

Next Generation Access – costs and conundrums

In September, the ITP held an animated conference, sponsored by Alcatel Lucent, with Next Generation Access (NGA) as its focus. Influencers from all sectors of the industry inputted into what became a fascinating – if sometimes heated – debate

In September, both the Broadband Stakeholder Group (BSG) and Francesco Caio, former CEO of C&W, have produced in-depth reports on the deployment of fibre-based broadband (see page 9 for the former). Not surprisingly then, the authors of these two insightful documents were top of the ITP list when it came to selecting keynote speakers for the conference.

Held at the BT Centre in London, the delegate list reflected the extent that the topic impacts on all sectors of the ICT industry and, ultimately, the UK's economy and place in global communications. From technicians to financiers, the depth of interest – and concern – was evident from the incisive questions taken from the floor.

Here we recreate the event, for those unable to attend. The questions and answers are truncated for reasons of space; for a complete transcript of the event, please visit: www.theitp.org Welcome then, to Kip Meek from the BSG.

Kip Meek

We have been asked to speak quite briefly today, both Francesco and I, so that we can have as much time as possible for discussion afterwards so I will be brief ... The recent report that we produced came up with three numbers, five, 25 and 29, all of which have billions attached to the end of them; the five is fibre-to-the-cabinet [FTTC], 25 is fibre-to-the-premise [FTTP] on a GPON basis and 29 is fibre-to-the-premise [FTTP], but on a point to point basis ... One of the purposes of that piece of work was to look at the costs of, first of all, going either to the cabinet and then fibre-to-the-home [FTTH] – again one of the key conclusions was that about half the costs incurred in going to the cabinet would be re-used in a future fibre-to-the-home deployment. The other thing that I'm going to bring out right now is that the report did emphasise, as you would expect, that achieving ubiquitous coverage is a lot more expensive than partial coverage. There seems to be a point at around about two-thirds of households in the UK when things suddenly became a lot more expensive.

So that, in very brief headline form, is what I want to say about the report we produced. Just looking forward a little bit, I think there are a number of things that remain to be done (and these will be foreshadowed a little bit more in Francesco's talk) but I think that one of the things that the BSG can do over the next few months is help to co-ordinate activities in broadband and I think you will find from what Francesco says that that is an important activity. I think that wireless is a very interesting area and wireless, I think, can stimulate the deployment of fibre. It has an important economic function there but also has a very important role in delivering next generation access itself – but for that to materialise we need to fight our way out of the quagmire of judicial process and challenges from left, right and centre, to the process of auctioning off additional spectrum.

There are a number of other areas which perhaps we can pick up in discussion which I think BSG can take forward into the future, but I'll stop now just to say that, going back to where I started, the facts of a turbulent economic environment if anything reinforce the good sense of the thrust of the Caio report. But I won't elaborate on that but just hand over to Francesco.

Francesco Caio

Good morning and thank you for having me here today. Having seen Lehman disappearing in a weekend it is comforting to be in a good, solid group of telecom engineers which I think, irrespective of the financial crisis, will continue to contribute to a real value added to society.

The report is available on the website, but in a very extreme summary the report indicates to the Government that whilst there is no need for public intervention in the form of either major subsidies or structural change in regulatory framework, in the short term there is a warm invita-



Houston Spencer (Alcatel-Lucent), Tom Kiedrowski (OfCom), Tim Whitley (BT), Francesco Caio (European Advisory Board), Kip Meek (Broadband Stakeholder Group) & David Malony (Ovum)

KEY NOTE SPEAKERS

Francesco Caio is chairman of the European Advisory Board and is a former CEO of C&W. He is one of the pioneers for Broadband in Europe both on the mobile and on the fixed side. CEO of Omnitel in Italy, one of Italy's most successful mobile operators, he also founded Netscalibur which was one of the companies that joined the drive for Broadband across Europe. He has produced a review on the future for NGA in the UK.

Kip Meek is a board member of Ingenious Media and chair of the Broadband Stakeholder Group (BSG), a group set up to advise the UK Government on Broadband issues. He published his report on NGA from the BSG.

THE PANEL

Moderator: David Malony; **Panel members:** Tim Whitley, corporate strategy director with BT Group; Tom Kiedrowski, principal within the International Team at Ofcom; Houston Spencer, vice president of Marketing and Business Strategy for Alcatel-Lucent in Northern West Europe

tion to act now to create the regulatory and legislative framework to make sure that the private investment in NGA can be expedited.

I'd like to highlight some of the things that I have found more interesting in the course of the report and the first one is that there is a huge, huge appetite to co-operate and work together across players and across different institutions to crack this issue of next generation access and, as Kip was mentioning before, I think that the BSG could play a very important role in the UK. There is already that framework that works very effectively, and if anything my recommendation would be to step up and make their presence more felt and more clearly understood.

There is very little certainty about the potential of revenue increase once you have fibre deployed ... The temptation to look back and say, 'Look it requires a lot of investment, a lot of scale. There is only one player that could do and it is the vertical integrated incumbent' ... but I don't think the UK can afford to, or actually has to, go that way and for a number of reasons. The first one is that I have found an enormous, enormous depth of understanding and knowledge across players, and maybe, with a bit of an outside perspective, the invitation to be slightly more self-confident wouldn't hurt. You guys know an awful lot and you have been actors and leaders in shaping one of the most competitive environments in the telecoms industry in the world, so



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that's not the time to walk away from these issues but to roll sleeves up and crack it.

The second reason is that there are some elements of the deployment of NGA that are not always brought to attention, I think, in a fair way. I will quickly go through five points that have attracted my attention and somehow driven conclusions and the recommendations.

The first one is that the development of NGA is fundamentally a huge civil engineering work. The report from BSG states that very clearly; from 60% - 80% is just engineers and technical teams on the street digging and putting in an infrastructure. Anything that could lower that component of cost has a material benefit on the business case. Hence the debate on access to ducts, access to sewers, sharing the street works, the opportunity to develop overhead.

The second thing is that ... there are ways of fostering infrastructure-based competition by picking the right design of the network ... I always found it interesting to go through the list of incumbents who have all gone to GPON and the newcomers who have all gone to point to point. I think there is a debate to be had, because whilst GPON is less expensive and we now have specific numbers, I am not sure if it is always the best solution to guarantee long-term competitiveness of offer and innovation.

The third is that, as Kip was saying, wireless is going to be very important. I am not sure that we will see in our lifespan, or in mine for sure, the one gigabyte metric wireless proposition. But, you know, we're going to get pretty close to what is available today – if not better – and it would be a shame not to take that into account when you take the country view, or the nationwide view, of the NGA.

The fourth reason is that there are new ways of funding this stuff. I think we will not see any NGA as a result of the monolithic upgrade of an existing network, but rather a combination of different technologies, different regional and local networks. The issue and challenge is how to make sure that all of this individual investment can be integrated into a cohesive network. But I think the local network ... has a very important role to play and there is evidence that many people, many groups in this country, are thinking about it and what we can do as an industry to favour that type of investment.

And finally, the fifth reason; it is also important when we design this new network to remember all of the revenue streams, one of which clearly is usage. But there is an interconnect revenue that is very important that needs to be resolved from a regulatory point. There is the wholesale revenue stream that is also important, particularly when it comes to gross margins for content, and you know that the Pay TV review is an important element ... I think the issue of transparency on how traffic is managed could be a platform to have access to an additional revenue pool that could be very, very useful indeed to fund this network.

So, in the interest of time, I'd like to get your reaction to this; there is in my view sufficient knowledge and competence in this country across players to take these factors into account and find a very peculiar UK-way to NGA.

Thank you.

Q: DAVID MOLONY:

I'm sorry to pick on you first but there is a question which I'm sure everyone will have a view on. Is Francesco's review a blueprint for a renewed national effort in NGA and particularly, how does it help all the players in the industry that you know well to work better together to deliver a better network that we can all use.

A: TOM KIEDROWSKI

First of all we should all talk about networks plural because I think that one of the distinguishing features of Next Generation Access is that you will have a patchwork of different solutions and that's absolutely well and good. It creates more headaches for the regulator in terms of assessment and in terms of ensuring consumers are protected and that competition, which in itself does well in the current generation of Broadband, continues. I think that one of the very useful things that Francesco's report did was to highlight the broader range of issues that have to be tackled. A lot of emphasis is placed on regulatory certainty and what we as a regulator can do – and that is clearly important. There's a limit to what the regulator can do particularly where you have private sector investment – and that in itself has constraints – and there is a need for public sector interventions in certain areas particularly where it's more than likely that the private sector is not going to rise to the challenge particularly when we are talking about different job reviews within the UK. So I think that's very important and there are obviously things that are beyond the scope of our remit. Unfortunately,

Ofcom does have to operate under the statutory responsibilities that we have. We don't have responsibilities for some things. We don't have, for example, a magic wand to address issues of inclusion in terms of universal service and whether something needs to be done and that's very much on the agenda so I think those are some of the key areas that I think Francesco has helped set out.

Q: DAVID MOLONY

Tim, someone reading Francesco's and Kit's reports would say this is BT's job. Why doesn't BT just get on with it? Why is the UK different? Give us some examples?

A: TIM WHITLEY

Sure – quite a challenging question... I think that the first thing we need to footnote is the profound conclusion that we don't need to panic. Both the BSG's and Francesco's reports are clear in giving the message that there is reference to market failure yet. This is not a time to be too casual about things but there is no strong case for intervention. That's an extraordinarily important message and it's one that I think we might take on. In the wider ecosystem it's absolutely not the case. That's the first thing that's very important to note and that's an extremely helpful data point. In the terms of the wider suggestion, there's a whole map of suggestions that are helpful... There's no monopoly on innovation and we know that when the industry is faced with key technical economic challenges such as this that we need innovations.

In terms of your actual question – why doesn't BT just get on with it, I think in a way it's self-evident from the BSG report that we lay out in very large numbers, and we then, in the next breath, say there is no economic case here because the case is very shaky. There is no clear sign of revenue, so despite the fact that there is a passion and belief that it would be good if we as an industry make this happen... the raw economics do actually say something of what needs to be done in a very considered way... The other aspect of the Caio report and the BSG report which I think are both very helpful in terms of being sensible, mature and very considered observations on this debate, is that there would be a massive danger of precipitously investing – invest in what?

I think we need to go to the next level in this debate. So if you think about what's actually happening, with BT in July announcing superfast broadband – we announced the willingness to invest a significant amount of money; one and a half billion pounds. We've been moving at pace in terms of developing our thoughts around what products that would lead to. We've been having more detailed product consultation with our commercial business partners and ultimately the success or failure of that is going to be whether or not there is a product there that Openreach can offer, that CPs [Commercial Partners] in the UK want to buy. Ultimately that success would be whether or not there are services that those CPs can envisage that their customers want to buy. So there's a next level down which I'm delighted to say I think the UK industry is now getting into. The Future Access Forum, which Openreach held with their CP partners yesterday, is right down at the next level. It's thinking about where do the various control points sit? You know there's a value chain here where CPs will want to be able to offer their customers certain items of differentiation. That does require you to get in to, I'm afraid, quite complicated and quite difficult technical debates which would bore the pants off most normal people! The momentum I see building – and the reason I think that there is progress – is that off the back of the great competitive market we have in the UK, those conversations are now happening in earnest and at pace. Let's see if we can crack the challenges of NGA just as we cracked the challenges of broadband.

Q: DAVID MOLONY

Let's go back to Houston ... Vendors' eyes light up when they hear about public infrastructure investment. Greece announced a couple of weeks ago fibre to 2.1 million homes – great. So what's gone wrong? Are you not pushing hard enough?

A: HOUSTON SPENCER

We might get a good hit of upfront investment if there was an immediate decision for Government intervention, but the thing that Francesco's report does very well is to balance the fear factor – the slight shock that came from the BSG report a week before that said everybody had been talking about £15 billion to fibre-up Britain and all of a sudden the BSG says, no – it's probably twice that. Then Francesco's report comes along and says, 'Actually let's



Who pays? Not surprisingly, the funding of broadband deployment was a focal point for debate

moderate between the technology romantics who want this to happen today, and the economic rationalists who say the best way for this to happen is for people to make rational investments that give you a pay back in an atmosphere of clear competition' – and that's the best outcome for everybody... It's very easy to get frustrated in the UK debate in particular because in the UK we say, 'but Japan's doing it', or 'Hong Kong's doing it' or 'Paris is doing it'... it's very frustrating because as soon as you try to compare the UK situation to any of those other situations the answer you get is consistently, 'Oh yea – but they're different'. Which sounds like an excuse – but scratch the surface and they are fundamentally all very, very different and I wish as a vendor I could say, look here's a comparison; it's pretty clear they're making it happen, we're not, let's get on with it. But the scenarios are extremely different. What drives the business case in the US, which does get you a 15%-20% uptake in Revenue Per User (RPU) versus what drives the business case in Paris where you get zero uptake in RPU is a set of different variables to try to think through to make it stack up in the UK.

Q: DAVID MOLONY

Who's going to spend the money Kip, and who's going to invest if it's not going to be BT?

A: KIP MEEK

I hope it's going to be a number of people in that context because it will be the people who buy the 2.6 gig block of spectrum. It will definitely be BT; it will be, I hope, the next generation of competitive broadband suppliers, the Skys and the Carphones. I hope it will be the mobile operators and I hope it will be Virgin.

Q: DAVID MOLONY

Do you think that Virgin Media is going to be the challenger? Is it going to be a stimulus to BT to do more? After all, Virgin Media, which has a little bit of chequered history, has taken a long time to get to where it is today.

A: FRANCESCO CAIO

I think of Virgin Media as Next Generation Access network today... They haven't delivered yet but my sense talking to other industry participants is that the credibility of what they are doing is growing by the day... The threat of losing existing business, that could act as a very powerful catalyst to upgrade the network and I think my belief is that Virgin is playing that role already to a certain extent, in a similar way to what they played for First Generation program. As Kip was saying, there is no replacement for competition.

A: KIP MEEK

The thing about Virgin is that it doesn't have very many places to go. I don't know if there's anyone from Virgin in the audience, but if you look at its fixed line voice revenues – they're fine, they're reasonably high margin, but there's not a lot of growth there. Ditto on the Virgin

mobile side, so if you look at the content business, we all know that Virgin's content business suffers the same affliction as anybody who is not Sky suffers; and it's difficult to see a lot of growth coming from there. So the only real area of growth for them is broadband and they do have something that is a genuine USP there.

A: HOUSTON SPENCER

In the US you see both Horizon and AT&T rolling out NGA as fast as they can and as fast as they can afford to, but in the US the expectation that your services bundle will follow your entertainment provider is the norm. Here, when you have Pay TV being delivered in a completely different way on a completely different bearer that is unrelated to the broadband, it's an entirely different dynamic. So you do see in the US a 15%-20% uptake on RPU because of that expectation that the communication services bundle and broadband will follow the entertainment provider. Here, that's separated – and I'm not talking about technology now, I'm talking about the behaviour of consumer expectations and what decision that drives, so we see a very different dynamic between entertainment provision and broadband provisions.

Q: PETER NICHOLLS (BT Global Services)

A question to Tom Kiedrowski. Would you consider something like allowing BT to work with the BBC to deliver their services and offer customers a reduced licence fee for taking over fibre to innovate and to get them to increase take up?

A: TOM KIEDROWSKI

I've got absolutely no problem with BT working with the BBC, or indeed any content provider working with network providers. I think actually one of the things the NGA will require is greater co-operation and I think you will see that reflected in the NGA document that we publish next year. When it comes to licence fee funding as some corollary of that, that is a separate question.

Now, we've got a review of public service broadcasting already undertaken and I don't think that's an option that has been considered but, yes, I would put that one to one side and say that there's nothing wrong with BT and the BBC working together. But I don't think it needs to be incumbent upon changes to the licence fee.

Q: PETER NICHOLLS (BT Global Services)

But if, for example, we offer an incentive to Mr Smith, 1 Acacia Avenue, and if we appeal to his pocket, then it's going to drive things. Also there may be a reduced infrastructure cost for the BBC's existing transmission network to take it over a carrier's network. So there's play-offs there; but if we stick with the existing infrastructure that we have, with the commercial models we have ... we need to break that down somehow, else we're never going to get anywhere.

A: TOM KIEDROWSKI

Well, I don't think we are going to stay with the existing commercial models – they will change. But I think it should be led by private investment really, and not trying to tweak other goals that are being established, such as the promotion of UK-originated content, as the licence fee does.

Q: DAVID MOLONY

What about Francesco, could you comment on that? Do you see that as an option – that there might be sources of funding in the entertainment industry, public broadcast? Did you consider that?

A: FRANCESCO CIAO

There is no doubt that we are dealing with an entire value chain, and the idea of looking for a stream of revenues? I think it's mandatory for everybody at the drawing board when they do the business plan. I think particularly on the entertainment side and all the debate around the i-player, the catch up television and the proximity between broadband and some type of entertainment ... we are in the world of convergence and you need to be focusing on the value delivered to customer and then identify the most cost effective platform to deliver that benefit.

Q: ANTHONY WALKER (Broadband Stakeholder Group)

One of the many interesting things in Francesco's report is when he talks about the efficient use that the UK is making today of its existing network. So we may not have the fastest networks around the world or in parts of Europe, but if you look at all the metrics around things like online advertising, time spent online, amounts of e-commerce, it looks like we make incredibly efficient good use of today's network. Now, as you compare the UK with other European markets – do you see that as a strength or a weakness in the case for Next Generation Access, and then as supplementary to that, when you think romantically about the future, what do you think? What kind of use can the UK make from Next Generation Access? What's your most optimistic scenario of what this could all mean for the UK?

A: HOUSTON SPENCER

I think that Anthony is quite right to refer to various indicators that the UK is innovating on broadband to a degree that you don't see in some other countries, and the example that Anthony cites about the UK having the most dynamic online advertising market is a good one. It's not incrementally slightly more than any place else, it's quite a jump. It's more active than the US market and certainly way more active than any place else in Europe, and examples like that I think frankly make a great case for NGA in the UK which does tie directly to your second question and you're providing a fantastic runway here to my favourite technology romantic point ...

We have no idea what it's going to be used for. What we do have in the UK is evidence of a range of things coming together that make the UK a good place to innovate on broadband, and just because in some other markets we've seen 100 megabytes delivered and not much new being done with it, that's kind of interesting, but it doesn't prove that innovation doesn't follow bandwidth. What we see in the UK is that innovation has followed bandwidth to date. That makes us an interesting place to try and roll out more bandwidth and see what we can do with it, because we've already proven that we're pretty imaginative once we've got the bandwidth available. To the follow up question – what in our imaginations will people do with it – no clue.

We as an industry are pretty bad at predicting what people are going to do with the cool tools we roll out. Everybody knows the story about SMS. Nobody thought it was even a product! Bell Labs, which is part of Alcatel Lucent, demonstrated the first fax transmission in 1925 and if you try to roll out a business case for that, it was not actually going to take off until the '80's – so we're pretty bad at taking really great basic technologies and saying 'here's how people are going to use them'. We also co-developed the MP3, which sat around as a really interesting file format for audio for a while, but look at the number of different things that had to come together for the MP3 to really take off as the mass market medium for music. The exciting thing is that we have the chance this time as an industry not to walk into, what some people call the Tom Watson fallacy – the story about Tom Watson predicting that the worldwide market for computers would be about nine. We have the chance not to walk into the fallacy this time with NGA saying 'OK. We don't know what's going to be done with the tools but we know that it's a tool for innovation and we do see places in the world that innovation wants to happen'.

Q: JOHN YEOMANS (First Capital)

As a telecom professional I very much agree with Kip and Francesco on the whole thing. As a financier, that's where my challenge comes from. A lot of people look at the regulator or the Government to say 'They need to start – they need to change it'. The issue here is one of financing at the moment and I'm worried, not just about what's going on outside but what's going on here as well. This is a party where everybody is socialising and talking but no-one's got on the dance floor, and I think what Francesco effectively said was people need to get on the dance floor within the next 12 months ... But consortia finance, project finance, is what would drive that from a financier's point of view. It needs some reasonable certainty of demand to work, so you can look at all the inputs and outputs and say what you're getting. But we haven't got that certainty of demand – except for a lot of stories. So surely the way to generate it is some smaller scale projects? Piece it together quickly with people taking a lead – and it's not necessarily the ones that are nearest to the exchange ... it's listening to where the demand is. I'm a director of a streaming media company. I know darn well that the transformational thing in IP is video. It just swamps anything else one way or the other ... It may not be just that, but you've got to piece together the case of who the target markets are – that's the job of the industry and

it's the job of the industry surely to take a lead. And if this industry can't afford £100 million in the next six months to do it, where's it coming from?

A: FRANCESCO CIAIO

I go back to the mention of small experiments to test, verify and amplify the result. A couple of points; with the Nordic model, whatever you want to call it, some of the things we've observed are based on the notion that a given community, where you could put your arms around say, 15,000 households, can provide a viable platform for a positive cashflow in the not too distant future, if the investor has some degree of certainty with the take-up rate being north of 35 or 45. I'm not saying that's easy but I'm saying it's probably easier. I agree entirely with you, with the idea of going looking for these type of communities and trying to see whether there is an opportunity to go and test the interest and appetite ... I think there is something there to be explored. Just to complete on this point, one of the things we've observed, again in the Netherlands, is commercial banks being willing to marginally extend the value of the mortgage on any households so that the households become the owner of the fibre-link, shifting the balance of scarcity from the provider to the households and to the users and if you think of the cost of a new fibre-link even in a rural area serving even 2000 or 3000 ... so that's something that I think should be explored.

There are local developments. We looked at one in Northern Ireland, a new development – the Titanic Development in Belfast – where they are using the notion of pre-registration. They have fibre to the home – that is something that you could look at almost as a real life lab ... I think there will be an essential role to be played by BT, by Virgin Media, by the big guys, but I think also the big guys will benefit in terms of risk by having the comfort of saying, look in a community you could go pre-reg and get 35% and off you go – and be cashflow positive in 24 months rather than in five years.

Q: GAVIN YOUNG, CHIEF ARCHITECT, C&W ACCESS

We've heard a lot of talk about the way NGA may evolve in this country through a patchwork of networks, franchises and regional investment, so we could end up in the situation we had with the cable industry ... I know Ofcom has recently joined the broadband forum ... but how do we really give the incentive to people to follow those guidelines?

A: TOM KIEDROWSKI

The thing that's important to know is that it's trying to be technologically neutral so that it's not dependent upon any network architecture ... I would sort of throw it back to you and say that once we've facilitated that, it's very much down to the CPs to actually go and speak to your wholesale providers. What is it that you actually want? What do you actually need? Because from all the conversations that I have with operators in this country, there's quite a variance of business models and that's a challenge for us as a regulator. I think it leads us to a conclusion that we cannot hand it to you on a platter ... you have to engage, you've got to articulate your business model, you've got to look beyond current generation broadband and do the research that you need to do to see what your customers want and engage with BT and other wholesale providers. I think that's absolutely crucial and you shouldn't rely on the regulator to do that.

Q: BOB FRANKLIN, CEO TELCO CONSULTING

A comment and a question. I felt a little bit disappointed in reading the report, and felt that maybe we should do more – not necessarily Government investment, but certainly the whole investment approach. I've been a bit more encouraged listening to this morning's debate, because some points came out about investment. I think there's a huge investment case now, and I think personally, in my experience, there's a lot of demand out there. I think we in the UK are often reluctant to invest in infrastructure and I think it's really a crucial investment – whether it's BT or others ... My question is, when do you see this trigger point in terms of demand for services? Or what would be your example of these particular services – be it TV or others – and when might that come? One, two, three years and so on?

A: TIM WHITLEY

We don't know what the definitive answer is, so all I'll do is trot out the obvious answers, but maybe link it to something we haven't discussed this morning. So what are the services that



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people are starting to see that actually drive fixed network bandwidth? The answer to that is of course video of one sort or another. Somebody in the audience made the point that video is the clear obvious bandwidth driver, so the good news is that it is starting to happen ... I think the second thing that we can see that is going to be potentially driving the need for speed, whether people are going to be willing to pay a great deal for it, is fast file transfer. So many digital camcorders out there, people with footage of the kids, uploading to the network ... there's something in that whole space which is about the ability to upload information much much faster. That's something that's exciting. And I suppose the third element ... I think the big next thing is going to be around ADSL 2 plus and actually exploiting the infrastructure as we have already ... As we uplift to ADSL 2 plus, which is already our next plan (and other operators are already there with that) that moves the medium speed up to 10 megabits per second. So there's masses we can do. If we get on apace with our VDSL base capability – and obviously Virgin will have their DOCSIS capability system – I think it's a really interesting transformed capability. Today's upstreams are around 500 kilobits per second to a meg. If you're doing well, VDSL will move that at least 10 times; so potentially eight megabits per second upstream.

A: HOUSTON SPENCER

We have to be humble as an industry on this question, because whenever we've been asked it in the past we've come up with very smart answers, almost all of which have been wrong! We marketed 3G on mobile videophony. We as an industry are really good at giving people tools to invent other stuff to innovate with. That's what we're great at; but we have to be humble in this question even though it is the critical financial question in the business case – what are the services? How will they be used? What will they be worth? What will be the willingness to pay?

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Grosvenor House, London
- Friday 21 Adastral Park Family Christmas Lecture
Dr Mark Lewney – Rock Guitar in 11 Dimension
Adastral Park, Martlesham Heath, Ipswich
- Saturday 29 London Family Christmas Presentation
Speaker – Marty Jopson
Brunei Gallery, University of London



DECEMBER

- Thursday 4 ITP, IET & BCS Annual Christmas Lecture
Yarnfield Park Training & Conference Centre, Stone
- Saturday 6 North East Family Christmas Presentation
Speaker – Marty Jopson
Hilton Sheffield Hotel, Sheffield
- Sunday 7 Midlands Family Christmas Presentation
Speaker – Marty Jopson
Birmingham Central Library Theatre



JANUARY

- Saturday 17 North West Family Presentation
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