit they will not reach their maximum potential until later in the development. This will enhance usage in areas such as gaming, broadcast services, and security. Horizon one is also where we will start to see the lower cost per gigabyte as greater efficiencies in our network and in the way in which we use spectrum helps to control costs.

Horizon two is where customers will see increasing improvements in products and services. This will include precision IoT and agriculture, fixed wireless broadband at scale using millimetre band wave spectrum, and again Nikos is going to talk to you a little bit about fixed wireless because there's a lot of confusion around fixed wireless. And also the large scale adoption of industrial automation.

Finally horizon three will see new use cases and emerging business opportunities up the stack and on top of connectivity. Some of these use cases such as autonomous vehicles, remote surgery and augmented reality are obvious to us now, however some

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of the new use cases will only emerge as the technology develops. And I would remind us all that in the early development of 4G no one could accurately predict, and did not predict, how this would lead to the development of the app economy and the businesses and use cases that have been built upon it such as large-scale video streaming.

We are at a critical moment in the deployment of 5G and Telstra is already a global leader in the race to deploy it. In late 2017 we completed a world-first 5G trial call over a millimetre wave band spectrum using our production core network. In February this year we launched the 5G Innovation Centre on the Gold Coast. That Centre has since been the home to the world's first precinct of 5G enabled Wi-Fi hotspots, Australia's first 5G connected car, one of the world's first 5G e-sport experiences, and the world's first end to end 5G non-standalone data call on a commercial mobile network.

In August we announced we had started switching on 5G technology on our network. Firstly we put up cells on the Gold Coast and quickly followed those with the first regional mobile base station in Toowoomba making Telstra's network the first in the country to be 5G ready. In September we hosted a meeting of the global standards body known as 3GPP to progress the development of international standards. In October we turned on 5G-enabled mobile base stations in Adelaide, Canberra and Perth. We're the first carrier to deploy 5G in these three cities, and these sites are among the first locations in Australia to be upgraded with 5G technology. We have set a benchmark of having more than 200 5G-enabled sites live by the end of 2018 and I'm pleased to say as of today we already have 130 of those installed and operating live.

In November in partnership with our network partners Ericsson and Qualcomm Technologies, we achieved Australia's first use of a commercial 5G chipset in a form factor device over our commercial spectrum. And this brought together all of the components of the end to end 5G network for a real world 5G data call. These achievements mean that we are well on track to meet the commitments we have made as part of our T22 strategy to extend our network superiority and 5G leadership.

So thank you very much for being here today. We're going to very much enjoy spending the time with you on diving deep on 5G. We have to look to the future at the same time as managing obviously a very tough economic and competitive environment at the moment. As Robyn has said we're pleased with our ongoing trading performance, our SIO momentum continues to be strong, and we need to continue to fight for and win customers in the market and that's what we're going to do every day. But at the same time we're making the investments in the future that are going to enable us to take advantage of the growth that I believe that 5G will deliver for all of us.

And finally I'm today pleased to announce that we've also made the world's first 5G connection on a mid-band device in Australia's first 5G to 5G video call which Nikos did yesterday I believe, and we're just about to see a video of that call with Nikos on the Gold Coast. And so thank you everybody, and then I'm going to hand over to Nikos. So thank you.

Nikos: I'm getting nervous. Hey, hello Gold Coast.

Call Recipient: Hello Nikos how are you?

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Nikos: I can't describe how happy I am to see this.

Well good afternoon and very nice to be here. My first analyst meeting so let me tell you who I am and where I come from and explain the accent for a minute. So very Canadian, Greek name, Greek accent. So it's a story that takes a beer to explain, and I was crossing my fingers just in case you were not sure. It did work on the first try, excellent picture, excellent voice - but I wasn't sure, I have to say.

So who am I? Nikos Katinakis, I'm responsible for Networks and IT and I joined seven weeks ago or so, counting and heading quickly to the second month. And my previous job was with Reliance Jio in India. For those of you that don't know what Jio stands for it is life and it was by far the largest project that has happened at least in my professional career, and probably until the end of my career. Massive, massive, massive - and we deployed by the time I left 170,000 base stations and we went from zero to one hundred million customers in less than 180 days. Massive scale.

So why am I here? Well a couple of things. What we learnt at Jio is that it's not about labour cost, it's about automation. And what we did with that network is really automate everything: workflow, network, deployment. And we had a really, really strong customer in view. So when I got the call about this opportunity in Australia, even though it's a much smaller network, and I got described the project and what Andy and the team are trying to achieve, I really said I have to join. So I'm really, really excited that I got the opportunity, because this is a fantastic project and we're really, really building the telco of the future, and I'm happy to be part of this.

So what is Telstra? I think most of you know this data. Largest mobile network, about 10,000 base stations, multi technology - so this is not a 4G only network, it's a 3G and a 4G and we're building a 5G network. We have by far the fewest dead spots. Two and a half million square kilometres. And just to put it in context this is a quarter of Europe - it's big. And more importantly it's by one million square kilometres larger than the next competitor. That's an important point. Largest coverage, we have fewer dropouts, and I want to point very, very briefly - not only do you have a 3G, 4G network at two and a half million square kilometres, we have an IoT network that covers even more area, which is close to 3.5 million square kilometres. And I'm going to talk very, very briefly at the end about why this is important and why we have it.

How do we get to 5G? I don't know how many of you remember but I was there on 1G, I was there on 2G and 3G and 4G, and it's easy to forget that 1G was really about voice - big phones, expensive. It was just the beginning of a journey. And when 2G came we all got really, really excited about SMS and texting and the world of possibilities. And then 3G came and then we got really excited about data because that was the beginning of getting speeds of more than a hundred kilobits per second. I know none of you remember what that means.

And then 3GS - who knows what 3GS is? The first iPhone and everything changed. Because I don't know if you remember 3GS the iPhone that changed 3G came just about ten years ago. So does anybody remember how it was ten years ago? No, because we live and breathe what we have today. Then we went to 4G. So 3G enabled the beginning of data and apps, it was a user centric environment, it was all about downloading apps and playing on the phone and the beginning of these interactions. Then 4G came and everything became faster. Now we start watching videos, a lot more applications - Facebook, Twitter - everything on the device. Personally, I carry

two, my friend Christian is carrying six. You get a sense about how these things have become embedded into our life.

But the point I'm trying to make is that ten years ago we didn't really know how this was going to evolve. Some people were having discussions about why 3G, why do we need it? How are you going to monetise? And then when 4G came - why 4G? How are you going to monetise? Guess what we have exactly the same conversation about 5G. So we have a very clear view about many of the applications that are going to enable and are going to be enabled by 5G, but I have to tell you there are many that we don't know. They're going to be invented once we provide that bandwidth and that capability and that low latency to people.

And 5G is going to come in three waves, Andy spoke briefly about it. So at the beginning low latency, very useful to us, high capacity. We need to move as many users as possible, as quickly as possible over to 5G because we expect that these consumption trends that we see today will continue at the same pace or faster. We are going to consume more and more.

What else is 5G about? More spectrum, and spectrum drives both capacity and speeds and now for the first time we start talking about frequency bands that are outside what we usually use. So we used to talk about low bands, so 700 and 850, and mid bands. Now we're talking about mmWave, and I'm going to dazzle you with my knowledge about mmWave. What it means is tiny, tiny, tiny frequency bands - sorry, massive frequency bands, tiny waves - which means a lot of capacity, a lot of speed, very small penetration. So as we talk about high frequency bands, 28 gigahertz, 36, 37, 60, 70 - it means that from the outside you will never be able to penetrate inside a building. Now the first reaction will be: that's terrible isn't it? Actually it's very good because today the way we use our spectrum, 850 for example, if we have an 850 base station in here it penetrates the wall so much it actually leaks outside the building and causes interference. That means a worse experience for you.

So the inability to penetrate walls is actually good, as we talk about massive capacities and massive speeds in environments that are not common today - factories, mines, etc. You actually don't want these waves to spill out. So a big, big plus. Capacity ten times, scale ten times, latency one thirtieth. And we're going to talk a lot about latency because this is one of the attributes of 5G that enables so many of the automations that we all talk about. And I don't want to steal the thunder from my friends Michael, Michael and Christian, so I'm just going to tease you every now and then about what these applications are.

The key enablers, I was told to be technical but not to put you to sleep, so if I'm crossing the line you tell me. Beam-forming - what is beam-forming and how do we use it? This technology has been around for many years. It has never been successful because it was never integrated to any of the Gs. So none of the tech companies that were making it really made any money ever. A lot of them have come and have gone. So for the first time now 5G incorporates beam-forming into the spec, so finally it works properly because the network works in collaboration with the beam-forming antennas. And what it means is instead of having a radio that just blasts waves now I can pinpoint my wave, my coverage, to a particular device. So as you drive or as you move I can point the capacity, the speed, to you as you move. That's a fantastic improvement. What it means is I'm not wasting power which is the most precious resource I have on the radio network.

Multi-user MIMO - and under the umbrella of multi-user MIMO there is a couple of other technologies like Massive MIMO, etc. What does that mean? A few years ago with 4G LTE, MIMO was introduced to the devices and a 2x2 MIMO, what it means is that you have two antennas that transmit at the same time and you have two receivers that receive at the same time. The simple math means that in a 2x2 MIMO you double the efficiency. Obviously if I say 4x4 MIMO what it means? Well it's four times the efficiency. And then you take out the device and you say, "Oh that's very smart Nikos, how does it work? How can you put four antennas or more in something like this?" Well guess what, you cannot. And that's why you haven't seen high penetration on user devices of these high ratio MIMOs.

So the next technology innovation that 5G brings then is this multi-user MIMO and Massive MIMO. And what it means is that from the radio side, where we have a bit more space and a lot more power we can put a lot more antennas - four, eight, sixteen - but on the device side I don't need that. I can stay at two in the small form device, I can go to four in the tablet, etc. The good thing is if I combine now beam-forming and multi-user MIMO I can have many streams of data effectively doubling, quadrupling my capacity and speeds, on any device as everybody's moving. So it's good.

Wider tunnel bandwidths - with LTE we have gone up to a maximum of 20 megahertz. Now just to give you context in the good old days of GSM, and you remember GSM, that tunnel was 200 kilohertz. So from 200 kilohertz you have moved in 15, 20 years, to now having tunnels that are 20 megahertz. The massive difference allows us to do the things we're doing today, because bigger is like having a much bigger shopping bag - you can put a lot more stuff in. I can serve a lot more users at the same time. And now with 5G we're going from 20 to 100 as a first step and up to a gig as a second. So you can imagine now again the incremental difference in capacity and speed those capabilities enable.

Network function virtualisation - what it means is that we're taking all the software that we have and we enable it in a way that we can use generic hardware anywhere, because until 3G and 4G we had vendor specific software running on vendor specific hardware, exactly where the vendor had to put it. So Ericsson software, Ericsson hardware, in that location, that's it. I had many choices as long as I did that. So now with the virtualisation what happens is I can use the application from Ericsson but I can use generic hardware underneath - from HP, from Dell, from IBM - and I can put it anywhere. I can put it in this data centre, I can put it in that data centre, I can put it at the edge. And I hope in a future session of this we can talk about edge computing and things like that.

So that not only lowers the cost it allows us to have a lot better resiliency and flexibility as to how we do things because we can save capacity everywhere. I'm going to use the word: RAN virtualisation. So RAN virtualisation means you know we have the base stations and we do everything at the edge, now we can virtualise the RAN which means I can take a lot of the hardware and the software away from the end site and I can put it somewhere else. So now I can direct capacity across the network, I'm not stuck with what this site is consuming. So I think you're starting to see the trend about how 5G enables some fantastic things that we were only talking about for the last 15 years.

The distributed core it's a similar theme, we have taken a lot of this capabilities and we have put it in data centres across the country and network slicing, which I think is going to enable some of the more interesting use cases in the industry. I'm not going to tell you which industries, it's coming with Michaels and Christian, but I am going to say that network slicing means I can take a virtual slice over our network including the radio and the core, and dedicate it to something specific. It could be a mine, it could be public safety, it could be a particular game - it could be anything I want. So as we talk monetisation think about how many things I can put on that slice with no other traffic on it. And it can be enabled and disabled only when you need it. Very interesting.

And how are we going to go through this? The first, truly the first use case for us, is capacity. Extremely important because we need to move these users off the network and put them on 5G so we can continue allowing the users to have a fantastic experience, massive buckets while lowering the cost. And then we progress slowly, you can see smart home and augmented reality and smart TVs, and those are coming in different waves. As 5G capabilities get more and more enhanced and deployed those use cases get enabled.

And I know the question that's running in your heads. This guy is talking about a lot of data, who's going to pay for this? What is the capital going to look like? Well what the thing is we're trying to enable 5G is that as this consumption increases our unit cost decreases. So if you put the two together we're not looking to spend more money, we're looking to lower the cost that makes up consumption enabled without spending more money. And that's a very key point. It's not about spending more, it's about making the cost a lot lower.

And I know another question you have in your mind - are we alone in this? So first of all the use cases around the globe that people are looking into, you can see different flags around the chart, I think every press around the globe has spoken about Verizon's fixed wireless, I'm going to talk a bit about that. Cloud gaming, both in the US and China, industrial automation - you can see the different flags and what they're focusing on. You don't see any Australian flags and that's because we're really looking at all of them. So the unique thing about Australia is that not only we're large and lots of empty space, we actually have a bit of everything. So we have streams looking at how do we do all of these things? But once again capacity is number one.

Alright, and where are we with the spectrum auctions? I can't talk about it, you know we're in the middle of an auction, that's ongoing. The spectrum that's being auctioned is 3.6 and we see the public information that everybody has is that the next auction about millimetre wave is going to come in the 2020, late 2020 timeframe. We would love to see it sooner, it's up to the regulators, but the opportunity here is that as we get these capabilities we would like to see them deployed as quickly as possible. And the reason why I say it would be nice to see the millimetre auction a bit sooner is because we would love to use that spectrum, deployed.

The next question you're asking is what does everything we do generate in terms of handsets? Are we going to have the variety that everybody else is going to have? Are we an orphan? So if you look at this chart you'll see that the spectrum that we're talking about - especially in the millimetre bands and the mid bands - extremely well aligned. And why this is important especially with countries like US, China and Europe is that they drive a lot of the device ecosystem. And what we want is that choice, we want

the Apple devices to show up here at the same time as everywhere else, we want the Samsung devices, we want the Google devices - we want everything to be available to all of us. That consumer choice is important. So that alignment is what this enables, and that's why I think we're in a very, very good space because we have achieved that alignment.

What about fixed wireless? I think it's one of these topics that is very, very common around the globe. Verizon is doing massive announcements and when you get the first page prints about fixed wireless, first customer in - I don't know remember where it was, Houston, Arkansas, something - you know it's a big story for them. So why is fixed wireless an interesting use case for Verizon but the rest of the globe doesn't talk as much about it? Well a couple of things. One is they don't have the spectrum that everybody else has. So as you look at use cases they are in a bit of a unique spot. They can't do mobility at this point, they have to wait. So the fixed wireless was really the first opportunity they had. From our perspective - and we are running trials and we have run trials, so I think we understand the economics and the deployment challenges very, very well, and I'll give you some insight into that - it's one of the things that we're looking at. We'll see, we'll see how it goes, because in order to deploy a fixed wireless service in the strict sense you really have to send a technician out, that means a truck roll. They may have to climb on the roof, they may have to put something on the side of the house, and that something is typically a small dish of some sort in order to receive the transmission. They have to run a cable from the device inside the house, and now the moment you say I'm inside the house you know the challenges - oh my wall is too nice, I have my wood panelling, please don't drill holes, no don't touch the fake ceiling - it gets challenging.

But that's what you have to do, you have to run a wire now to something inside the house, let's call it the wi-fi router, so that you can get the coverage. Now you remember right - truck roll, technician, device outside, device inside, cables, drilling - that costs money. So just to give you a sense from what we know from Verizon and public information, the device costs in the order of \$400 US - that's expensive. It takes a minimum of two hours which means on a good case where the owner doesn't quite care and just put the cable, I want broadband, it can take four to six hours to finish that installation. It's expensive, and the estimate that has been made public is that this whole thing may cost up to \$4,200 US for one customer. I don't know about you but this sounds expensive. So we're looking at it. So we don't know how exactly it's going to work out for us.

And this is my final chart, I promised to you at the beginning that I'll talk a bit about IoT. We are IoT ready and we have deployed two networks in addition to our 4G network. One is this Cat-M1 - and one is the narrowband IoT, and you can ask me what's the difference. So the bottom of the circle you'll see one can do up to one megabits per second, and one can do 200 kilobits per second. The difference is that as you go slower you cover a lot more. So without deploying a lot of extra base stations you can cover a lot of extra surface. Just to give you an idea our 4G network I said covers 2.5 square million kilometres. The narrowband IoT covers 3.5. So another one million of coverage. That's massive. And what this enables even though it's a slow speed, relatively speaking, don't forget this is four times faster than the original 2G, and this is the early days of 3G, so it's not really slow. But this enables a lot of use cases around sensors and how they transmit data, so farming - anything that doesn't do video, at least high-speed video or high-quality video - is enabled through this.

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And if you go to the Cat-M1 where you go up to 1 Meg, you can even enable video now. No you cannot do every traffic camera in the city, that's way too much, but for sure you can do videos. If you have an application where you have a couple of cameras in an industrial site and you want to monitor, no problem. If you wanted to have 100 cameras that's a problem. But if you have 100,000 sensors that are only transmitting a couple of kilobits per second, no problem. So you can see how smart farming can be enabled today but there is a future for that as well. And Christian in particular will speak a lot about how sensors themselves are evolving and how that ecosystem is changing and how 5G enables that change.

So on that note I'm going to finish and I'm going to ask Michael Ackland to step to the podium to talk to us about Small Business and Consumers.

Michael A: Thank you Nikos. So just to briefly introduce myself, my name's Michael Ackland, I head up our Consumer and Small Business function as well as the Sales and Service teams in that function. I joined Telstra a couple of years ago, actually to head up our Telstra Country Wide Team, and all of our retail channels. And before that was 12 years with GE.

I'm really excited to talk to you about the opportunities for 5G for our mass market customers, for our consumers and for our small business customers. We think this represents a really enormous opportunity for our customers to experience significant value and will also generate tremendous value for us. And so I'm really pleased to share some of that today.

Nikos and Andy covered, and I think covered this already, it's really important - our 5G roll out is progressing well. 130 5G sites already live, 200 by the end of the month across Canberra, Adelaide, Perth, Brisbane, Launceston, the Gold Coast, and Toowoomba. And I think it's important to note that that 5G roll out gives immediate benefits both to us - Andy talked about that, Nikos talked about that in terms of lowering the cost per bit - enabling us to continue to support some of our market leading propositions that our customers really love, like Peace of Mind Data and the Smart Modem.

It also means for our customers, and we've seen this in the Gold Coast, that as we upgrade the core of our network in readiness for 5G we're seeing improvements in 4G speeds as well. So that opportunity for our customers to experience faster speeds on 4G, a more efficient consumption of data, is immediately exciting for our customers. But as some of you saw earlier that experience really evolves further when the devices are available. Like with previous generations we're working with all of the leading vendors to make sure that our customers are first to experience 5G devices, and we will have the first 5G devices on sale in the first half of next calendar year. Devices like this that you've seen out there on display, the HTC Mobile Smart Hub, and what's interesting is not only do we think that as these devices roll out we will have early adopters who are keen to come and experience that technology and keen to experience the value that those devices will provide, that we will see value come to us and also to our customers with those devices.

The other thing about 5G which again Nikos talked about is the opportunity leveraging all of the investment in Network 2020 as well as 5G that we've made, the ability to slice our network. And this is really important for consumers and our small business customers because this allows us to build products and services, network connectivity

experiences, where we can tailor the quality of service to the services that our customers want. So if you want an immersive media experience where you want 4k or 8k on all of your devices we can provide that as an additional network service into the future. Again this gives our customers the flexibility and options that are core to the T22 strategy that we've previously talked about.

But this is where it gets really exciting. So to step back - the first element of value for us and for our customers is the increase in speed and latency and network performance to do all the things that customers do now, but to do it faster, to do it better, to allow us to give our customers access, to very data rich experiences. But off the back of the ability to network slice and to really differentiate on the connectivity experience, the use cases that open up there for our small business and our consumer customers I think is really exciting. And we're working closely with a whole range of partners on a whole range of these use cases. And I only want to touch on a few to just give you a taste of why we're so excited about these use cases for our customers.

So think about a small business and the opportunity for a small business to be able to access with the speed and reliability and the data usage that they need, all of the cloud applications that a small business customer might be interested - that ability without the complexity of all of the set up that would be required today, on the go to have full access as a small business customer, to a full range of cloud business applications. Secondly, and Christian will talk a little bit more about this, the opportunity with 5G to do wireless HD closed circuit TV with image processing and facial recognition, and to have that to be available to small business customers around security applications and a range of other applications where that high-speed visual processing just simply isn't available on today's technology.

We then think about our consumers. In 2020 75 per cent of the traffic on the mobile network will be video. The opportunity for customers to have much more immersive experiences around video and differentiated their experience around video across all of their devices, we think is really significant. Christian is going to talk more about virtual reality, augmented reality, but start to think about experiences that you may have, immersive experiences that this will enable in a stadium, at a concert, at an exhibition, in your home. You're able to get high definition 4k, 8k video experiences combined with the immersive experiences around augmented or virtual reality in real time, we think is really exciting.

The last one I want to talk about, and we have talked about this - it comes up all the time as one of the early use cases - is cloud gaming. So a couple of things about gaming - one is gaming is not a niche application. We know in our customer base we have over two and a half million households that are intense gamers. And they're not kids - 39 per cent of these are Gen X and Gen Y, 24 per cent are Baby Boomers. These are people who spend a lot of time gaming and love their gaming. The gaming industry itself is making a big transition away from expensive consoles or gaming computers towards cloud gaming. We're working with many gaming houses and technology companies - Microsoft, Sony, Nvidia, around how this transition is moving forward. Console gaming declining 5 per cent per annum, cloud gaming growing at over 15 per cent per annum. But to enable cloud gaming and to be able to do that across all of your devices you need a different connectivity experience.

So what do you need? Well you definitely want ultra-low latency - if I'm playing Fortnite and I fire that gun I want that ultra-low latency - I need high bandwidth. These

are going to be data heavy, data rich experiences for our customers. And the other point, and Nikos talked a little bit about edge computing, and I think is where the combination of the technologies we've talked about in terms of network slicing and edge computing become important because it's not only the latency of the network that is important with cloud gaming, we want the end to end latency. So the opportunity to create a network slice to give a gamer access to local cloud compute capability and get that end to end latency so they get an experience that feels like they have a \$3,000 gaming computer in their home in a cloud gaming environment is going to be huge.

So the benefits of 5G with the ultra-low latency, the bandwidths and the speeds to create a seamless truly immersive ultra-responsive gaming experience across all of your devices we think is huge. And we've actually started, we've proved some of these experiences. In March this year at the 5G Innovation Centre on the Gold Coast we ran a pro gaming event with the pro gaming team the Chiefs. In fact pro gaming, e-sports, is one of the fastest growing sports in the world. So I want you to get the sense that there are use cases that are evolving - gaming will be one of the very early ones which combines experiences that only the combination of technologies that Nikos has talked about will be able to deliver. And these are big and growing markets that people who play these games and are devoted to them will be willing, and are willing, to pay for a fundamentally differentiated experience.

So I want to sort of step back from that and just wrap a little bit around how in a Consumer and Small Business environment, what are the ways in which our customers will realise value and we will realise value from the 5G investment. So the first one is that that connectivity experience is significantly better, it's faster. Our ability to cost effectively provide customers with access to data rich experiences is step one in terms of enhancing that core connectivity experience. The second level is, as we have in the past, is ensuring that our customers have access to market leading 5G devices that make the most of that connectivity experience. Whether that's handheld phones, whether it's mobile broadband, whether it's media devices to help them experience those immersive media experiences, or the gaming devices. Giving our customers and making it easy for our customers to access the best market leading devices in the world is core to how we will move forward.

And lastly and I think this is where 5G becomes incredibly interesting for us from a value point of view, and incredibly interesting for our customers, is the ability to provide differentiated connectivity and differentiated service experience for each of those use cases utilising network slicing, utilising software defined networks, utilising the edge compute capability, to give customers when they need it access to a truly unique connectivity experience - and gaming is a great example but there will be many more. We're also working hard with our partners to make sure that as well as the devices we can give our customers access through us to the applications and services that will enable them to experience those use cases.

So really this is just the start and I wanted to paint a picture for the mass market of the different ways in which we see 5G delivering value to our customers and to us. The use cases as Nikos said are going to continue to emerge and they will change, but what will remain true for all customers is that 5G use cases will depend on the quality of the connectivity and the technology that underpins them. And in Australia, Telstra is first in 5G and we look forward to providing the very best 5G experience for our consumers and small business customers in the years ahead. So with that I'd like to welcome Michael Ebeid to the stage. Thank you.

Michael E: Good afternoon everyone. Thank you Michael for the introduction. For those who don't know me I, like Nikos, joined Telstra about seven weeks ago and I promised Andy that about Christmas time we'll stop counting the weeks. But it has been a really exciting seven weeks. I came here, my previous role was the CEO of SBS where I'd been for about seven years. But I certainly started my career with IBM in technology where I spent about ten years, and after IBM I spent about ten years in telco with Optus before spending ten years in media. Now of course technology, telco and media are all converging and that's a real asset to us at the moment I think in terms of the things that I'll be able to bring to Telstra.

One of the things that's really consistent throughout that is my love for technology, I've had a real passion for it. And I think it started back in IBM when I was about 21 years old, a graduate, and IBM at the time - and I'm really going to age myself here - was launching the very first ever PC, the IBM JX. And there was a lot of discussion internally about would anyone actually want to buy a PC in the house because it was only going to be a business tool, nobody would want a personal computer except in business. Fast forward ten years I was at Optus and we were launching 2G and SMS came along, and we had similar conversations, debates internally and externally - would anyone ever want to send an SMS message and pay 20 cents for it, when you could just pick up the phone and call somebody? Why would anyone want to send an SMS?

Fast forward another ten years and I was working at the ABC when we launched iView Australia's first streaming service. Lots of discussion about why would anyone want to watch video, particularly long form video, on a computer screen or a small screen? The iPad hadn't even been invented at that point. So I tell you this because one of the things that I'm really excited about I think 5G is a bigger game changer than all those things put together, and I want to talk to you a little bit about why that is particularly with use cases in the enterprise space. And I'm really excited by how fast we're rolling out 5G and the others have already spoken about some of that today.

It might sound a little bit lofty but I do believe that this is absolutely going to turn the dial up on innovation and supercharge our fourth industrial revolution if you like, and it's going to be underpinned by emerging technologies that you heard earlier, such as AI, drones, robotics, AR, and in particular IoT. And as you heard the first stage of this will be about enhancing if you like today's 4G and 4GX and a lot of those benefits will be about improved mobile broadband through increased latency and reliability. But then we'll see dramatic changes in stage two and three with the higher spectrums as you heard from Nikos.

So for us in the Enterprise part of Telstra how are we going to capture some of that for our Telstra customers? It is about enhancing the core connectivity with offerings through improved capacity and speed, but it's also going to create a whole lot of really exciting use cases which I'd like to share with you at the moment. So if you see these use cases here, some of them are consumer, some of them are enterprise space, and it charts them out across. And what we're going to see is a lot of use cases across major industry and market sectors. A lot of those market sectors where Telstra Enterprise have got real capabilities today to be able to really take advantage of those things. And we're going to be able to expand and explore them, and evolve them I should say, as more devices and varied devices come available, and together with our Enterprise customers we're going to be able to create and envisage new and varied use cases.

So let me now talk to a couple of these cases that are highlighted in yellow there starting with the mobile branches on the bottom left corner there. So for a lot of bank branches, retailers, small retailers, this will be a real game changer for them in terms of being able to improve their set up costs for light infrastructure if you like, or personnel branches. We'll be able to significantly reduce the cost of setting that up, providing real efficiencies and time saving in terms of its ability to be connected. And we're already piloting some of this today with the Commonwealth Bank of Australia and seeing some really interesting results out of that.

Let me now talk to some of the other ones around mining, logistics and smarter cities, but first I want to talk a little bit about the sector I know pretty well in terms of broadcasting. So Telstra Broadcasting Services today is exploring lots of 5G use cases for things like outside broadcast, live broadcast, remote editing and the transmission of content from drones or other remote sources and devices. I think there's going to be so many opportunities for media to really substitute a lot of fixed infrastructure - things like satellite infrastructure, OB trucks, that will be able to replace a lot of that reducing the cost of productions, particularly for outside and live broadcasts. Electronic news gathering is another one that we've traditionally in media had difficulties or limitations with things like bandwidth and coverage. 5G again will really enable the media sector to do proper news gathering using 5G in a way that you don't have to then have an outside broadcast truck or indeed even a news van with a satellite dish that you'd often see around the cities today.

It will also enhance the distribution of content, so imagine say a 4K camera with 5G connectivity, being able to connect a remote camera to a studio facility. That will completely change the economics of production. Today our Telstra LTE broadcast solutions addresses some of these challenges already through our mobile broadband. But I think 5G again, will really supercharge this and significantly enhance the customer experience as well as help content owners deliver at scale for broadcast.

One of the things that we saw earlier this year was the US Golf Open where they transmitted much of the golf, the US Open, using ultra high definition cameras, 4K cameras, over a 5G network, having to save laying out hundreds of kilometres of cable. And you can imagine the cost saving of that and the ability to be able to broadcast that live - reducing the cost and improving efficiencies. The second one is around the enhanced stadium experience or VR, where we'll be able to capture, cameras will be able to capture a lot of data, volumetric data, analysis, reconstruction, compression, and encoding of video to deliver a real virtual reality experience for the viewer, to see what it's like being in the stadium.

For the last couple of years when I was at SBS we explored with 4G virtual reality putting people in the Mardi Gras parade and we got ten iPhone cameras with 4G sim cards in them to capture a 360 degree view of being in the parade, and then using an app people could later, after we took it back to the studio and fused all the vision together, could actually experience what it would be like in the Mardi Gras parade. Now of course we couldn't go live but with 5G you would be able to go live giving audiences the ability to transport themselves. So 5G will mean that real immersive experience, that multidimensional experience, could be done live, and it would open up new pricing models for both broadcasters and for advertisers. So whether you're adding additional camera angles or behind the scene efficiencies 5G is going to

significantly change the remote production and broadcasting model that we know today.

Let me turn to smarter cities. I think smarter cities will become far more widespread with 5G - interconnected parking meters, bins, lights, more efficient energy management. Again 5G is an absolute game changer when it comes to physical security, where 5G latency and bandwidth enable multidimensional cameras, high-definition video surveillance cameras replacing fixed and expensive infrastructure. Again that will enable us as Michael talked about, real-time face recognition. Now this is going to be really important in the world that we're living in today in terms of heightened security. Being able to do this will really be a game changer for a lot of cities.

Of course 5G will also open up a myriad of IoT opportunities. Things like energy management through our narrowband IoT, dynamic temperature control, pre-heating and pre-cooling and lighting for workspaces, video sound and temperature sensors, will be able to really augment the current urban sensor network that we have for traffic monitoring today that we're actually doing now - and traffic light safety as well. With 5G we'll even be able to get into the urban forest management detecting things like canopy health or indeed insect populations or managing native birds, etc. So many use cases that industries across all these areas will be able to take advantage of.

Logistics is another one of course that we're very strong in today. In 2017 Telstra acquired a company called MTDData which is a key part of our IoT ecosystem. What we're really excited about is combining the capabilities of MTDData and the capabilities of 5G and what that could mean for a lot of industries but in this case the logistics industry. In particular things like enhanced vehicle platooning where low latency access to high data rate feeds from roadside sensors will absolutely be able to reduce the costs of logistics, more efficient trips both in terms of time and fuel, improved safety and a greater insight into data for reducing collisions. Again, we're already doing some of this with some of our customers today.

And Telstra's got deep capabilities in the mining services area through our Telstra Mining Services. Autonomous operations are absolutely becoming mainstream across this industry. The semi and fully automated heavy vehicle machinery including drills, dozers, trucks, are absolutely essential for an economically sustainable mining operation. And the needs of today and tomorrow's miners are pretty much well met at the moment through the capabilities that we've got through LTE technology. However 5G is going to have the ability to augment our 4G LTE deployments with capacity, latency and speed all together, really building on that vision of having an everything is connected, everything is autonomous or remotely controlled for the mining sector.

In mining, 5G use cases are largely and needing to be specifically built, architecturally built with private networks and designed and built by our Telstra Mining Services. And there's also going to be a lot of other ways that we're going to be able to augment the 4G LTE networks around the provision of accessing more spectrum there, you can see, higher data rates through edge cell, requiring fewer cell sites inside high risk areas, in mines particularly, and higher density sensor deployments that use lower power sensors on absolutely everything. Example on conveyor rollers or air quality and seismic sensors embedded in the walls of underground drives.

So our mobile networks today feature a mix of technologies. You can see they're spanning across Bluetooth Locator Network, Telstra Air, our Cat-M1 and narrowband IoT that Nikos talked about earlier. All these are going to provide the foundation for us to capture new value pools for us. This value is going to be derived by addressing industry specific applications and expert capabilities that we're going to be able to create for these use cases. So these are going to require strong professional managed services to create some of these value pools and I think Telstra is really well positioned today with our NAS services, our professional services, and our deep industry capabilities to be able to build on these. And naturally I think this is going to require a shift in our business and commercial models, and this shift for us has to be about going beyond traditional service provider contracting and actually exploring commercial models that results in shared success.

So many of these use cases are today being deployed around the world, being experimented around the world and here locally with us at Telstra. So for a lot of them we're not inventing or reinventing the wheel - they are real and tangible with very clear revenue opportunities. And these cases and many more are soon going to be able to be addressed at scale by Telstra Enterprise. So I hope I've given you a sense this afternoon of how well positioned we are to be able to continue to be that trusted partner for a lot of our corporate and governments to take advantage of this and really leverage the broader opportunities that 5G is going to be able to bring these corporates, our society and governments as well. And I think some of these technology advancements is just some of the reasons why I'm really excited to have joined Telstra seven weeks ago. Thank you very much. So I'm now going to hand over to Christian. Thank you.

Christian: Thank you so much, ladies and gentlemen. Christian von Reventlow. This is my fifth week at Telstra, so I'm the outside insider, and I'll take this perspective in this speech, as you will see in a minute. And being new to the game, I thought I'd give you a little bit of an overview of Christian, and basically me having vast experience in product and software development across various technologies, countries and segments, and I actually bring experience from Deutsche Telekom, T-Mobile, Intel, Nokia here, to Australia.

Now, you might actually be thinking: what is this Christian guy actually about who is standing here? What are his core beliefs, and how is he actually going to shape the activities in his area? And I actually believe value creation is core for products and innovation. And value actually gets created if you truly address customer needs through technology. And what this actually practically means is you can measure success, and you measure success by money coming in. Revenue is a trailing indicator of success. And that basically shapes the thinking. How do you create value if you focus in on this? Then you create revenue, EBITDA, value for everybody.

So, looking a little bit at the challenges, what we have at hand, in my past I introduced agile methods, for example, at Intel, delivering the fastest software project ever at Intel. And then we have the challenge at hand to digitise customer interactions, and this is what we actually did at Deutsche Telekom; introduced artificial intelligence in the call centre, leading to a net promoter score upswing of absolute 50 per cent, lowered the total cost of operations by 4 per cent, and, you won't believe it, the call centre agent loved it. And if you want, in the break, I can actually explain you how you do it, introduce AI that call centre agents love it.

And last, but not least, leveraging the latest network technologies to create value for customers. My team and I did this in the past, and we actually created the first ever cloud offerings in Europe in 2001. And this is exactly the challenge which we have at hand here. We have a new networking technology, 5G, new computing paradigms, you heard a lot about Edge computing and similar stuff, and we need to create value for customers, for shareholders, and everybody. So, off you go.

This is the fourth presentation today on 5G, so I do need to take a new perspective, don't I? So let's take this from the customer perspective. Let's understand what customers desire, and what the trends are, and let's match this with the technology. And then talk a little bit about money. Because if this matches, a higher willingness to pay results, and customers are willing to pay a premium for these differentiators. And we take two different stances. We look at it today, and then we do a time warp, we travel five years in the future, and have a look how value gets created in five years' time.

So let's dive into this, and let's dive into this and start today with media on the go. When I was young, my parents didn't allow me to watch TV. Imagine this. We are back to those days. TV viewership is going down since 2010; nobody wants to watch TV anymore. What are people doing instead? Watching YouTube and Netflix. And even the older people are starting to use YouTube and Netflix. And interestingly, this leads to even today 15 per cent of all internet traffic being Netflix globally. And, as Michael already pointed out, mobile data traffic continues to grow, and we expect 75 per cent of it being video in the upcoming five years.

Where's the money, you might ask, in this? If value gets created, and revenue is the trailing indicator of value being created, where's the money? You see carriers worldwide charging for media stream on passes. For example, Vodafone Italy on average creates €15 per month for stream on media zero rating services. Again, a sign value is created. And very interestingly, what happens is it actually pulls additional data traffic as well. Again, if you look at Vodafone Italy, those customers who go for media stream on passes, they subsequently consume 20 per cent higher data rates, and pay for it.

So what else is happening today which is related to 5G? Gaming – you heard my colleagues talk about gaming, and there is a 16 percent CAGR for gaming between 2012 and 2017, and it's truly the TV of the young generation. And there are three elements in gaming which we want to go through. So, one, mobile gaming is already 40 percent of gaming today, today – total gaming today. And subscription models are coming up. Current average gaming services produce an ARPU of \$22, an opportunity to be captured here. Second, fixed gaming. Gaming, as my colleagues pointed out, Fortnite you need real-time connectivity, otherwise you can't play Fortnite, I can tell you from my own experience and my teenage kids' experience. We want real-time connectivity and Deutsche Telekom is charging five bucks per month for this, and SingTel, where gaming is even hotter, charge unbelievable \$70 per month for real-time gaming connectivity.

What else? Game watching is the third element. E-sports, really hot for the generation under 35. Unbelievable for my parents, frankly. They say how can you watch gamers in YouTube, to my teenage son. This is a completely incomprehensible. And there's YouTube, and it's so hot, again, revenue being a trailing indicator of success and value

being created. Paid services like Twitch, watching people playing games, people pay \$7 to \$35 per month. Unbelievable, but true.

It leads to the question: What's next in gaming? So, okay, we game here. I'm well known for my stack of mobile phones – I only brought three today, sorry, not six, I'll do it next time. So now I want to play a high end game on this mobile phone. Frankly, folks, it ain't gonna work. It ain't gonna work. It doesn't have enough compute power. You need tons of GPU power to play a game like Fortnite. And to make this a little bit tangible, I actually brought you my gaming PC. Here it is. Maybe send it through that you get a little feel for it. And then next we are going to compress it in a mobile phone. Here. If you would just send it up a little bit. Yeah, don't drop it.

Yeah. So now we are going to compress this PC. How much is it? What's the weight of it? Comments from the audience? How many kilos? Four kilos? So, yeah, now we are going to compress the four kilos into this form factor. There's Moore's law but it ain't gonna happen in the next two or three years. So what's the consequence of that? Cloud gaming is coming. And if you lift up this PC, then you know why cloud gaming is coming. Nobody's going to carry this box around. When I walked in, in the morning, in the Telstra office with this PC, people stared at me and said, "Christian, what's this PC?" So this big PC gets moved in the real-time cloud, close to the customers. This is what's called Edge computing. And then, as a Fortnite player, you want to have fast response time, so you need low latency connectivity, QS on the last mile, exactly what carriers can deliver. And that's the next thing in gaming.

Also, augmented reality will impact the future of gaming. Do you know what augmented reality is? I don't see many people nodding. So let me explain this a little bit. You all got in a plane, in a bus, in your car, to come to this conference here today, and now you are all physically sitting here. Augmented reality actually is if most of you would be at home, and you would look next to you, and your colleague would be sitting next to you as if he would be physically here. This is what augmented reality is about. I would be standing here, and I would look in the audience, and I would believe you are all here, but in reality you are all at Bondi Beach, probably surfing. Huh? See. Augmented reality, everybody here without physically being here. And augmented reality is really growing strongly. CAGR for augmented reality from 2017 to 2022 is really high. Thirty-four percent for the sub-amount, virtual reality, 105 per cent CAGR for AR, and 65 per cent CAGR for augmented reality enabled smartphones.

And you see the carriers getting on board. O2 in Germany, for example, has even started to produce content for augmented reality. They are co-developing Star Wars Jedi Challenge, and off you go. And you know some other carriers are going big into media, like AT&T in the US. And gaming subscriptions get added to the portfolio what carriers are offering, and worldwide you see an average revenue of \$15 a month for augmented reality gaming subscriptions.

And on we go. More is happening here. Repair and maintenance of equipment happens with AR. And then in medical training, flight simulation is coming to the medical domain. What does that mean? Flight simulation in the medical domain means training doctors can perform surgery without physical bodies being touched. Isn't this good? You can do a surgery and train it 500 times before you first touch a human body. So the overall quality of the medical experience goes up. And then in design and modelling, buildings can get simulated and seen through AR and VR before they are

actually contracted. Your interior designer walks with you through your home, and you can see where your future furniture will be. And the same for logistics.

Well, you see, all this actually exists today, can be built today, can get monetised today, so there's lots of business for 5G with ARPU's and revenues attached today. Now, let's do a little bit of time warp. And let's do a little bit of time warp and understand how will the 5G world look like in five years' time. And to figure that out, I actually asked 270 kids in five countries to build the future, using a method called design thinking. With glue and Sellotape, they did build the future. And then I gave them money that they could actually invest in the same concepts, and this – in the best concepts. And this was in Seoul, Singapore, Stockholm, Amsterdam and Frankfurt. And interestingly, the results were the same.

So what the kids actually said is smartphones will be around for another five to six years, and will be the main area of interaction. And then they will actually be replaced by smart glasses. And I brought you a prototype of smart glasses. Here it is. Ah. There's this three-dimensional object floating on top of Nikos. Are you Nikos Katinakis? A world leader in network technology? So you see, this is how in five to six years' time the replacement of the smartphone will look like. Yeah, send this around. So you can experience this a little bit. So far so fine. Now, if you put on these smart glasses, and you move your head, then all the pixels need to get re-rendered, 90 times a second. And the compute power you need, that's this brick which you just did send around. And I don't think this big brick computer will ever get put into this form factor phone which is going through the rows.

So, what does this mean? Augmented reality has the same needs as gaming in terms of compute power and low latency, edge computing, controlling the last mile. We as a carrier are spot on with what we are doing.

Let's take a little bit broader impact on 5G in the future. Connected driving, connected car penetration, has grown from 24 per cent in 2018, predicted to grow to 60 per cent in 2023. In Europe, we find many carriers take advantage of this opportunity, like Deutsche Telekom or A1 in Austria. They charge \$15 per month for services like Wi-Fi hotspots, driving statistics, emergency services and geo-monitoring. When my oldest son gets a driver licence, I'll turn geo-monitoring on that I know where, for heaven's sake, he is driving, and I can actually give him some positive reinforcing advice if he happens to speed.

In the US, these services are actually way higher priced. Like OnStar by GM has three different plans between 34 and 80 dollars per month, again, an opportunity for carriers to monetise. Drones, the infamous killer use case for 5G, as you see from the stats, more than half of the US millennials believe in the idea of drone deliveries. And, yes, Gen Z loves instant gratification, so probably love this one-hour drone delivery. Frankly, folks, I'm not really sure that 5G is the killer use case or drones are the killer use case for 5G, out of the simple reason, even if you have 11 9s stability in the network, there will be this five seconds when the network is down. And I'm not sure that I want drones to have flying around at that point in time. Just for your entertainment I thought you would laugh about it. No? Okay. [Laughter]. Hasn't worked. See, that's the problem of these afternoon presentations. Here we go.

Consumer robotics, something which is way closer to my technical heart than drones, frankly. Currently consumer robotics is mostly focused on automatic vacuum cleaners,

CAGR is 20 per cent, worldwide market is 9 billion in 2022, and frankly, is irrelevant for telco's at this point in time. However, again, travelling five years into the future, looking at what the young adults were telling us, in five years' time they all expect to own a robot as a personal butler. And, again, you don't want to have all the compute power in these robots, because they become heavy, expensive, large batteries. Same requirements as we have for gaming, augmented reality, you need real-time connectivity, Edge computing, off you go.

And with that, we move a little bit on. Intelligent environment – everybody talks about intelligent environment, and futurists are telling us that everything will become intelligent. Like, for example, if I would have gone through High Street this morning not wearing a suit but a t-shirt and jeans, then the intelligent environment would have accessed my calendar and would have concluded no, no, Christian, today is not t-shirt and jeans day, you need a suit. And every shop window I would have walked along there would have been red signs, buy a suit now, buy a tie now. And this is already coming. Maybe.

But at least we have smart home and security. Revenue per customer in the US is \$50 per month, for example, and in Europe you find various services between 10 and 40. Tracking devices and services, again, as a precursor of what we were just talking about, being sold globally, creating revenues between \$5 and \$15 per month. And last, but not least, emergency services for elderly, delivering \$40 a month, as incremental ARPU. However, in my experience, go to market, frankly, is difficult.

And with that, 5G is the technology for today, and for the next decade. Is everything of this relevant today? No. Half of it is relevant today, and then there's additional opportunity in the future. And this is totally in line with what Andy and Robyn said earlier on. We invest now, create value now, and create value in the future. And we expect that more use cases will come online in the future. So, summing all this up, we have learnt about the need for Edge computing, for real-time connectivity, more bandwidth; telco's are ideally positioned for this future; Telstra is investing for the short and for the long term.

And, again, please note again, alignment with Robyn's comments earlier on, we focus both on short-term and long-term value creation. And most interestingly, if you actually listen to what the consumers are saying, they are saying the same thing as the technologists. And this is good news, because the buyers are requesting the same thing what the suppliers want to supply. And that's a sign there will be business. Thank you.

If you may come up for Q&A, that would be great.

Robyn: Thank you, Christian. So there are microphones down here on both sides of the auditorium if anybody wants to come down and ask a question. We'll also get some questions online as well. So ... So we have the first question here.

Kane Hannan: Good afternoon, Andy, Robyn and everyone. I suppose I just wanted to kick off with something that probably didn't get too much airtime today in terms of 5G, but just around the potential for opex savings coming through from the network automation. It would be interesting if we could hear your views around the potential for opex savings from this technology, and then whether that's captured in the 2 ½ billion productivity program. And then just a second question, I suppose more for Nikos. I'd be just interested in your initial thoughts around what you're seeing with

Telstra's network, how it compares to the previous networks you've worked with, and if you were to restart again with Telstra's network from scratch, what things you would look to change about the network.

Robyn: They're good questions – I'll start, if you like, on the opex side. So clearly we have some pretty aggressive targets out there in terms of our opex, fixed cost spend coming down at 2 ½ billion over the next few years. In terms of the chart that actually Nikos used, the cost per bit of traffic – and he showed it, actually, the capacity and the network, and the cost in the chart down below – if you look at that, it does equate to about one-fifth of the cost of the benchmark, which was in 2016. Now, that is in the – it's total cost, it's both capex and opex costs to run the network. And so there is a lot of effort in terms of doing that because of the capacity that we know that we need in the network. And the work that the team's done in the network of the future area has actually done a lot of that heavy lifting; 5G brings it another step function down. And so the team's been focused on that for quite some time. Do you want to answer the –

Nikos: I'll add a couple of words.

Robyn: Yeah.

Nikos: On automation, what we're talking is two things. One is workflow automation, which is simplifying tasks and automating the handover, so removing papers, and Excel spreadsheets, and all these good things that are flying around, so take them out of the equation. A lot of that is captured, or all of it is captured in the numbers that have been disclosed. I would say there's an incremental opportunity as we look at '21 onwards, '22 to '25 or so, where network operations become a lot more automated. So in other words, can I generate the activation of x, y, z capacity in that element? I don't need to send people out, I don't need to have a truck roll, I don't need necessarily a little crane. So that opportunity is not fully captured, mostly because we have a lot of legacy equipment still in the network, and that's going to be replaced over the next three to six years. And, of course, 5G will continue to be deployed in the next three.

In your comment, in your question around the previous experiences and how Telstra stacks up, from the outside I have to tell you Telstra has a fantastic name. Like no other way to describe it. It's well-renowned around the globe about their network reliability, the aggressiveness in being first, and the quality of everything that Telstra is doing. And that's reflected in every time you visit another telco. They're all going to listen to what we're doing. Technical press, they all want to write about us. And more importantly, what I've seen recently, and that was experienced in a recent trip to the US, traditional software companies are listening a lot more to what we're doing. So when we visit Microsoft and the CEO is showing up to a one hour and a half session with Telstra, you know that our revenues compared with Microsoft are tiny. I mean who cares, Microsoft would generate that revenue in a day. And yet he spends an hour and a half with us. That's a good indicator of how much weight we carry around the globe. So it's excellent.

Christian: Yeah. So I can attest to this from my Deutsche Telekom, T-Mobile experience. When my colleagues heard that I moved to Telstra, they actually became envious, and said, "Wow, you go to this place who really does all this." And so I think this is just support for the position Telstra has globally in implementing and actually monetising the investments.

Nikos: One more thing, because I think I didn't fully answer your question. And now that I'm here, I guess, indirectly, you're asking is reality matching perception? I would say yes. So in my seven weeks or so here, I would say looking at the quality of the people we have, first calibre. The quality of the network, excellent. I think can we improve even more? Absolutely. There's always room for improvement. And I'm sure somebody in the audience is thinking. "But didn't you have a couple of outages?" Yes, we did.

And I think an important message to convey at this point is that four years ago Telstra would have – any network around the globe would have been down for a couple of hours, and nobody would have noticed. Because we were just not using the network in the same way. So fast forward now, we use the networks in such a different way that we truly depend on them. So even two minutes down it gets noticed. But in reality – and I recently reviewed all the numbers of how Telstra has been performing over the last three, four years – we go down by 50 per cent every year in the last three years. And by 50 per cent I mean hours of customer impact. So tremendous improvements, and yet more visible. So that's something we need to continue working on.

Andrew: Could I just make a comment as well? So one of the interesting things about Nikos's experience is that for the last three to four years Nikos was running the Reliance Jio's network, and most of the telco guys, I'm sure, would know that Reliance Jio is quite unique. Because at one level, India is relatively economically, and, arguably, technologically less developed in the telco space. But having said that, the Reliance Jio network had to be built to basically support a business model where ARPUs – initially ARPUs were zero, but ARPUs were very, very low.

And so, in fact, what that manifested itself as was very, very significant focus on automation, and very, very advanced network build. In a network of 250,000 bay stations across the country where you're getting that sort of level ARPU, you've got to actually operationalise the network at very, very low costs. And that's one of the skill sets I think – I mean as well as, obviously, his background with Rogers and Ericsson, one of the skill sets that Nikos brings.

Robyn: That's great. Thank you. There's a question over here.

Eric: Yeah, it's Eric Choi from UBS.

Robyn: Hi, Eric.

Eric: Thanks very much for the presentations today as well. I just had two questions, if I could. The first one, just for Nikos, you had that slide on average mobile cost per gigabyte over time, which is very useful. I'm just wondering if you could comment on how that compares to the average costs that you pay to nbn over time, and where that sits today. And then just a second question, just a more high level question. You obviously outlined a lot of use cases for 5G; a lot of them seemed long dated. So just interested if we could get your thoughts on the pecking order of what's the most material use case in the near term. Is it higher consumer ARPUs? Is it fixed wireless? Is it lower unit costs?

Andrew: Could I – Eric, can you – sorry, just the first question again?

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Eric: Yeah, so the first question – I guess you’ve outlined your average costs on mobile in terms of a dollar per gigabyte. And I know nbn doesn’t charge on a dollar per gigabyte but you can impute an average retail cost that they’ve charged you over time. So I was just interested in how those two compare to each other.

Robyn: Yeah, I mean we’ve never published it, but it is fair to say that in any network around the world the fixed network is going to be more effective at pushing large bits of data around, and therefore more cost-effective as well. We’re not going to comment on the nbn cost per –

Andrew: What I’d probably say, Robyn – that’s right, because we don’t – haven’t really compared them in that way. I mean I think another way to address the question – and this goes to the fixed wireless question, really, which is ultimately in part or perhaps sits behind your question – is that our average customer today on our mobile network uses about 5 gigs a month. The average customer on the nbn uses somewhere between 200 to 250. So, i.e. 50 times as much data. So it’s one thing to watch a – streaming the AFL on your AFL, Telstra AFL app on a 7-inch screen, it’s another thing to project that in –

Robyn: 4K.

Andrew: - high def or 4K cricket on a 62-inch plasma screen in the home while the two kids are in the back study downloading Netflix. And so, there’s no doubt that mobility has an opportunity to create – it’s becoming more efficient, lower cost, but it is a very different paradigm to fix.

Robyn: Yeah.

Andrew: And, sorry, the second question was about –

Robyn: The second was about use cases.

Andrew: Yeah, the priority of use cases.

Robyn: Yeah, so who wants to start on that one?

Nikos: I can start with the immediate one, as we said, it’s all about capacity. So through reducing that cost per bit delivered, and the ability to offload from 3G in particular over to 5G. So that’s immediate. And then we get into what the team referred to, augmented reality or gaming, industry verticals. Those will come very quickly after, we believe.

Robyn: Yeah, I mean we’ve talked about it before, and Nikos’s slide in the three time frames over 5G, it was actually an important slide. Because if you think about it, that first business case, do we go 5G as a company? Well, clearly we want to lead, but even more importantly, when we look at the business case it pays for itself in that first phase through the cost per bit of traffic that we talked about before. That’s why we’ve answered that question upfront, because- and then over time, these use cases will absolutely yield results as well. So the team’s focused on both, deploying the technology so that we get the capacity increases and the lower cost per bit, but then also really going after both the enterprise use cases and the consumer and small business cases.

And we've talked publicly before that the enterprise use cases you can see very clearly around transport and logistics is an extension of what we're already doing with MTData, for example, the mining use cases, the broadcast use cases, which you did really well today, Michael. And actually just going through those, you start seeing other things. But the gaming would not be something that we would typically have looked at, but you start doing what we've done in the innovation centre, and that's why we did that, so that the ecosystem creates some of those use cases as well. And that was a phenomenal experience during the year.

Christian: So globally it's interesting to see that actually media and gaming as a successor or enhancement of TV is picking up so much steam. And then with more bandwidth and actually lower latencies, the user trades goes up. Because if you actually select a video, and it starts playing faster, then the likelihood to watch longer goes up. And this is why there are some carriers which actually get paid by some of the streaming services for providing faster response time to these streaming services. Which, again, is indicative that – what we actually just showed in those slides and the incremental ARPU which people are willing to pay for these streaming services and effectively faster response times, probably apply to the Australian market as well.

Andrew: And I would say, just finally, Eric, that I do believe – I mean this is a forecast, if you like, not one of Telstra but of the industry. I do believe that we will see ARPU increases in the industry as 5G comes along. I think customers will be willing to pay more for 5G in the early days. That's not the same as saying that we are going to differentially price for 5G, we haven't disclosed what our pricing strategy is going to be, but we saw this with 4G. The new technology comes along, customers want to come to that new technology, they're willing to pay more, the operators have just spent a bucket load of capex on rolling out the technology on the spectrum, and I think are more inclined to use – see that recovery and improving return on invested capital. So the bottom line is ARPUs in the industry are in a negative trajectory at the moment, just given the competitive dynamics, but I believe as 5G starts to roll out that will be one of the things that will breathe growth into ARPUs in the industry.

Michael Ackland: And we'll have devices for sale from the first half of the next calendar year, and as Christian said, it's the early adopters wanting it, but it's also customers changing their usage as the experience changes. And I think the other point is many of the use cases we talked about, there's some longer term ones, but there's shorter term ones that are dramatically enhanced by 5G, like the transport solutions, and like gaming – I mean our customers are using our connectivity services right now for gaming, are here and now, and we're working with many partners around how we start those journeys on those use cases out of the Innovation Centre earlier. So I think this will – while many of them feel long term that the ability to capture value as our network improves and as we work into those use cases, as we've done so well in our enterprise space, and as the devices, all the range of devices become – and we will be there selling them next year, that it'll become very real quite quickly.

Christian: Yeah, globally you see in addition something happening in the B2B space. B2B customers actually observe that if the response time of their websites and if the response time of their apps is dramatically faster, the click-through rates go up. And actually the likelihood to buy goes up. So there is some indication that there's willingness to pay for these faster response times, even by seemingly not that affected organizations like a local BMW dealership. You don't want to wait half a second till

the webpage refreshes, you want it instantaneously. And once B2B customers have experienced this difference, they are actually willing to pay for this difference, as it monetises so nicely.

Robyn: Thank you, Christian. So there's another question here, thank you.

Ian: Thanks. Ian Martin New Street Research. I guess the picture that's emerging of 5G's initial gains are about unit cost reductions as volumes go up, and cost of managing the network, and owning and operating the network goes down. And that the later phases are potentially revenue enhancing as you – with these additional technologies, other products, it's emerged that people value. But the other aspect that we've talked about, particularly Nikos, is that a lot of this depends on converging of fixed and mobile networks. Particularly you talked about some of the technologies, network slicing, and so on. And Michael – I think both Michaels talked about product sets that sit across fixed and mobile. And maybe in five years' time we're not talking about a mobile network and a fixed network but a converged network in this 5G world.

And so I just wonder if we've got to face a major constraint in realising those benefits because of the industry structure we've got here. Andy, you've obviously talked about it in terms of the overall wholesale cost, but we've also got this structural price structure with a capacity charge that surely limits the ability to get some of this benefit that we're talking about. We've got limited points of interconnection, we've got a government-owned monopoly. Is it the case that we're just not going to see the full set of these benefits emerge for 5G until we get this industry restructured, and the private sector owning and operating both the fixed and mobile networks in some new structure?

Andrew: I would say it's a great point. I think absolutely there is no doubt in my mind that where the wholesale price is on nbn is creating a distortion in the market, which is going to be a bad outcome for customers in the long term, because it's going to drive costs up just because of the pure cost of it. And to your point, it'll drive non-optimised technology behaviours, essentially. Now, from a technology perspective, we already are converging; we have a converged core across fixed and mobile. But your point, which is absolutely spot on, is that the business – it's much harder to converge the business model because of basically the different way in which the structure of the industry is occurring. And it is a problem.

I mean I do think long term – you've heard me say before – that 5G is not going to replace the nbn, for the reason that I gave to Eric a moment ago, that you're comparing 5 gigs of data compared with 250 gigs of data. If you want to shift all of the data that's going on the nbn network onto the mobile network, you're talking about a very big capex spend. But absolutely it will – whether it's 10 per cent or 15 per cent of extra customers, I think will very legitimately go to mobile only. But I think the real sweet spot is, from a customer point of view in the future, customers don't care whether they're connected on fixed, mobile, wireless, satellite, fibre, they just want to be connected where they want to be connected and when they want to be connected.

So we have to try and create an industry structure which doesn't have unintended consequences and biases by virtue of the economic design of the industry. And I think that's why the wholesale price on nbn has to reduce, and it has to reduce by at least \$20, not tinkering around the edge of \$2. And I get why that's difficult and unpalatable,

and all the rest of it, but until that happens we are going to have a suboptimal industry structure, and that's going to be a bad outcome for customers.

Robyn: And so if I can also touch on a little bit of what you talked about as well. Because with what we're doing or what we've done on the networks of the future area, which was actually all on the left hand – on the right hand side of Nikos's chart, the one through eight boxes that he had – it was actually a brilliant chart. Because on the left hand side of that chart it had all the properties of 5G, but what it's also doing is taking advantage of the network of the future investments that we've made on the underlying network. And so, whether it's NFV or SDN, those are already in place as we've done many of the service migrations to NFV as part of the networks of the future program. And so, yes, there is an industry segmentation there, but our networks have been converging over time, to Andy's point earlier around the core. We've virtualized the IMS core now, that's already been done. And so a lot of those benefits will be unlocked as we're coming into the 5G era.

Christian: If I may comment to your initial line, how the revenues per customer will look like. What I actually do see globally – and, again, I'm new to the Australian market, so I can't comment to this market – I'm actually seeing that more functionality gets added to the basic connectivity offerings worldwide. Which in many countries actually is leading to an ARPU growth. And I think that's just an interesting data point to observe. And that is only possible because these additional offerings do appeal to a wide variety of customers. Otherwise, the market structure wouldn't support this to happen. So ...

Ian: And Christian, and Nikos, so when you came here from outside, and you saw this industry structure, I wonder what your initial impressions were in terms of your ability to do the job you've been hired to do.

Nikos: Weird. For sure not used to it, and typically you see countries going the other way, where government projects become privatised instead of the other way around. But if – I'm going to answer both questions at the same time, your previous rendition. From a technology perspective, the good thing about where we're going is that you can abstract the network. In other words, you can make it look anything you want. So when the customer activates a service, they don't need to know exactly what's lying underneath. So whether it's an nbn network, or a Telstra network, or whatever is hiding underneath, it's almost transparent. And part of the Digitisation program and T22, that's a lot of the capability that we're enabling. Would it be easier if it was not structured like that in Australia? Absolutely. I mean let's be clear.

Christian: Yes. From the, again, customer perspective, I tend to take the customer perspective and say what will customers want, which you then later can monetise. What I find surprising walking the High Street is that people only talk about price. And in other countries people want more security, they want more streaming, they want to game, they want what you pointed out, seamless connectivity between fixed and mobile. So it actually feels that there are other pots of value which do exist and which actually could get leveraged in Australia as well. How this is going to look like, I'm new to this, so I don't think I should be judgmental in any shape or form.

The other observation what I actually have is that you are all positive about technology in a very energetic way. So when people talk about technology, they get bright, shiny eyes, which actually is the best indicator of willingness to buy. I know it's kind of

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subjective, but if I look at you and I talk about a topic, and you get bright, shiny eyes, then I know this is an area where people will buy. And Australians love technology. Telstra has always been at the leading edge of technology. As an outsider, what attracts you to Telstra is Telstra is a nation builder, and exactly this building of the future combined with a customer base who likes this stuff is actually an indication that there is a good future. I'm not saying that I know how it stacks up in detail, but the pieces do fit together, if I may say so. And it's not going to be just plain connectivity, I think, that's for sure.

Robyn: Yeah. Thank you.

Ian: Thanks.

Andrew: Thanks, Ian. Actually, the last point on this, Ian, you will remember as well as I do four years ago when the fixed access determination was – which was basically the last pricing decision in relation to Telstra providing wholesale broadband services to the rest of the industry, the price was basically reduced by about 9 percent to, roughly speaking, \$20 across – averaged across a range of different services to our competitors. So that price today for nbn services is around \$44, with nbn's plan to get that to 50 bucks, at around about the same time the ACCC is going to review the Telstra wholesale pricing, which will be relevant for the homes that are not connected at that point, and the ones in the last 8 per cent. So it'll be interesting to see the disparity between wholesale pricing and the situation where Telstra was the wholesale provider and in the future under the nbn, which is what's really impacted the industry and customers.

Robyn: Thank you. A question here.

Peter: Peter Dubrijevic from Polymath Investors. You've obviously did – have done a lot of work on 5G strategy products, including, no doubt, financial modelling. My question is quite simple: By the end of the 5G rollout, will the net debt of the corporation be higher or lower than it is today?

Robyn: That's a great question, but not one we're going to talk about today. So it is a really good question. So, yeah.

Andrew: Yeah, well, I'm not sure –

Peter: Just broadly up or down from today.

Andrew: Sorry?

Peter: Just a broad up or down from today.

Andrew: Do you mean in terms of –

Peter: Net debt.

Andrew: – the capital cost of the –

Peter: No, I'm just talking about the corporation's net debt.

Robyn: No, he's talking total company.

Andrew: Well, that's a function of a lot more than 5G. So I'm not sure I can answer the question.

Peter: Could I ask –

Andrew: Because you're really asking what's our net debt going to be in 2022/2023. I mean that's a function of many, many things.

Peter: Well, could I ask a related question?

Andrew: Yeah, yeah.

Peter: Do you think it's prudent for the corporation to pay dividends if it has to borrow additional funds, i.e. if the net debt's going up because of the payment of dividends, is it prudent?

Andrew: Well, we reset our dividend policy last year, as you will recall, to basically be in the range of 70 to 90 per cent of underlying earnings, and 75 percent of the one-off payments from the nbn. And we did that – I did that with the board – for exactly the reason that I thought it was imprudent to pay out a dividend ratio of 100 per cent of NPAT, which is exactly what had happened in the past. Now, of course cash flow and working capital from period to period has an impact, but net-net the bottom line is that we're paying a dividend payout ratio which is lower than our net profit after tax. Which ultimately means that we are retaining free cash flow and we're retaining profitability for investment in the future, which is exactly what we're doing with 5G.

Peter: So if the capex requirements going forward because of the 5G rollout are substantial, and your net cash flow is negative, you'll still – and your net debt's going up because you're paying dividends, that's still okay?

Andrew: Well, I think that our –

Peter: Speaking on a cash flow basis.

Andrew: Yeah, no, no, I get that. Well, I think what I would say is that we've done – we believe we've done a whole lot of the heavy lifting capex investments in the program that we've been putting in over the last two to three years to get ourselves network 5G ready. And as we look forward into the future, we believe we've already given guidance to the market that we expect our midterm capex to sales ratio to be in the range of 14 per cent. And then we take that into account with the dividend payout ratio I've said, that shouldn't – over the medium term that wouldn't increase our net debt. And the only reason – sorry. Yeah, the only reason why our capex could change or be different in the future as a consequence of that is if there are new use cases on 5G that drove a much higher level of investment, but they would then have to be done on a discreet basis and have to yield the benefit from doing.

So, for example, a very, very significant fixed wireless network rollout – for the reasons that Nikos alluded to – would be very capital intensive. And so that's why you'd need to look at that very carefully. But within the context of just pure mobility and the sorts of things we're talking about today, we've done a lot of the heavy lifting

on 5G. We've already got 200 sites, pretty much, up and running, and we will roll the rest out within the context of our current capital capex projections.

Peter: Thank you.

Robyn: Other questions? Are there any questions on the phone, on the call? Any other questions in the room? We can bring a microphone to you if you can't move your ...

Joel: Hi, Joel Straddling from Global Data. There was a brief hint of 5G rollout so far delivering an enhancement to 4G service. Is there a financial reward on that? And in terms of baby steps, are you looking at developing some services on enhanced 4G to help drive and grow the business?

Robyn: Nikos, why don't you talk about the bonding of 4 and 5G, and then maybe Mike-

Nikos: Short term, the way 5G is being deployed is we're rolling out a 5G radio on 4G sites. And what we'll do with that is we'll take a 5G carrier, so in other words one of those radios, and we combine it – called carrier aggregation – with 4G. And what the device gets then is a combined 5G/4G experience. And that's really the first thing that will happen. So automatically you'll see a user experience that gets improved, a lower cost per bit, and it's easy to implement. That's really the first use case that we're doing already, or that's where we're going first.

Joel: Can you make more money?

Nikos: Can we make more money?

Michael Ackland: Well, I think clearly anything that continues to enhance our network differentiation for consumers, whether that's – and for small businesses and for enterprise customers – we do look to monetise, and to attract more customers at the right price points. And then I think as the devices roll out, and, as Nikos said, those devices will be – we would have bonded 4 and 5G experiences, the ability for customers to get, I think, really quite broad utility from a 5G device will come quite quickly for customers. And we think network differentiation drives value for consumers, and – yes.

Andrew: And I think it's probably worth – sorry, Nikos – just talking about – we've talked a lot about 5G today, and that's because we promised that we would, and we wanted to really immerse you in the realities of 5G and address some of the perhaps misconceptions and the technology behind it. But 4G is a very important technology, and it's going to be with us for a very long time, and we're going to continue to invest in it.

In fact, I just did a launch yesterday where we launched the – you might remember two years ago at the results ... I'm trying to remember when it was. It would've been our half year results in 2016, I think, where we basically launched the Nighthawk M1, the world's first gigabit per second download device mobile hotspot, Netgear, which we did with Netgear. We just launched today, or announced – sorry, yesterday, the M2, which is a 2 megabit – sorry 2 gigabits per second download speed mobile broadband device on our 4G-X network, and that's going to market, I think, in the coming weeks, Michael, so we will continue to deliver product and experiences –

Robyn: Into 4G.

Andrew: On 4G. The extent to which we can get incremental revenues is obviously partly a market dynamic, and we continue to get our price premium in the market, and so therefore it's important we continue to invest in the differentiation round our network leadership. But it is also true to say that ARPUs in the market are coming down, overall, just as a consequence of price competition, increasing data allowances, introduction of essentially, effectively unlimited, although we don't market it as unlimited, but peace of – what we call peace of mind. Data is obviously impacting ARPUs across the industry, but I mean the 4G – Nikos, the 4G roadmap has got a long way to run, hasn't it?

Nikos: Yeah.

Andrew: There's ongoing evolution in that technology.

Nikos: Yeah, I mean the new M2, first of all, has voice, which is a significant improvement. What we've said publicly is that 3G will only start shutting down in the 2020 timeframe, so that's when we really seriously re-farm the spectrum. So you can see now as we shift technologies, 4G will be with us at least in 2023, '24, maybe even beyond that. So, yeah, no plans to touch that one. That data will become the network that carries a lot of the data as users transition from 4G to 5G, and from 3G to 5G.

Robyn: Other questions? There's one here. Microphone?

Eric: Thanks for the question. Eric Pan from JP Morgan. So I was at the earlier presentation on your 5G, and obviously fixed wireless broadband is one of the earliest use cases for it, and, it seems like, with your M1 and your M2 mobile broadband product already out there, are you able to start offering it as a fixed broadband substitute rather than mobile broadband? Because one of your competitors is expected to market a fixed wireless broadband product starting in 2019, as soon as they get their hands on the 3 ½ gigahertz spectrum.

Robyn: Do you want to answer? Okay. Or you should start. Michael.

Andrew: Could I just say, though, before you do, this is – so in the US they do not have mid-band spectrum available. So the spectrum that is being auctioned right now in Australia, and one of the lead spectrum bands for 5G around the world, which is in the mid-band, so sub 6 gigahertz, 3.4, 3.6 gigahertz, is essentially not available in the US. AT&T and Verizon have millimetre band wave spectrum, and the 28 gigahertz band and the 39 gigahertz band. And so the reason that Verizon are focused on fixed wireless is, frankly, that's where they have to go. So when it's ... When fixed wireless is identified as one of the early use cases, those two things get conflated a little bit, or the US model is picked out as a consequence of that.

The flipside of that is that what's going to be available first in Australia is the mid-band, which doesn't have, necessarily the same capacity from a spectrum perspective as the millimetre wave band; millimetre wave band won't be available until basically two years' time. Now, having said that, as Nikos had on his slide, customers are using mobile as an access layer to get broadband in the home as much as they are using fixed – or rather increasingly they are – to get fixed. I think the distinction with millimetre

band, and the reason you get into all of the aerials and internal wiring and everything else, is the higher you go up in the spectrum bands, the more capacity you're pumping through the air, the more you've got to put the infrastructure pieces in place.

And so there are already lots of, if you like, fixed wireless, whatever you want to call them. Customers today are choosing to have a mobile delivered service – and we already had those services, which we're not seeking to compete with anything in those, other than just in the general mobile market – and as 5G technology comes along, that will offer additional opportunities to do that. Sorry, Mike, I'm jumping the line, but I want to clarify this point about how the spectrum bands play in this whole fixed wireless dynamic. It's quite important.

Michael Ackland: Yeah, I think that's a fair summary. I mean the mobile – our mobile broadband offerings in market are very popular. The M2 with voice will be great for many customers, and the opportunity for mobile hotspot services, 3 or 5G and the mid-band will enhance that experience. Which is, as Andy said, is very different to the millimetre wave experience where you have the capacity to have very, very significant data, but that requires a lot of in-home infrastructure, and has a different set of economics; and, again, on the spectrum timeline that's out there publicly, is a few years in the future. So I think what you might see in the short term on mobile hotspots is something that is superior to 4G, but in many ways delivering the same but an enhanced experience.

Robyn: Well, and it's also fair – obviously Andy talked about the spectrum, but the other thing is the chip set. So the chip sets that come in from Qualcomm, obviously, and other providers of chip sets, the early versions are always in a slightly bigger form factor. And the, actually, beautiful devices that we've seen on that early broadband type of service are actually a little bit bigger than a handset. And so you walked around the showcase – and for those of you who haven't, you should walk around the showcase, because we do actually have some devices out there that are 5G and they're live.

Andrew: And I don't know – sorry, Eric, I was going to say I don't know how familiar people are with the nbn fixed wireless service. So, as we all know, nbn has an obligation to provide fixed broadband service to everyone in Australia. They have an additional obligation to provide 92 per cent of the population with a fixed broadband service using essentially a fixed access network, so copper, fibre, HFC. For the last 8 per cent, they are able to do it wirelessly. The technologies that nbn are using are fixed wireless and satellite. And so nbn is already a very significant user of fixed wireless connectivity at the moment, and, again, I don't know if you know how nbn deploy that. They build towers, or they use our towers and they put radio access equipment on the top of the towers. And then one of their nbn technicians will go to a home, and go and stand on the roof of a home, and get a pair of binoculars out and make sure they can actually see a clear line of sight to the tower, and then they'll apply effectively an antenna to the side of the home, and then wiring, exactly what Nikos is saying.

And one of the areas where nbn is challenged at the moment – and you would've seen that in their latest plan – is that the fixed wireless network is very congested, and they've got real capacity issues, which is why they've had to put in, I think it was, another \$800 million in building out that capacity. Because it's – for all of the same reasons we talked about. So the whole fixed wireless environment is not a straightforward one, and there are definitely use cases, and definitely 5G will make a

difference. But it's worthy of just looking at all the various different models and all of the various different technologies, and seeing how they're working.

Eric: So maybe just to follow up on that, if you can help us understand the technical differences, because looking at your M1 and M2 technology, you're actually aggregating low band and mid-band spectrum, and you're able to achieve one gigabit to 2 gigabit speeds. And –

Robyn: On the 4G network.

Eric: Yeah, right, on your 4G network. This compares to the 25 megabyte, the most commonly taken speed on the nbn. So why couldn't that product be used as a substitute?

Andrew: Because you can't conflate speed with capacity. They're two different things. So one thing is to send a signal very fast – and there's no doubt that over radio waves of 4G and 5G you can do that very quickly – but capacity is a different thing. I use a very facile example. It's a bit like apparently Christian there's a thing called the autobahn in Germany, and you can drive as fast as you like, apparently.

Christian: Yeah. Which is true at 2 am in the morning.

Andrew: Good luck if there's 10,000 cars in front of you, that's called a capacity problem. And the way you solve for capacity in radio is basically towers, so the amount of infrastructure you've got, and spectrum, the amount of spectrum you've got. And Nikos, I'm getting into dangerous territory, sounding like a radio access engineer, but I mean that's – which is distinct, different than fibre and copper and –

Nikos: Can I try? Let me try to explain it –

Andrew: You'll do a much better job than me.

Nikos: - in a slightly different way. I'll use HFC, which is a cable network, as a good example, instead of fibre, mostly because the HFC networks work in a very similar way as the radio network. So back home in Canada we call them radio in a glass, just because it's working exactly the same way. So a typical cable network has the equivalent of 750 to 850 megahertz available bandwidth to go down that coax cable. Now we're comparing this with 20 megahertz or 40 megahertz aggregated LTE that we offer in the M1. So what that means is that even though the speed is a lot faster, when you have a lot of users, at that speed, consuming straight streaming services, it adds up to a capacity that a mobile network typically cannot handle.

So in other words, a mobile station that has a capacity of 600 users, 600 users means not everybody's streaming at the same time, but you have this behaviour where you downstream for a couple of minutes and you download a couple of megabytes worth of data, but then you stop, and the next user gets served, and the next users get served. What the mobile network cannot do is have 600 users streaming high quality video at the same time.

Christian: Yeah, it's like a garden hose, so you can put your finger on the garden hose and then get one jet of water and one tree gets lots of water, wonderful. Then if you

take your finger off, then it's kind of sprinkling over a larger area, but everything is just getting a drop. And that's exactly this challenge between speed and capacity.

Nikos: And what Andy said about the enhanced investment in the fixed wireless by nbn, this is exactly driven by that reason. So in other words, you have a lot more uptake than expected, consuming a lot more data than expected, on what is really a wireless network.

Andrew: And so the only way to solve for that, Nikos, is you –

Nikos: Put more.

Andrew: Stick up more kit.

Nikos: Expensive.

Robyn: Other questions? Any last questions? Okay, there's no questions on the call. So I think we may call it an end to the session. So I think Ross is going to come up and close the session, but, thank you.

Ross: Good afternoon. Thanks, it's the close of our Q&A for funds and analysts. There are refreshments outside available for you, and you'll be joined shortly by the management team. We also have two showcases yet to run to see the 5G and IoT; they're at 3.45 and 4.25. And as Robyn said, thank you for the plug, they're fantastic. I went there earlier today, and it's really well worth a visit if you're not already registered to do it. In a few moments we'll commence a media Q&A, which Nicole will assist with. And lastly, I'd just like to do some thank yous for you folks attending today; to all the people behind the scenes that made this come together today, it's an excellent event; and to our management team for the presentations and Q&A. Andy.

Andrew: Yeah, no, I just want to say one last thing. So, look, thank you everybody for coming along today. I mean I realize that this was very much focused a bit into the future and really around 5G, it wasn't meant to be a more detailed and immediate trading update, or focus on some of the things that are immediate. We'll obviously pick that up with results at the half year. And I want you to know that we're absolutely acutely focused on every single objective we've set there in terms of continuing to grow our subscriber numbers; mitigating the competitive impact of ARPU's; mitigating the impact of nbn; the productivity program that we're driving through as well; and all of the initiatives we've got on the mobile network, as I mentioned, from a 4G perspective' and all of our products and services in market at the moment.

As well as, of course, all the T22 stuff where we're building out new technology platforms; we're reducing our number of products in the market, and many of the offers that we've already put out. So that's all going really, really well. But this was an opportunity to perhaps go a bit deeper on 5G, because the technology is here and now, it's at the early stages of its evolution, and it will evolve over time. And some of these things around fixed wireless, there's still an enormous amount of innovation that's happening at a global level with the equipment manufacturers and the chip sets, the silicon and stuff. And so that's going to evolve.

And I think the same will be the case with 5G as it was with 4G, that we won't be able to predict all of the use cases and the revenue opportunities today that will eventually

come, but we do believe, as Robyn has said, that reduction in the cost per gigabyte of data will immediately play into capex efficiency. I do believe it will breathe some reprieve, if you like, into the overall industry revenues, and, as we see early adopters move to that technology, there are definitely some early revenue use cases. And I think that's why we're so focused on making sure that we lead, we're first, and we have the capabilities to take advantage of it in the long term. So, thanks, Ross, and thank you everybody for coming along today.