Vodafone 4G Webinar

Thursday 27th March 2014, 14:00 GMT

Steve Pusey, Chief Technology Officer

Thank you operator and good afternoon everybody; thank you for joining us. What we would like to do this afternoon is two things: one, update you on our rollout strategy and our 4G plans, but also give you some deeper insights into our thinking on 4G, our strategy, and how it will evolve. To that end, I'm joined by my two colleagues: Miguel, who owns what we call the Competency Centre, which is the team which decides and requests strategy of our partner community and supplier community, and Alberto, who's responsible for the detailed rollout plans of all of our European footprint, so we have two very 'deep in the trenches' colleagues with me that can add some colour to your questions.

If I may, I'll spend about 15 minutes just walking through the slide presentation, and hopefully to pre-empt some of your questions, and then we'll get deep into what areas of interest you have.

If I may, I'll start on page 3, which starts, 'Each generation of mobile technology.' Vodafone's been involved in 4G from the outset with two colleagues in Europe, two competitors, one might say. We crafted and drafted the original requirements documents for the next generation of wireless, which was new in the industry, previously the supply community had drafted the specification and footprint for the evolution of wireless. This has led us to help shape what we expected, and the original draft of this was quite simple: Provide a step change in customer experience. Now that sounds simplistic but that was it.

What does that we mean? As we move towards that right-hand side of the chart, you can see we absolutely delivered a step change in performance that the user can experience. The blue bars under LTE and LTE Advanced represents average user experience under a 10MHz spectrum provider, and for LTE Advanced, when we do bonding or carrier aggregation, what one might expect under 30MHz. So it's definitely providing it in downlink delivery, in uplink delivery, for many applications, peer-to-peer particularly, but also in latency. As we look at real time requirements, and particularly as we think about where LTE might take us in the future with machine-to-machine and advanced applications, latency is going to be vital and is paramount.

So we're very pleased by what we've seen, we're very excited by the future, and what I'll do now is just walk you through where we are and where we're going. If I can turn to the next page.

Vodafone currently is launched in 13 markets, listed on the page there. We've just about approached 17,000 base stations connected. The footprint is rolling out very aggressively now; I think it's fair to say our next financial year, starting in April, is the year of LTE for Vodafone, and we've started ramping but it's a very aggressive rollout that we have planned - I'll cover some of the ambition in a moment – and we're very excited by the early results that we've been seeing.

If we can turn to the next page, page 5, those results are quite evident that from 11% of the Smartphones that are now 4G capable on our network, it's already 17% of the entire

European traffic is on our 4G footprint, and that's quite remarkable, given the amount of base station coverage in these early days. Also, on an individual user level, usage is up more than 130%, and a reference one might take there is a typical UK user on a Vodafone Red Plan might have been experiencing 590 megabytes a month, and as soon as they move and upgrade to 4G, we're seeing them quite healthily surpass 1.3GB a month, heading towards 1.4GB on average, and some of our European properties are experiencing even greater usage than that. Right now, we've been pretty consistent in stressing that although there are great headline speed improvements, the improvement that 4G is offering in the consistency of 3Mbps, particularly for video usage, and today we're already at 81% of the sessions across the European footprint where our customers are experiencing 3Mbps or greater.

Just to remind you why we picked 3Mbps, on the right-hand side, you can see the definition of video standards from 240p to 1080p, to remind you high definition starts at 720p. Today, only 6% of our traffic is actually high definition, although we will anticipate that that evolves in the future. So whilst our networks were quite adequately serving 1Mbps and 480p right now, we set the bar higher, trying to anticipate the future, and that's where the denominations come from, and the stresses that we put on our infrastructure and our operations to deliver consistent 3Mbps or greater.

In addition to that, we try and cover consistently beyond obviously the metropolitan areas as we go towards rural, and our plans under Project Spring, which we're living up to thus far, is to deliver over 90% outdoor population coverage by March 2016.

If we turn to page 6, the speed and pace, and I know a number of you have asked this before, the speed and pace of which we've rolled out 4G has largely been determined by the availability of spectrum and suitable spectrum to consistently deploy. Our preferred coverage spectrum, our footprint spectrum for ubiquitous coverage, has been 800MHz, or the lowest band sub 1GHz that we could consistently deliver against, and, of course, we will, and we are using, either 1800MHz or 2600MHz for the capacity performance layers, particularly in urban areas.

I think it's clear from the chart, which is why we've shown you a wider denomination of spectrum here, that our ambition would be, as 3G traffic moves towards 4G, that we would certain re-farm the 2100MHz and give us even more capacity at 4G, and of course, ultimately, release some of the 900MHz capacity for use on 4G as well, and this is where carrier aggregation comes to the forefront. We would expect, by way of example, that we would be able to re-farm our first carrier on 2100MHz, particularly in urban areas, within the next two to three years.

The darker coloured references are the spectrum that we've deployed on today in each country, and I think it's of note that we did acquire a significant amount of TDD spectrum, which is seen in the far right-hand column. We are using it today for things like backhaul but of course this can be reapplied and used in the future as technology advances, to give us the option for carrier aggregation across TDD and FDD layers to bring a combined effect. We'll take any questions on this later.

If I may move on to page 7 and draw your attention to some of the evolutions and innovation that are taking place in LTE, and we'll use this as a proxy to talk about LTE strategy in your questions. If we start with carrier aggregation, or bonding as some people use it, we have deployed this in Germany, Spain, Italy and Portugal to date and we've made some press announcements around that. It really brings two benefits: the media quite commonly report on headline speeds, and that's great, it certainly does that, and we've demonstrated in these properties 300Mbps by bonding a 20MHz, usually at 2600, with a 10MHz, usually at 800,

and we can deliver some great headline speeds, as I know some of our competitors are doing as well now. But not very much talked about is the improvement on cell edge coverage to deliver that consistently, and we're seeing some very pleasing results on the deployment of carrier aggregation to improve the edge of the cell and deliver that overall consistency of service performance, so we will certainly be looking to deploy this in urban areas particularly.

The consistency of that service and the speeds will improve as time goes on, right now the standards and specifications are allowing for two carriers, but for those of you that may or may not have visited Mobile World Congress, we have started demonstrating a third carrier combination and there are plans from the supplier community towards up to five carriers, which is where you hear some of the spectacularly large headline speeds that we are expecting as time moves on. And, of course, these we will bring to bear in Vodafone as commercial opportunities, as and when those arise.

If I can turn to page 8. There's been a lot of debate about VoLTE, or voice over LTE in an IP format, and we're pressing ahead. VoLTE is the native high-quality voice solution for 4G. Devices are expected through 2014 to start to get delivered with some consistency. It will do more than voice, of course, and we're evolving with our colleagues in the industry a standard that will allow for richer communications than just voice, to incorporate instant messaging, video solutions, perhaps voice on interactive gaming, and beyond. So this is an important step and it is somewhat in its infancy in terms of widespread commercial availability, but we are pressing ahead on all elements with this. We've successfully tested it in Germany and we are beginning our VoLTE rollout as we move into April and May and you'll see it in most of our markets available through the next 12 months. Again, we'll be happy to take questions on that.

Page 9, as I have it, the next page please, the small cells. We're great supporters of small cells. We believe a great network consists of a very good macro layer with sub 1GB spectrum, our preferred, right now available in most of our markets, is 800MHz, and that can be complemented to deliver either hotspot or service excellence areas with small cells. We don't see an either/or, we see them being complementary and we see the necessity, of course, to have a macro layer. It's very unlikely one could ever cover a country with a 2.6GHz spectrum and it would certainly be very, very expensive, needing at least somewhere between, depending on the height of the cells, 20 to 50 times the number of cells in urban areas. We've tested these 2.6GHz particularly on lampposts, we've tested them on bus stops and advertising facilities, and depending on the height that we can get, you need ten times multiples of sites to deliver the same coverage area of the footprint of one macro cell at 800MHz. So very good for capacity, very good for spot coverage, excellent complement to the overall macro coverage solution, but not an either/or, complementary.

Our preferred solution to this is a site that has both 4G and Wi-Fi, and we think through the rest of Spring we will adequately cover the voice layer, and over time we'll move that, as I just said, to VoLTE, but our preferred solution is a 4G site with complementary Wi-Fi. And to pre-empt the questions on Wi-Fi, we see Wi-Fi as part of our strategy. For us in technology it's just another piece of spectrum, and it has pluses and minuses, the pluses are it's free, the minuses are because it's free everyone can use it, which means it has security challenges, it also is very difficult to control in certain areas, volume of use and type of use, and therefore interference levels, but we see it being a complementary part of our offer, and along with our convergence strategies in the home, will be commercially packaged in the future as part of Vodafone's solutions.

So in our small cells we are including Wi-Fi. We're doing small cells in two areas, and the industry has labelled it heterogeneous networks, but we're doing this in two areas outside, but also indoor. It is very difficult to get indoor coverage in deep urban areas, such as the

city of London, Canary Wharf or the middle of New York or the middle of Tokyo, so we sometimes need to complement the external coverage with bespoke indoor solutions. We have pioneered this, I think it's fair to say, at Vodafone the vendors, suppliers would say and we're aggressively deploying bespoke indoor solutions now through at least three suppliers. Of course 800MHz spectrum is much better at getting indoor than 1800MHz or 2.6GHz so we're quite pleased with the results that we get in general from 800MHz but we are complementing for that service excellent particularly for our VGE customer set. We will accelerate that through Project Spring and we see thousands of buildings having bespoke indoor coverage.

Moving on to eMBMS or broadcast video over 4G. The 4G standards allow for something new. Today we have what's called Unicast where we send an individual signal to an individual device. 4G allows broadcast, and we are testing this, we've put it into Germany at the Borussia Mönchengladbach stadium. And this had some interesting potential one could easily see, I know our colleagues in the United States have used it at the Super Bowl for example, where for a specific sporting event you could seize 5Mhz of the LTE spectrum and broadcast to many, many people, just like broadcast TV a specific channel or specific event, and then you can return that spectrum to the mass population usage after that event has concluded. So again we've been experimenting with these new capabilities that 4G offers and offering up that for consideration for commercial use, which we are now looking at.

Lastly on shorter term technology evolution, the convergence of TDD and FDD. Again Vodafone has been pioneering this with the likes of – and we have to thank them – China Mobile. We've been supporting this for some four years now. Why, one might ask? Two reasons: one is the reuse of spectrum for capacity and carrier aggregation that we mentioned earlier; but secondly the economics of supply and demand of the radio infrastructure. If we can get to the point where we have one piece of hardware that is software defined, we can gain the economics of global scale, particularly incorporating the scale economics of China and parts of India into one global unit, and we see that being a benefit on the speed and reach that we can get and making our money go further for the CAPEX that we deploy. So this made a lot of sense to us.

We've already deployed in backhaul with TDD, but we've started doing some lab trials on carrier aggregation across FDD and TDD spectrum, and we see this being a very positive plus for the future. Again it will also help, as we say, on the chart for the future possibility of roaming experience, and so having talked with the likes of Qualcomm and others, I think the whole industry is progressing towards the convergence now of TDD and FDD, which will again speed up the user experience and hopefully give us the ability to reduce cost.

It won't stop there, on page 12 there are many more evolutions of 4G to come. We are working on network function virtualisation, self-optimising networks for performance excellence. We are looking at machine-to-machine. 4G offers us some wonderful new opportunities to grow our machine-to-machine capability and product portfolio. Emergency services, 4G because of its consistency might allow us, and the standards are evolving, to replace the tetra radio that's used by emergency services. The emergency services have quite limited capability on current tetra and voice push to talk. We can add data, we can add many applications, and it looks like a very robust solution for that.

Of course Higher Order MIMO will improve the capacity and performance that the user receives, and this needs a symbiotic relationship between chipset device and radio network but they're all evolving. And LTE bonding, we've been experimenting with that and we're looking towards launches of that in a number of property where we link and we have flexibility between 4G, DSL and VDSL, and perhaps even cable capabilities, to maximise what we have in the vicinity of a customer. And of course re-farming, the quicker we can

move our base towards 4G the more we can re-farm spectrum and we can give more capacity to that spectrum, and of course this is a good circle of improvement.

So short, but really we wanted to allow you more time for questions than presentation. 4G is an absolute key component of the Vodafone strategy. It was gated and our speed is gated against the availability of spectrum, but we're there now and we're actually marching ahead very aggressively under Project Spring. We have said that we will build an additional 77,000 4G sites in 24 months. That's a very aggressive build programme. We have the assets in place to build the very best 4G in Europe and where spectrum allows the best in the AMAP region.

We will accelerate and we are pushing very hard, we have launched with all of our suppliers Project Spring. We do believe it will clearly give us a differentiation in the market, and we're driving many, many new evolutions in innovations that will enhance the performance and the capability that we can deliver to customers over the 4G footprint in the future.

So at that operator I don't want to talk too much because we're here for you to answer your questions, so we would much prefer that we hand over the microphone to our guests and we'll be at your disposal to answer to the best of our ability.

QUESTION AND ANSWER SESSION

Question 1

Nick Lyall, UBS Limited

You focus on consistency of coverage. In which country do you have the most consistent 3Mbps coverage in Europe, and where is the most patchy at present? Are there any significant gaps with your main competitors that you can highlight?

Steve Pusey

Thanks Nick. Alberto has his sleeves rolled up and this is his day job, so if I may I'll hand that one off to Alberto.

Alberto Ripepi

Thank you very much Steve and good afternoon to everybody. We can say that we are pretty consistent across all our properties in terms of data session greater than 3Mbs. The best markets in Europe are Spain, Portugal, Netherlands and Italy. We do not see any gap with our main competitors, so we are best or co-best in all the markets except Greece where we are behind Cosmote.

Question 2

Guy Peddy, Macquarie Securities

LTE Advanced, is it meaningfully different in terms of performance?

Miguel Marin

Good afternoon everyone. The answer is yes, LTE Advanced as you know has the real components, one is carrier aggregation, but we also have Higher Order MIMO with

advanced interference cancellation and others, and we do think it's very significant. In our analysis in urban areas it shows more than 50% performance improvement across most of the area. It also shows a significant capacity uplift. Bearing in mind that we are involving the aggregation of several frequency runs, typically you move from 10 to 30MHz, so you really have a significant capacity uplift and therefore significant consistency of experience under high load. And finally last but not least, we also expect an improved latency because of the higher speeds and capacity involved.

Question 3

Tim Boddy, Goldman Sachs

I just want to talk quickly about the scope for further volume increases within LTE. I think your very first slide, slide 3, talks about 20 times uplifts in spectral efficiency, but I think that's relative to GSM if I've got it right. So what spectral efficiency improvement do you get when you go from LTE to LTE Advanced?

And just as a broader question, are we now kind of coming to the end of the massive increases in spectral efficiency that we saw for example with the shift from UMTS to HSPA+?

Miguel Marin

First of all, as you can see in our chart we're talking about an improvement in the spectral efficiency of about 2.5 times from our 3G HSPA to LTE. LTE Advanced does not per se improve the spectral efficiency but it adds a lot more spectrum, so you have a fantastic capacity when you use LTE Advanced. New developments of LTE like higher order modulation and others will also increase spectral efficiency, so I think that we have a good path ahead of us to continue increasing spectral efficiency above and beyond the fantastic step that LTE represents with respect to 3G.

Tim Boddy

I'll just follow up on that, because obviously there's a cost dynamic here. Some of your US peers have quantified the benefits on a cost per megabit basis of LTE/cost per gig. Do you have a sense as to what that benefit is compared to 3G? And then similarly, what's the forward for that in terms of how much? I guess my concern is that spectral efficiency isn't going to improve at the rate it has improved historically, and therefore beyond the shift to LTE there's not much more scope to lower cost per gig.

Steve Pusey

There's two things. One, I don't think we've ever specifically stated the cost to carry or cost per gig, so that's a tough one to answer, but I'll try to be helpful and tackle it in a different fashion. The cost per gig has a couple of factors. One, how do you maintain a consistent cost base overall whilst increasing your traffic load, and that obviously reduces your cost to carry. We have been pretty consistent on our network OPEX being flat through the last three or four years, which is enabling us a pretty consistent flat OPEX. And in terms of a site, the SingleRAN technology has allowed the cost per site in depreciated CAPEX remain

reasonably consistent, even with the upgrade. So the cost to carry will inevitably reduce due to a relatively consistent per site cost, with it slightly going up as we've added more functionality, but we've introduced SingleRAN which has reduced the energy costs etc, etc. So when you do the math on that, the cost to carry does reduce based on increased volume.

Spectral efficiency is obviously part of that, but it's not necessarily now the driving factor on reducing the cost to carry, and there are of course other elements like the improvements and reduction in backhaul cost and how do we get more effective? As Malus' Law allows us to do four times the capacity for pretty consistent cost in microwave, the economics where appropriate of fibre, the increased carrying capacity of our metro optics and our backhaul optics as we go from 10GB to 40GB and beyond. So all of these things conspire, as well as the simplification of the core network, things like software defined networks or network function virtualisation, will reduce the cost to serve and the cost in CAPEX of the central network as well.

So I think you have to consider all of these things, not just the spectral efficiency, which acknowledge is relevant, but is not necessarily the driving factor going forward. You have to consider all these things on how quickly does the cost to carry reduce below today's current levels. I'm sorry, as we haven't put a specific out there, if you'll excuse me from putting one out, but I'll check with my colleagues if that's appropriate in the future. I think you have to think on all of those things to look at it. But for sure it will consistently reduce as we go forward and of course add to the volume, that helps an awful lot.

Tim Boddy

Just the very last from me. Do you think that speed of reduction will match the speed of reduction we've seen in the past? I appreciate you can't give a number on it. It's just we've been through this period of incredible efficiency gains of SingleRAN and these heavy evolutions of technology, and now it sounds like you're saying it's more going to be about other parts of the network where you see the gains.

Steve Pusey

I think first of all we're still rolling out 4G and so we're still experiencing that gain, point one. It's going to take us the best part of two years to get 90%+ coverage. So one, we're still experiencing it through the next two years at least, just even with that spectral efficiency. Secondly, we're still completing some of the SingleRAN so we gain the benefit, the residual of the deployment of that. Thirdly, yes it is the gains in the other areas, in microwave economics, in backhaul, in metro, Ethernet and core. The next big wave is going to be the simplification and cost reduction of the core as we go to software defined core as opposed to bespoke hardware. So all of those gives us confidence that certainly for the next two/three/four years we see a continuation of the trend lines that we've seen. So the direct answer is yes.

Question 4

John Karidis, Oriel Securities

Not related to the main subject under discussion today but why did Vodafone come last in the RootMetrics independent study of UK mobile network quality?

Steve Pusey

Thanks John. Do you know we're quite proud of what we build and so excuse me for having a little passion here, it's the word 'independent' I would challenge. You know, we don't know what they've measured, we don't subscribe to RootMetrics so it's very difficult to say what they've measured and I do believe what they've measured is even prior to us deploying our 4G infrastructure in most of the cities in the UK. So I can't comment because we just don't know what they've measured.

I can only comment on what we do do, we do two things, we use P3 which is used by many companies, it is independent and we publish that and it doesn't show the same results of RootMetrics whatsoever. And probably more importantly, which is truly independent, we double check our own drive testing which is of course largely outdoor with Ookla, we subscribe to and buy, as many of our competitors do, the monthly Ookla results.

So this is the applications that most of you see on your Smartphones or your tablets which allows you to push a button and get an instant speed test, speedtest.net. All of those from all of our competitors, and it can be done anywhere, indoor and outdoor and that's quite important, it can be done anywhere, we can't control it, we can't dictate it, we can't control the quality or performance of the device that's being used but it is truly wholly independent.

Now we have those results and they're widely available, so does everyone else and we actually fare very, very well indeed, in fact I think it's fair to say we're proud of the fact that if we look at the UK the fact that we have 800MHz spectrum, we perform better in those results, specifically on 4G, because of the indoor nature of the number of tests that are done, which is real life, shows that we get much better indoor coverage for our LTE and we perform better.

So I'd rather not comment but I'm proud of what we do. I think the UK, we're aggressively improving both voice consistency by the way and the government allowed our competitors to roll out early on the 1800MHz so there are some coverage gaps which we're rapidly catching up with, of course, because we were a year later to start but wherever we deployed we are very good and that we will accelerate now we've got the foot on the accelerator. So I can't comment on it but I'm proud of what we've got and I do not agree with it.

Question 5

Simon Weeden, Citigroup

Can you comment on the adoption of VoLTE, time to market, impact of existing voice traffic, ability to free up 2 and 3G spectrum and cost implications?

Steve Pusey

Okay, hi Simon. So VoLTE is, and perhaps I'll start and let Miguel who's managing this for us add some colour. VoLTE is something that's in its implementation stages now around the world; I wouldn't call it mainstream anywhere. As with any new science it will go through stability teething problems, we will iron out all the little glitches and we will get it perfected. I think you'll see 2014 as the get ready year, it's the year that will put the infrastructure in the ground in the core. Of course ubiquitous VoLTE usage needs the aligning of the stars of

device populations that can utilise and experience it, so how quickly will everyone have a device that can use VoLTE and are they equipped to do so? And the ubiquitous coverage of course of 4G. So there's some time where we will still have a 900MHz coverage layer of the 2G voice that will cover the edge of the infrastructure, but I think perhaps 2015 you'll start to see it become more widely used. I think you have to regard 2014, and I have been flying around the world including going to have deeper looks at places like Korea and Japan who are probably the most advanced in this and of course the US, but this is the get ready year, 2015 will be when you'll see more aggressive deployments of this.

What do we hope? We hope that it further allows us to reduce the dependency on the 1800MHz and the 900MHz spectrum but these things take years not months and I don't think you'll see a dramatic effect in Europe particularly in the next two years because it takes time to perpetuate the devices and the coverage through the infrastructure. So we're going to need to provide a 2G voice layer for some time.

Question 6

James Ratzer, New Street Research

Yes, Stephen, thank you very much indeed for having the call today. The first question really is about capacity utilisation, on your slide you're showing spectral efficiency going from 3G to 4G improves by around 150% and you've also demonstrated two slides relating your thing about 130% more data usage per customer of 4G to 3G. So is it a fair assumption to assume that for people going 3G to 4G you're seeing your capacity utilisation remains broadly stable and how do you measure your capacity utilisation at the moment? What would you say that is? And then if there's no further spectral efficiency going to LTE-advanced to meet future demand needs do you need to increasingly rely on the small cell part of the strategy you talked about to meet future capacity demands?

And then the second question I have is if I just compare what you're doing versus your competitors, the big ones like say Telefonica, Telecom Italia and Deutsche Telekom where have you had a focus as seeing the biggest area of differentiation from what your competitors are doing? Thanks very much.

Steve Pusey

Okay, good question James. It's difficult to know other than what we see and what they suggest exactly what competitors do everywhere but of course we have lots of eyes and ears in the market so if I may I'll focus on where we would see our differentiation coming from and perhaps ask if you judge whether that and how that materialises. But two questions. First of all on capacity. We measure capacity in a number of areas, we measure it on a busy hour average, so how utilised is our infrastructure, what headroom do we have end to end from the radio right through to the core in a busy hour on average? And we publish this for you, on average in Europe, and of course this is averages of averages so some are a little busier, some are a little less busy, but 34% utilised in Europe and 38% in AMAP.

Of course that's not particularly helpful, it does tell you whether you've got a big problem looming, but more appropriate is the hotspot measurements where we look at sites, we measure them consistently over a number of days and if our reporting mechanisms are showing a site, an example may be a busy railway station or an airport lounge or something where we see that consistently busy, over 90% busy over seven days, we will regard that as a hotspot and place a CAPEX treatment to that. So those are how we measure them and how we treat them and what we look at.

Capacity is not necessarily our issue, we've got plenty of headroom in spectrum and current capacity and of course each time we add an upgrade to a site when we go from 3G to 4G we usually upgrade the backhaul to go with it to release that performance and inherently as a by-product of course it adds more capacity. So how busy our utilisation has been pretty consistent through the last few years, not because we've deliberately added capacity investments but by nature of the improving performance for our customers has come with advanced capacity with it. So that perhaps answers that.

Where we see differentiation certainly we see it in the rapid deployment of consistent three megabit across 3G and 4G and there's a lot of devices still on 3G in the short term which is why we've had to place both bets for what customers experience. Certainly the consistency with small cells indoor and outdoor where we're very aggressive and certainly just doing it harder, more consistently everywhere as a determined programme with the capital plan i.e. Project Spring, to back it up.

You're much better placed to look at the balance sheet competitiveness of everyone else and how will they respond but we're very proud of the starting point that Miguel and Alberto and others like them have put us in. As we push the accelerator now our expectation is that that becomes more determined as each month rolls by and that whilst there may be a competitor that decides they're going to match us, I don't know, perhaps a Deutsche Telekom, that's obviously their prerogative, consistently we will drive and that will absolutely give us a gap between third and fourth player and we expect in a number of jurisdictions between one and two. Anything to add there Miguel?

Miguel Marin

Yes, I wanted to add something on the figures that you quoted before. Yes, it's true we're multiplying the spectral efficiency by two and a half, but remember that we are using now 15 MHz of 3G spectrum in most of our markets and with LTE we're adding another 30MHz of more spectral efficient spectrum. So the end effect is that it will multiply capacity by six, just by using the same macro deployments. Then by adding small cells, by adding TDD which is not taking into account in these figures that I've quoted and by the way by adding also the second digital dividend that will be coming in the future I think we will have a fantastic capacity to offer a fantastic experience to our customers. I'm not concerned with capacity in our networks.

Question 7

Kulbinder Garcha, CS

Given how aggressive you are being with Project Spring and 4G how do you see the competitive response in any of your markets? How do you keep CAPEX in check?

Steve Pusey

We've got, well I'll take the last part of the question first Kulbinder if I may, and thank you for the question. First of all we've got a very strong capital programme within the company, very strong governance around it, everything is done on a business case basis, everything is done on a returns basis checked against return on asset and our cost of capital per market and we very aggressively match across markets to see where is most profitable for Vodafone to deploy and in what volume. That's done at an executive level by the CEO and the CFO along with myself and my colleagues and it is a very strong discipline within the company and is reviewed on a quarterly basis by the way. So very strong governance around the deployment of CAPEX. Of course this moves, competitors respond, things

change, so we do it on a quarterly basis for that very event as we look at the changes and that's a regular cycle in the company.

With regard to competitors I have seen some announcements in India about some more aggressive roll out from one of our competitors, I haven't seen any particular noteworthy response in Europe, they may be doing something that we haven't been told about but I haven't seen anything particularly in direct response to it so I'm afraid I can't give you much example on that I just haven't seen anything. If you have, of course we'd respond to it. For me the way I coach the team here this is a bit like a 100 metre race, the company has the confidence in our strategy that networks matter, that differentiation can be built, and they've bestowed on us the ability to do and drive. In a 100 metres race if we keep looking over our shoulder maybe a competitor will catch us, but we have got a very aggressive build programme in front of us that everyone is very, very focused on getting out of the stable very early and delivering. So I'm pretty confident that if we keep our head down and keep delivering very fast that would be a problem for our competitors to catch us but of course we would respond appropriately if we saw any particular movement.

Question 8

Shyam

In your view how long would it take for FDD, TDD, carrier aggregation to become mainstream? What are the major challenges currently for the carrier aggregation?

Miguel Marin

Okay, the first thing I would like to say is that we have been showcasing FDD TDD carrier aggregation in the Mobile World Congress in Barcelona this year at the Vodafone stand between 800MHz and 2600MHz TDD. It's still being standardised, I think that it will become mainstream in 2015, 2016, more or less. Now, as major challenges I think that the networks are ready for the first step of carrier aggregation, we have already mentioned that we have so far launched in four markets already. I think that the terminals, which are the other component of this equation, are running a bit behind and we expect to have the first terminals supporting carrier aggregation in the second half of this year. But that will still be FDD carrier aggregation. I think that terminals supporting FDD and TDD will follow in the next year.

Question 9

Mandeep Singh, Redburn

I just wanted to ask about what sort of financial or ARPU type benefits you're seeing from the early results of 4G. You said you were very happy with the early results; if you could just go into what does that actually mean for customer spending? And perhaps distinguish that from ARPU you were getting when you first rolled out 3G which weren't sustained, and why you think this time it could be different?

Steve Pusey

I think the latest figures that we put out, so I refer to those, were those that we put out at the last quarterlies. The ARPU uplift we're seeing, if we take the example of the UK, as we move from the example of a Vodafone Red customer to a 4G Red customer is around 19%. So, pretty consistent uplift. That includes content of course so there is some expense for the

content within that. But we are seeing the uplift and we're pretty confident that we can consistently drive an improvement. It may differ market by market because the conditions are different and the competitor response is different in each market. But we are believers that this will drive an ARPU increase.

Mandeep Singh

And on the sustainability bit we had the same sort of ARPU uplift when you rolled out 3G but they weren't really sustained. So, why is it different with 4G?

Steve Pusey

I think it's safe to say – and only time will tell of course – but I'm pretty confident that the experience difference of 4G and the consistency of the content that it allows and delivers is different to the 3G experience. The 3G experience was marketed on, if I may perhaps, video calling and early data. And don't forget that it wasn't consistently delivering the kind of megabits it required for the video experience that people want and enjoy. So, we have a difference here in that the stars align on the content that's very appropriate right now, from social networking right through to wholesale video download, which is different to the appetite and the richness that it had through 3G. So, I think content and performance are the two stars that are aligning better for 4G than 3G.

Question 10

Stefan Pongratz

How important is it from an interference and coordination perspective to use the same vendor to macro and small cell radios for outdoor and indoor small cell radio deployments?

Miguel Marin

Well, we think that you can use different suppliers in the macro and the small cell layers. As a matter of fact we have tested and we think the performance is quite satisfactory. So, we're not planning to be bound by this in our small cell deployment.

And if you look at indoor scenarios then this is even less important because an indoor scenario you are moving in a confined environment in which most of your interactions are done within the supplier of the indoor deployment. So, we don't think that this is terribly important particularly in 4G.

Question 11

Guy Peddy, Macquarie Securities

What capacity uplift for data volumes are you currently getting in the 14 networks relative to 3G? Or if this is a poor measure, how do you measure capacity improvements?

Alberto Ripepi

We in Europe see an increase of data usage by 130% in our network. The example is coming from Vodafone UK where a 3G Red customer is moving from 590Mbps per month in terms of usage to a 4G Red customers to 1400Mbps. So, it's more than double that is

increasing the usage; so this is the uplift that we are at the moment measuring in the UK and all the other European markets with the 4G launch.

Steve Pusey

And to add a bit to that: if the question was also leading towards the size of the pipe, obviously 4G is improving capacity. It's a factor larger than 3G to do it, given by the size of the capacity that it brings. And it's also driven as well by spectrum flexibility. We had three carriers who apply to 3G in most markets, which is 15 MHz paired. We are already at carrier aggregation with much larger volumes of spectrum at at least double that. So, the capacity uplift is coming from at least 100% more spectrum we have available already before we start farming, as well as the inherent, as we've improved the overall radio speed of course we've upgraded the backhaul – one could argue we could have done that for 3G as well. So, it's a bit cheeky to include that in a 4G uplift; but it is of course necessary to release the power of 4G. So, we're seeing quite dramatic uplift in overall capacity available in the network. Which is why even though, as Alberto just explained, the individual customer usage is quite dramatic when we move from 3G to 4G, the overall busy hour utilisation has been quite consistent because we've of course released the power of spectrum and backhaul capacity improvements from core, fibre and other improvements.

Question 12

Tim Boddy, Goldman Sachs

I just wanted to get your perspective on the extent to which we can ever see mobile replacing fixed in the last mile. Do you think that's realistic, given the IP bandwidth requirement for the user?

Steve Pusey

I think throughout history there has been a ratio which has been pretty consistent on the bandwidth capacity of a fixed connection and the bandwidth capacity of a mobile connection and they've almost run in unison, in parallel.

My very simplistic view of explaining this, Tim, is all networks in the future will be fibre with a wireless tail. And the debate is how long is that wireless tail: is it 500m off the end of a tower or is it 10m around a home? But all networks will evolve towards the same consistency.

Whether one could only use a longer wireless tail than put in a broadband pipe i.e. cable or coaxial or something similar into your home, really depends on what you are trying to do and where. If you're trying to deliver 200 channels of prime high-definition video I don't ever see the wireless infrastructure replacing that economically because of the economics of the use of spectrum. If you're trying to deliver basic internet service with wireless and replacing then absolutely yes: a fixed mobile substitution for internet-based services at the edge of the network definitely has a place.

So, I think you can only answer that on what are you trying to do with the infrastructure. One must assume that as we build bigger pipes applications and content will change and evolve to suit. I'm sure in five years' time we will all be enjoying 4k television with very rich content, and that will require another uplift in capacity. So, it's very tough to answer. It's complementary and it's not an either/or, and there will be opportunities for wireless to offer service and there will be opportunities where you absolutely need a fixed pipe.

I think the very shorter term certainly 4G networks can replace a lot of fixed connectivity, can provide a lot of fixed backup service connectivity for enterprises. And I can easily see us serving the garage or the corner store where there was once a fixed connection. It opens up a lot of new opportunities for us in the enterprise space which we will seize; and of course the consumer space as I just described. It depends on what you're trying to service.

Tim Boddy

Can you have a go at qualifying just in rough terms now I guess you're just starting to get your hands on cable infrastructure in Germany when you think about the overall cost per megabit how much of a cost saving is it to actually own private backhaul yourself compared to having to lease it? I appreciate there is a wide variety of different leasing costs; but just notionally is there a material cost advantage?

Steve Pusey

We haven't publicly put that figure out, so Tim I couldn't. I think you have to look at it – a fibre infrastructure, what we said to the guys is do the separation this way: it's not a technical limitation, as Miguel will ably tell you. We've got 2GB in the field now and we're testing 10GB microwave. The busiest LTE sites around the world, or certainly those I've seen in foreign pastures, require 200MB in the busy hour. So, we've got stuff today that's doing 2GB. We've got a requirement of 200MB. Now, we're way ahead of the demand curve on capacity, and there's microwave of 10GB in the labs. I have seen demonstrated 40GB microwave by one of our vendors by the way. So, it's not going to be a capacity constraint on Vodafone.

I think the way to look at it is slightly differently: to release the power of microwave one has to either apply more spectrum to it or get out and upgrade the physical hardware. So, that has an operational cost or sometimes a CAPEX cost to do it. Offsetting that equation the other side is where is your fibre; how far is the dig to your base station from your fibre run; and what are the economics of the country you're in. It's a damn sight more expensive to dig up the streets of London and Berlin than it is to dig up a farmer's land and extend to a base station in the middle of a field. So, it's far too generic to make a comparison. Certainly our plan is that anything under 150m to 200m run we'll extend the fibre; beyond that it's an economic trade-off between what we have in the field, what capacity it's delivering and the cost of the upgrade versus the cost of the dig.

Certainly if we have fibre we prefer it. We are going to put fibre to all our metropolitan base stations inner city because in the future we do see that we'll hang small cells etc off of them. It's not a particular urgency right now, but that's our strategy and we're pushing ahead. By the end of Project Spring there will be probably 36% of our base stations in Europe will be directly connected with fibre. But we don't run direct competitive economics on has a particular competitor got a huge advantage versus us. It's not something that is a make or break in the model right now.

Question 13

Sean Johnston, Bank of America Merrill Lynch

The lower latency on 4G networks, how much better does it make OTT voice products, like Skype and FaceTime? How do you address the risk that the better quality network makes OTT voice even better?

Miguel Marin

Obviously 4G networks have a significantly better latency than 3G networks. But then in general the lower latency and the higher throughput makes any IP application work better. So, yes, Skype or any other over-the-top voice applications will work well on 4G. But I think that we also have on the other hand VoLTE on 4G, which will be a fantastic quality service native or on LTE.

Steve Pusey

I'll add Sean some of your thinking on this. First of all what makes a great service? Consistency – the internet is best efforts; when the internet runs across operators and across boundaries it is a best effort. There are no quality controls in the internet on the interconnection between operators and between networks. VoLTE and the consistency and the quality between operators is aiming to address that. So, we would hope that our own addresses that with better consistency and quality for particularly high definition voice, if we can call that.

Secondly communities make better, more attractive networks and one has to ask where's the community? It's still not intuitively easy to go from FaceTime to Facebook and back and so on and so forth. Also our exposure to metered voice from a commercial point of view is reducing by the day and is now low. So as a commercial exposure of course bundles have reduced the risk on this so it's really a quality thing and I would venture we have the opportunity to deliver much better quality than a best effort over the top in any circumstance with an open interconnection to our peers in the industry as opposed to a closed mechanism between Skype, Facebook and any other type service.

Question 14

Stefan Pongratz

As the majority of your sites will be equipped with SingleRAN base stations do you envision that the same base stations will be used for both 3G and 4G or will the increased 4G usage require Vodafone to use dedicated base stations to the 4G layer to maximise capacity.

Alberto Ripepi

Thank you very much for the question. So the answer is yes we strongly believe that Single RAN strategy that we adopted several years ago is the right strategy because as soon as the customer will move from 3G and 2G to 4G we have the chance with the Single RAN equipment to move and the flexibility to move capacity from one layer to the other layer. So we do consider Single RAN as the sole equipment that will deliver in our properties and it's the right strategy and flexible strategy looking at the future.

Closing Comments

Steve Pusey

Okay so operator and guests if I may thank you very much for spending time with us today. Hopefully that has addressed a number of your areas of interest and questions. I'd just like to close by saying we're very proud of what we've built. We're very energised by what we're building. There are 30,000 engineers in this company that have been given the best train set in the world to go build and we are equipped, we are skilled and we're motivated. We will build a differentiation and we will build something that we can talk about and sell.

So thank you very much for your time. Thank you for joining us and we look forward to speaking to you very soon.