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Official Committee Hansard

SENATE

ENVIRONMENT, COMMUNICATIONS, INFORMATION TECHNOLOGY AND THE ARTS REFERENCES COMMITTEE

Reference: Australian telecommunications network

WEDNESDAY, 6 AUGUST 2003

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SENATE

ENVIRONMENT, COMMUNICATIONS, INFORMATION TECHNOLOGY AND THE ARTS REFERENCES COMMITTEE

Wednesday, 6 August 2003

Members: Senator Cherry *(Chair)*, Senator Tierney *(Deputy Chair)*, Senators Lundy, Mackay, Tchen and Wong

Participating members: Senators Abetz, Allison, Bolkus, Boswell, Brown, Buckland, George Campbell, Carr, Chapman, Conroy, Coonan, Eggleston, Chris Evans, Faulkner, Ferguson, Ferris, Harradine, Harris, Humphries, Knowles, Lees, Mason, McGauran, Murphy, Nettle, Payne and Watson

Senator Moore and Senator Wong for the committee’s inquiry into Australian telecommunications network

Senators in attendance: Senators Cherry, Mackay and Tchen

Terms of reference for the inquiry:

To inquire into and report on:

(a) the capacity of the Australian telecommunications network, including the public switched telephone network, to deliver adequate services to all Australians, particularly in rural and regional areas;

(b) the capacity of the Australian telecommunications network, including the public switched telephone network, to provide all Australians with reasonable, comparable and equitable access to broadband services;

(c) current investment patterns and future investment requirements to achieve adequacy of services in the Australian telecommunications network;

(d) regulatory or other measures which might be required to bring the Australian telecommunications network up to an adequate level to ensure that all Australians may obtain access to adequate telecommunications services; and

(e) any other matters, including international comparisons, which are deemed relevant to these issues by the Committee.

WITNESSES

Committee met at 2.47 p.m.

BRADLOW, Dr Hugh Simon, Chief Technology Officer, Telstra

MULLANE, Mr Denis, Manager, BigPond Network Capability, Telstra

PINEL, Mr Don, Regional Managing Director, Queensland, Telstra Country Wide

PORTELLI, Ms Margaret, Group Manager, Consumer Affairs, Telstra

RIX, Mr Anthony, Head of Service Advantage, Telstra

SCALES, Mr Bill, Group Managing Director, Regulatory, Corporate and Human Relations, Telstra

CHAIR—I declare open this public hearing of the Senate Environment, Communications, Information Technology and the Arts References Committee and welcome everyone here today. I specifically welcome the team of witnesses from Telstra Corporation led by Bill Scales, who will be helping the committee over the next two days to tie up all the loose ends that have accumulated in the course of the 17 hearings we have conducted on this inquiry over the past 10 months. I also welcome Mr Don Pinel, Mr Anthony Rix, Mr Denis Mullane, Dr Hugh Bradlow and Ms Margaret Portelli.

As I have explained to witnesses, we are not quorate at this point with only Senator Tchen and me here. Until we are quorate, we are not protected by parliamentary privilege. But we are taking a record of this hearing and it will be part of the committee's evidence. The committee's hearing program has involved it visiting every state and the ACT to hear at first hand the main issues in each region. We also took evidence by teleconference from the Northern Territory, which we were unable to visit because of time constraints. Depending on how much progress we make, the discussions with Telstra today and tomorrow should bring the hearing phase of the inquiry to an end and the committee can then turn its attention to preparing its report to the Senate, which is due for tabling on 2 December.

Having joined the committee in the middle of the inquiry, it has been a fairly steep learning curve for me, especially on the technical side of things, and I have been very pleased by the various dictionaries that have been sent around with the terms. These discussions have been invaluable to all committee members to get a solid grasp on issues such as the strengths and weaknesses of the Australian telecommunications network, what plans are in train to deal with those weaknesses, and what further regulation of the industry's operations may be necessary and appropriate.

As you are no doubt well aware, the committee prefers all evidence to be given in public, but should you at any stage wish to give your evidence, part of your evidence or answers to specific questions in private, you may ask to do so and we will consider your request when we are quorate. It has been suggested that we deal with the latter half of the questions, but I am in your hands, Mr Scales.

Mr Scales—Thank you very much. We are very comfortable with that, and we will certainly follow your lead in that regard. I understand that you would like to talk about those issues which primarily go to the question of the provision of services to people with a disability. From the questions which you provided to us, there were around six questions in that regard. Using the numbering system which you were kind enough to send us, I think they start around question No. 44 and go through to question No. 50 or thereabouts.

CHAIR—Yes.

Mr Scales—When we went through each of those questions we noticed that there was a bit of overlap between some of them. With your agreement, we will try and take those questions one by one for completeness and use that as the basis for opening the discussion. Then we will make any comments or answer any questions you might want us to.

CHAIR—We are quite happy with that approach. The questions are very much a summary of the issues that have arisen during the inquiry. I am quite happy for you to take them in a block or individually.

Mr Scales—I will start with question 44, and that will give you a sense of the way in which we would like to handle them. If you find that is not acceptable to you, we will certainly change the way in which we do this. Question 44 seemed to us from the summary document which you provided to us—

CHAIR—We have a few people listening to us today. If you could introduce what the question is about, that would be helpful for recording purposes.

Mr Scales—I will certainly do that. In summary, question 44 states:

Council on the Ageing complained about the practice of ‘bundling’.

On that basis, it seemed that the concerns inherent in the question were that people—and particularly people with disabilities, who were concerned about the issue of bundling in general—were concerned that if they bundled products they may be required to pay their whole bill even though they may have queries about some portion of their bill. From our point of view, we can understand that there might be some concerns around that. Margaret might want to cover that in a couple of minutes. In general, bundling is one thing we do for the benefit of our customers. We are finding that our customers like to bundle many of their products, whether it is data or voice—fixed line voice or mobility. We are able therefore to provide discounts. At the same time, we know that there will be queries about parts of bills. So, when somebody has a query about a part of a bill, we try and ask them to pay that part of the bill which they feel quite comfortable with while at the same time we recognise that there might be another part of the bill which they may want to query. Margaret, you might want to cover that from a disabilities perspective.

Ms Portelli—As Bill has said, this is about the practice of bundling. It does not only affect customers with a disability; it can affect any customer who chooses to bundle services, which you can do under Telstra’s rewards package. Customers are able to bundle eligible products and services on a single bill and receive a discount on some of those services. Customers who have a fixed service can add one or more eligible mobile, BigPond or Foxtel services to their Telstra service and receive a discount. This is an option that they have. It is a voluntary package. It is clearly stated in the single bill terms and conditions that, if a customer does not pay their bill, all their services on that single bill may be disconnected. Customers are advised of the terms and conditions regarding nonpayment of their bill prior to taking up a single bill. That said though, disconnection of services is always a last resort.

Telstra does have flexible payment processes in place and, when we are notified that a customer is having difficulty meeting a payment, we can generally work with the customer on a solution. However, if payment is not made, then ultimately the services will be disconnected. This sanction will only take place after all of the customer notification requirements of the ACIF credit management code have been met—that is, that the customer is fully informed of what is likely to occur. In the event that a customer has disputed part of a bill, Telstra advises that the customer should pay the component of their bill that is not in dispute and Telstra will stop treatment on the disputed amount until it has been investigated and resolved. Therefore, as long as the customer contacts Telstra to raise the dispute and pays the amount that is not in dispute, their service will not be disconnected as I mentioned above. If, after investigation, Telstra finds that the amount disputed is correct, then the customer is required to pay the amount. If the customer refuses, this may result in the disconnection of all the other services on their single bill.

CHAIR—Are customers advised of that?

Ms Portelli—Yes.

Mr Scales—We can understand why this would be a real concern for them, particularly those representing the aged. We have very elaborate processes in place for making sure that people understand first of all what process they can go through to query a bill. Quite frankly, we rarely have issues around that, but I can understand that that could be a concern for people who are ageing. I think there were a number of other questions in this area. Question 45 also looked specifically at issues to do with people with a disability. I think it went to the heart of the way in which our disability equipment is available to people. Margaret again might want to cover that one.

Ms Portelli—Question 45 is a concern that is expressed about the availability of disability equipment from other service providers and carriers. Telstra does have its disability equipment program, but I think the point that was being made here by the Council on the Ageing and the Physical Disability Council of Australia was that other service providers had limited disability equipment programs. Telstra Wholesale established a disability equipment program in January 2003, so this is a fairly new initiative. It allows service providers to supply specialised telephone disability equipment to eligible customers in order for them to access the standard telephone service. Under this wholesale program, the full range of disability equipment that is available through Telstra's program is also available to those service providers who might want to offer that service to their own end users—that is, their own customers. Telstra has established a disability wholesale help desk for the service providers. Telstra Wholesale developed some application forms that very much mirror what Telstra has by way of an application process, although it is my understanding that some service providers may choose to develop their own and badge them with their own brand.

As far as the general public are concerned, they are advised to contact their service provider if they are seeking disability equipment. If they are not with Telstra and they want to have access to specialised equipment, the advice is that they contact their service provider. Their service provider has the choice of establishing their own equipment program or they can avail themselves of the Telstra Wholesale program. Since that program was established—and I again say it was just at the beginning of this year—it has received about 650 calls and has processed 37 applications on behalf of service providers. I also mention that the Human Rights and Equal Opportunity Commission and the Australian Communications Authority have issued some guidelines to service providers in the industry that they need to be mindful of potential discrimination to people with disabilities, who must have access to the same choices of services at the same prices as other users. That is something which will hopefully lead to a wider availability of specialised equipment within the industry generally.

CHAIR—Do you have any thoughts from a policy point of view on how we promote equipment availability across other providers?

Ms Portelli—This is perhaps something which is not yet widely known, but hopefully there will be better information about that. I would see that consumer organisations themselves might like to play a role in disseminating that sort of information. I expect as time goes on awareness will grow. It is a matter of whether service providers choose to publicise that to their own customer base.

Mr Scales—It is true that from time to time we do get a situation where other service providers would sometimes prefer that Telstra provided those services. In particular, while it is not related to this particular question, you may be aware of what is described as the Priority Assistance Program, which is a program set up to enable us to meet the needs of customers who might have a life-threatening illness. Whilst that program is particular to Telstra at the moment, the government has asked other providers to consider making the same service available to their customers. There is quite a bit of discussion going on within the industry about how that might be done in a way which does not necessitate the government putting into place a licence condition on them to ensure that it happens. From time to time this issue does arise. It often arises in the context of disability and in areas where there are some other services which we provide to the community generally where we find that some of the other providers are not that keen to provide them.

Ms Portelli—The next question is No. 46, and question No. 9 is very similar. If you do not mind, I will take those as one question, because they do relate to issues that have been raised by Mr Len Bytheway and others. Mr Bytheway is CEO of the Australian Communication Exchange, which operates the National Relay Service. As I understand them, the issues that have been raised relate to people who rely on text based communication and have arisen because of the deployment of certain technologies, one of which is the CDMA based wireless local loop system, which is a new technology being introduced by Telstra in certain areas where copper cable network infrastructure is not available. The CDMA standard does not currently support TTY communications or IP telephony. Telstra is only one of a number of carriers that are deploying IP networks.

Telstra will deploy wireless local loop systems under certain protocols that it has developed to ensure that customers who may require TTY access, whether for themselves or for members of their household, will be offered alternative TTY accessible technology. The front-of-house protocols we have established ensure that we ask customers the relevant questions so that we do not offer a service that is not TTY accessible if that household is likely to need a TTY service.

Mr Scales—Senator, are you aware of what TTY is?

CHAIR—Vaguely.

Mr Scales—Maybe Margaret could explain it to you.

Ms Portelli—I beg your pardon, I should not use acronyms; I should explain them. A TTY is a teletypewriter. It uses text based communication, so instead of speaking you type in what you want to say. It is an interactive text based conversation, shall we say, that goes directly between TTYs or via the relay service, where the text is converted into speech or vice versa. It is a device that is primarily relied upon by the deaf community and people who are speech impaired.

CHAIR—I have probably interrupted your question, but hopefully you are about to tell me that if they are on a wireless local loop and they cannot get TTY there are alternative services you could provide under your protocols.

Ms Portelli—Yes. It would primarily mean that we would have to offer traditional services so that they would be able to use a TTY. So if there was an occasion when a customer said, ‘A member of my household is a person who uses TTY,’ we would have to ensure that we did not install a service which was based on wireless local loop.

Senator TCHEN—Are you saying that that would basically disenfranchise anyone else in the house who wished to access newer technologies? For example, if someone in the house wished to install ADSL but another person in the household required TTY access, they would be stuck with the fixed line service which can provide TTY but not broadband services. Is that right?

Mr Scales—Don might want to comment on that. That is not quite right.

Mr Pinel—The two elements are not really the same. ADSL is provided over a copper pair and is broadband service. The wireless local loop is provided using CDMA technology—that is, the same technology we use for our mobile phone network, in regional Australia in particular—and ADSL is not available over a wireless local loop service. But TTY would normally then be provided by, as Margaret said, some alternative technology, such as having to lay copper to those premises so that the TTY service would work. So it is not really related to ADSL in any way.

Senator TCHEN—It is just that Ms Portelli said the whole household would be provided with the same service—the one that provides the TTY service. Is that the old copper wire service, then?

Mr Pinel—That would be the most likely option we would use, although there could be a radio solution as well that had TTY capability. It would depend on the circumstances, the location, the geography, where our nearest network connection point was and a few of those things. We cannot give a definitive answer about what we would use. There is a range of options that we could use other than wireless local loop, generally with a cost impost on us, because wireless local loop is normally our preferred way of providing the service.

Mr Scales—I think in a general sense, for companies like Telstra—we are not unique in this regard—what we are always battling with in this area is how to keep up with technological development in a number of ways, while it is moving as rapidly as it is. That includes how to make sure that we are providing people with a disability with the ability to link into that new technology at the same time as it is being rolled out. We are very conscious of the fact that the disability community in general see this as being a very important point of principle. We are very conscious of that from a lot of discussions with the disability community. We do our very best to try to make sure that, before we roll out a new technology, we have taken these things into account.

But, to be absolutely honest with the committee, it is not always possible to do that, so we sometimes get into this dilemma of not knowing how long one can delay the rollout of a technology that is required by the community at large, because one does not have available to an important part of the community a corresponding technology which will meet their needs. Margaret can give a bit more detail about this, but the fact is that we work with people of goodwill in this whole area to try to find those solutions as the new technologies are emerging. We try to work in advance of these new technologies, so it coincides with their introduction, but it is not always possible. That, it seems to me, is the heart of the question—and we can understand it. It is a dilemma, I think, for all of us who are involved in this particular area.

Senator TCHEN—I think it is perhaps fairer to say that the heart of this question is the concern that Telstra is not conscious of or not paying attention to this particular issue. But from your explanation I am happy that you are aware of the problems.

Mr Scales—I can tell you categorically that we are paying attention to this issue. Margaret should give you a bit of chapter and verse on this. We have very elaborate processes of consultation with the disability community. We have established quite robust processes for bringing the disability community into Telstra to understand what we are doing—communicating with them, making sure we are aware of their needs, thinking about what might be different equipment, handsets and so on to meet the needs of a particular subset of the disability community.

Ms Portelli—I am certainly aware that consumer representatives have expressed some concerns, particularly those representing the deaf and the speech impaired. The Australian Communications Industry Forum has established an Any-to-Any Text Connectivity Options Working Group, which actually started in March and has a membership consisting of consumer and disability advocates and carriers, including Telstra and the National Relay Service provider, and the ACA. That working group is making some progress. It is assessing both short-term and longer-term real time text communications issues, with a particular focus on the support of text telephony.

Telstra is undertaking a feasibility study to demonstrate some equipment and solutions which are based on a couple of technologies. We have imported two text phones to investigate their operability and functional testing is being undertaken by us in conjunction with the Australian Communications Authority. So far, it has been encouraging.

The feasibility study will explore whether this equipment that we are trying out offers real time any-to-any text connectivity services on Australian digital networks. That is exactly what the consumer representatives are saying: they want real time any-to-any text connectivity. They have concerns at the moment in terms of some of the technologies that are being deployed. There are some accessibility issues there. As Bill mentioned, there is a lot of goodwill and a lot of genuine intent, particularly in that ACIF forum, to arrive at a solution. In the meantime, we certainly are keeping disability groups informed through our consultative processes.

Mr Scales—Can I move onto the next question? I think the next one was question No. 47, which was about the deafness forum complaining that to get TTY telephone typewriter equipment from Telstra you have to get a doctor’s certificate. Your concern, according to this particular question, was about how many applications might be rejected. You wanted a sense of how many applications there had been and how many had been rejected and so on. Margaret might like to cover that one.

Ms Portelli—I will explain Telstra’s application process. To apply for equipment through Telstra’s Disability Equipment Program, Telstra’s customers are asked to complete an application form. The application form should be signed by the customer and a qualified professional who is either a medical practitioner—it can be a GP or a specialist—or an audiologist, an audiometrist, a speech pathologist, an occupational therapist, an ophthalmologist or an optometrist. Once the application for the equipment has been received, the disability inquiry hotline—our call centre which processes all these applications—checks that the form has been completed, checks that the eligibility criteria have been met and then contacts the customer to confirm details and discuss their requirements so that appropriate items of equipment are dispatched.

The question indicates that there was a concern, perhaps, that Telstra was arbitrarily making decisions on behalf of the customer. What I would like to explain is that certainly we have an application process and we do have eligibility criteria but we are very much about meeting the customer’s need, ensuring that we do understand the disability that they have and making sure that the right equipment is being sent to them.

Last year, we had approximately 15,800 requests for the supply of disability equipment. The disability inquiry hotline receives a lot more calls than that—well over that amount; over 40,000—but that was the actual number of requests we had for the supply of equipment. Telstra accepted and fulfilled just over 15,000 of those requests, some of which might have included more than one item of equipment. A person might need, particularly if they are deaf, a flashing light as well as the phone; they might need two or even three pieces of equipment.

One of the reasons why applications could not be processed might have been that the applicant already had suitable disability equipment. Sometimes customers have equipment in their possession but are unaware of the features that the equipment has. When they contacted the disability inquiry hotline we were able to point out to them that the feature that they were looking for already existed on the piece of equipment they had. So there were some that were not processed for that reason.

In other cases the applicant may not have met the eligibility criteria under Telstra’s program: that is, they must have local call access from Telstra. There might be a variety of other reasons but they are a couple, just to give you some examples. The figures I quoted there are for 2001-02 and we did have those statistics recorded in the ACA annual telecommunications performance report.

Senator TCHEN—From memory, the evidence given to us suggested that in some cases there might be a catch-22 situation. With the hotline, when you contact the applicant you actually call up by telephone. The issue is that the applicant is probably a person who has difficulty using the telephone and then he or she receives a call from the hotline and communication is not established. But that is probably an operational issue for Telstra.

Ms Portelli—That is right.

Senator TCHEN—What happens if you get a situation like this—where the hotline contacts the person and communication cannot be established?

Ms Portelli—Sometimes there may be difficulties, that is certain. But sometimes there may be a family member or a carer present. They deal with this on a fairly regular basis. We do monitor customer satisfaction. We publish our results once a year. The customer satisfaction regarding the staff of the disability inquiry hotline is very good. We have ways of monitoring issues to make sure that customers are not being handled in a way that is inappropriate. It is a very sensitive area, dealing with people like that. You are asking them about the particular disability that they have and what sort of equipment they want. But I am very reassured and I think Telstra generally is very reassured by the customer satisfaction results that we get on an annual basis.

With the latest survey that we are undertaking, which is actually in progress now, we consulted with members of our disability forum on the questionnaire to make sure that we had the right methodology and to make sure that we were asking the right sorts of questions. We are very mindful of making sure that the way we deliver service to this particular segment of our customer base is appropriate. For the last two years, the customer satisfaction results have been very pleasing.

Mr Scales—I think the next question was from Mr Stewart as well. It was not so much about the issue of whether a particular form of equipment was available and how people could register but the type of equipment which is available. It suggested that Telstra was not providing large visual display equipment. Margaret can also go into a bit of detail about that.

In general, Telstra provides a significant amount of equipment. We provide typewriters, computer modems, voice aid phones, volume control phones and a range of other things, and they are available. We are always testing new equipment to ensure that it suits the needs of people with a disability. In fact, we have people with disabilities who work for us and who test that equipment on a regular basis, so we know that we are meeting the needs because people are employed who have those disabilities and require that equipment. Margaret, would you like to address that in a bit more detail?

Ms Portelli—Yes, certainly. Telstra has just revised its catalogue of products and services for people with a disability. We are just distributing that now to community and disability organisations. I think we have already distributed well over 1,000. It is published online now. This provides a comprehensive range of products that might be suitable for older people and people with a disability. Not only does it include the products that are available under the disability equipment program but it actually talks about other products and services that just might assist people in using their telephone service. This year, it also has a little more information on affordability and it talks about the Telstra pensioner concession scheme and other low-income measures that we have introduced. So it is something that is literally just hot off the press and just going out rather broadly now.

Bill has mentioned that we provide teletypewriters, TTYs, computer modems, voice aid phones, volume control phones—the volume control phone is by far the one that is most widely requested and distributed—hands-free phones and telephone accessories, such as visual alert, general purpose alarm, holdaphone, which allows use of the phone without having to hold the handset for a person who might have a physical impairment of that sort. Customers have to pay just the standard telephone rental charge regardless of the equipment that they require. So you might need one or two bits of equipment and some of that equipment might be fairly expensive compared to a standard phone, but you just pay standard rental.

More recently we have announced Braille and large visual display TTYs—that is in a flier that we circulated amongst the deaf and/or blind community; we launched that not very long ago—so the equipment program has been expanded. As well as that we are developing a multifeatured disability phone. In the hearings you would have heard that perhaps a big button phone would be useful for some customers. We recognise that and that is what we are working on. We hope to have it available late this year. We are certainly working hard to achieve that time line.

CHAIR—That will be part of the program then?

Ms Portelli—That will be part of the program, yes. It might replace some of the existing products that we have, but we hope—and so far we have consulted quite a bit on this—it is just a matter of sourcing something that we think is likely to be suitable. Telstra has established a consumer advisory group for its disability equipment program, and the development of this disability phone is certainly being undertaken with that forum and other stakeholders. Our view is that we do offer a comprehensive range of equipment that you can get through the program and we do, as I mentioned before, undertake our customer satisfaction surveys to ensure that the equipment we provide to customers is meeting their needs and expectations.

Mr Scales—The next question relates to Telstra's decision to close in April six of its national aged and disability centres. Mr Hartfield of the Physical Disability Council raised this issue when he was with you. Again, Margaret can go into some detail about this. The reason we closed these centres is that we found that they in fact were not being used very frequently. On average we had about three visits per week to these centres. It seemed to us that we were not in fact meeting the needs of people with a disability. We felt obliged to try and see if we could find a way by which we could meet these needs in a different way. We have now changed our approach so that, for all intents and purposes, we are turning almost every Telstra shop into a shop whereby people with a disability will be able to get the sort of advice they need about what might be available for them. So instead of having what we had, which were six shops which specialised, we are trying now to have thousands of shops which will be able to provide the sort of information that people with a disability might need.

To some extent the point that Senator Tchen made earlier is germane to this issue, and that is that there is a catch-22 in this area. Often people with a disability require relatives and friends to help them navigate their way through this process. That is much easier for them to do if we have lots of points of access for them, lots of points of presence where they are able to go and know that they can at least be directed into the right area. Margaret, perhaps you want to cover a bit more of that.

Ms Portelli—I hope that we have made really quite good progress in putting alternative arrangements in place since the closures of the centres in March. Bill mentioned that there were only three customer visits each week despite quite extensive promotion of those centres in Telstra's publicity materials. Perhaps I can go to what we have done since the closure of the centres.

CHAIR—Just before you do that, could you deal with the consultation issue? The assertion from the Physical Disability Council was that the decision was made without consultation with the disability forum. Do you have any response to the issue that they have raised in terms of the process?

Ms Portelli—We did brief them prior to the closure but I think their criticism in terms of perhaps the haste in which it was done is something that we recognise. Certainly, we did receive some criticism about the lack of consultation that occurred over the closures.

Senator TCHEN—The complaint was that they were briefed of the decision rather than asked whether the centres should be closed.

Ms Portelli—Yes; that point has been made to me on a number of occasions.

Mr Scales—But I think it is true to say that we have learned from that. Dr Switkowski received a number of letters from people from within the disability community. They made their point to us very clearly and appropriately, and there is no doubt we have learned from that. To be honest, we thought we were doing the right thing. We thought that with so few people using these centres it would be appropriate to try and find a better way. But I think what we learned out of this process is that it is not enough to think that you are doing the right thing; it is appropriate to then turn around and talk to those people whom you are working with and ask them whether it is the right thing to do. So we have learned out of this; there is no doubt about that.

Ms Portelli—Since the closure, we have established an extensive network of locations—and they currently number over 70—for customers throughout Australia to view equipment and receive information about Telstra's disability services. Whereas before we had six centres—and they were just in the capital cities, excluding Darwin and Canberra—we have now got this extensive network, covering regional areas primarily through Telstra Country Wide area offices.

But as well as that we have negotiated arrangements with community agencies and independent living centres so over 40 TCW area offices now have a range of disability equipment that can go on display. They can also take that equipment out to events they might attend to improve awareness of and promote Telstra's disability services and the equipment that is available through our program.

As well as that about 40 community agencies and independent living centres have our equipment and our information on disability services—things like our catalogue and that sort of thing that people can look at. What I will emphasise, though, is that the disability inquiry hotline remains the primary point of contact. So if a customer rings up and says that they are a bit uncertain about what sort of equipment they require, we can make appropriate arrangements for them for how they might be able to go and look at equipment. We even have a home trial program where we can send out a piece of equipment for people to trial in their own home.

Telstra Country Wide staff are backed up by experienced disability personnel who are located within the disability inquiry hotline. As well as that, we have an internal training course on disability awareness that we ask our staff to undertake and we promote that and monitor the take-up of that. So we are trying very hard to make sure that if a person with a disability does go into a Telstra Country Wide area office they receive appropriate attention. But anything more complex about their telecommunication needs is usually dealt with by people who have more expertise within the disability inquiry hotline.

CHAIR—Thank you. We note for the record that we now have a quorum. You are now able to say whatever you want for parliamentary privilege purposes.

Ms Portelli—I hope you do not detect a change in my demeanour.

CHAIR—We might address the final question—50—and then go back to the beginning, Mr Scales. It would seem logical to me to do that to finish this section.

Mr Scales—Question 50 was from Mr Hartfield and relates to the height of payphones and access to them by people with a physical disability. Again, I will ask Margaret to address that question. We have had a number of reviews on this issue to make sure that we are meeting these requirements. It is a bit of a moving target.

Ms Portelli—The issue of access to payphones has really engaged us a great deal in our consultative process. One of the issues of course is the mounting height of a payphone for a person in a wheelchair or a person who has a walking aid. The height requirements may be different for different people because of the range of disabilities that are involved. A major research program on physical payphone access was commenced under the guidance of an independent steering committee in October 2000. This was not the first time we had researched this issue, but this research program in 2000 was comprehensive and the independent steering committee had access experts and representatives of consumer groups on it.

What we have done is commit to making public payphones reasonably accessible to all people in Australia on an equitable basis. To meet the needs of people with disabilities, Telstra are continuing with the initiatives outlined in our third disability action plan, where we have tried to pick up these issues which have been identified to us. We have an ongoing program to ensure that payphones are mounted in accordance with the findings of that research we undertook in 2000. We have an ongoing program to remove steps and widen doorways of booths and to refit payphones outside of a nominal height range. We are very conscious of the issues that are presented to us by people who have difficulties accessing payphones because they might be in wheelchairs or have other access issues. We are trying to promote awareness of access requirements among suppliers and commercial site owners, and we are also examining ongoing issues of people with visual impairment in regard to booth siting. This represents issues that are made known to us by people with vision impairment. Regarding the design of booths, if you are a cane user and are walking down the street, the position and design of the payphone does raise some issues.

These are issues on which we have been having an ongoing engagement with various consumer representatives. Those commitments are stated in our disability action plan, and we report back to our disability forum on what progress we are making against those commitments. We publish a performance report at the end of the disability action plan and have that independently reviewed. It is lodged with the human rights commission, and it is publicly available on our web site. The progress and history of those sorts of issues are readily available both in the report we have done on past action plans and in the commitments stated in our current disability action plan.

CHAIR—Going back quickly to question 49, in terms of the 80-odd places that you were talking about that now have equipment, are you engaging in almost catch-up consultation to ensure that you have the formula right in regard to access to information for people at the moment? What process are you now going through in terms of catch-up?

Ms Portelli—One of the chief tools that we are trying to use is this customer satisfaction survey. We have put some new questions in as a result of the consultation we had and the issues that were represented to us about the closure of the centres. We are trying to understand what impact the closure of the centres has had on access to equipment so people can see it and perhaps trial it.

I am hopeful that the survey we are conducting will identify issues if, indeed, there are any. We will certainly be sharing the results of that research with the disability forum. As I said, they have had close involvement with us in developing the questionnaire. We are of course trying to track the past customer satisfaction surveys with the current one that we are doing, so there has to be—

CHAIR—But you are not specifically going out and talking with disabilities groups about whether you have the formula right in terms of getting the information out?

Ms Portelli—We are doing that, and we have travelled quite extensively. We have done an outreach program in Western Australia. We have done one in the Northern Territory. Our manager of disability services has been to South Australia and recently he has been to Brisbane. We do quite a bit of outreach work, trying to talk to disability groups when they are having events—not only disability groups; community groups in general. For example, recently the Country Women's Association had a national conference. We made a presentation there on our low-income initiatives and also disability services. We do a range of those sorts of outreach activities, making sure that people understand what we are doing but hopefully getting feedback if there are any problems.

CHAIR—Mr Scales, we might go back to the beginning now, if you like.

Mr Scales—That is fine—thank you very much. Is it acceptable to you if I read an opening statement, Senator Mackay?

Senator MACKAY—Yes.

Mr Scales—Telstra is pleased to appear before this committee—I think it is now for the fifth time or thereabouts.

CHAIR—The fourth or fifth, yes.

Mr Scales—We appear in support of our detailed written submission, which we put to you last September. We have also been pleased to have facilitated visits by the committee to some of our facilities, such as the global operations centre here in Victoria. I know a number of you have been to the global operations centre as well as some of our other facilities in Brisbane and elsewhere. At the outset I would like to highlight that, since the Senate inquiry was established in June 2002, Telstra have aimed to continue to deliver on the ongoing advances in the operation and management of our network as well as the continuation of our strategy of delivering ongoing improvements in service levels and products to our customers, especially in rural, regional and remote Australia.

The general policy environment has also changed significantly since the inquiry began, with the commencement in January this year of the network reliability framework, which you would all know is monitored and implemented by the Australian Communications Authority. The network reliability framework applies, in fact, only to Telstra via a licence condition. It is specifically designed to ensure that telephone services across Australia are reliable by requiring Telstra to take pre-emptive action to ensure customers are not experiencing multiple faults. Under the network reliability framework, services cannot experience more than three faults in 60 days or more than four faults in a year. If these service levels are not met, Telstra must undertake remedial work to prevent further difficulties.

Additionally under the NRF, the ACA has the power to identify and investigate exchange service areas with poor reliability. There are a number of questions you would be aware of that go to this question about exchanges and their performance. The network reliability framework can also, through the ACA, issue directions to Telstra to remedy systemic problems and improve the reliability of exchange service areas. Since the commencement of the NRF, Telstra have maintained an average service availability level of greater than 99 per cent across all service measures. We believe that this result is solid proof of the underlying reliability of the network and our commitment to delivering high-quality service performance to our customers.

This result also reflects Telstra’s sustained investment in network upgrading over the past decade as the network has been converted from analog technology to digital. This has meant that we now have quite highly sophisticated computerised telecommunication networks that increasingly require fewer people to build them or even run them. This new technology is far less labour intensive and allows a significant amount of repair work to be performed remotely. Additionally, in more recent times we have adopted highly targeted programs designed to specifically improve network resilience, reduce fault levels and increase product availability.

For example, last year Telstra committed $187 million to upgrade the regional telecommunications network. This financial year we will spend another $231 million to further improve the reliability of our regional network. This is part of a $412 million overall program aimed at improving Telstra’s network right across the country. The large capital expenditure over recent years also reflects the significant investment that has gone into extending our GSM mobile phone network, where we spent something like $325 million, and building our CDMA mobile phone network, which cost us about $930 million.

During the life of this committee we have also significantly expanded the size of our CDMA mobile phone network. Last financial year we added 402 base stations and repeaters. This has increased mobile phone network coverage from 15 per cent of the landmass to almost 19 per cent of the landmass, with over 98 per cent of the Australian population now covered by Telstra's CDMA mobile network. This financial year we plan to add a further 482 base stations and repeaters. This will increase mobile coverage to well over 20 per cent of the landmass by June 2004.

We have also worked hard to increase the availability of high-speed Internet. As you know, that is another one of the terms of reference of this committee. To date, Telstra have invested around $1 billion in broadband infrastructure across Australia. Last month we announced a plan to spend an additional $1 billion on broadband infrastructure over the next five years. In recognition of the fact that technological limitations do not allow all customers to receive high-speed Internet services via ADSL, last week we announced the introduction of an enhanced ISDN product. This will be available to up to 96 per cent of the population and is part of our strategy to meet customers' needs through a variety of technologies and delivery platforms.

As I advised the committee in May, a combination of the significant upgrading of the technology used in the Telstra network, the delivery of a more robust network through better targeted programs and improved work practices has created a situation where fewer staff are now needed for maintenance purposes. We are in fact able to do more with less, with staffing levels now being reduced without service levels being jeopardised.

At this point I would like to turn to some of the themes raised when we first addressed the committee in December last year and which were also raised implicitly, or explicitly, in some of the 57 questions submitted to us last week by the committee. There seems to be an assumption that Telstra can and should provide identical technologies for everyone across the network and across Australia. Regrettably Telstra, like all other providers, simply cannot do this given the inherent technical limitations with various technologies. For example, ADSL has a technical limit of about 3.5 kilometres from the exchange. This is not a fault of Telstra's; this is the limit of this form of technology. However, the effect of this particular technical limitation is that we are constantly striving to find different technical solutions for different customers who want high-speed Internet capability but do not have access to ADSL. We are trying to focus on customer needs and using our expertise to find workable solutions using the most appropriate technology.

Another assumption seems to be, particularly in many of the questions which have been put to us, that Telstra can and should provide the infrastructure necessary to deliver the latest technology before genuine demand has been established for the services provided by this technology. I think we have to say that all organisations—whether they are public, private or even not-for-profit—must ensure that their investments are somehow, to the best that they can manage them, synchronised with demand for their goods and services. Of course Telstra are no exception to this very general rule. We would think that addressing these assumptions is necessary if we are to have this genuinely informed debate about the capacity and adequacy of the Australian telecommunications network and Telstra's role within it.

On that last point, there is another assumption that seems to be inherent in a number of the questions, and that is that the Australian telecommunications network is Telstra and Telstra alone. We would again submit that this inquiry should also focus on the ability of competing telecommunications networks in Australia to deliver the same variety of consumer choices, lower prices and a consistent improvement in service performance. How these outputs are achieved is the responsibility not only of Telstra but of all of the competing networks and the literally thousands of highly trained individuals that make up those networks.

Finally, I would like to comment on some of the claims that might have been made by other witnesses. For example, some witnesses have claimed that Telstra's network would collapse under the weight of heavy rain and sought to use the committee's Sydney hearing in May to continue with this claim. However, it is fair to say that this claim has proven to be simply wrong. In May, despite some of the worst rains in Sydney in 40 years, the Telstra network did not collapse. After the inevitable sparking faults, which we see almost every time this happens, fault levels were quickly returned to more normal levels. I make this point simply to ask the committee to be as demanding on the claims of other witnesses as you are entitled to be on Telstra's.

In conclusion, I would like to emphasise that Telstra are committed to providing the highest level of service to customers at the lowest price possible. It is in the interests of our customers, our shareholders and our employees; it is what we are in business to do. Telstra have consistently delivered on these dual goals since the telecommunications industry was thrown open to competition in 1991, and we are committed to continuing to do so in an increasingly competitive and complex environment.

With your agreement, Chair and committee members, I would now like to introduce Dr Hugh Bradlow, because what we noticed in a number of the questions which you gave us is that there was a desire by the committee to talk about what I think you describe in some of the questions as 'the bigger picture'—that is, what the network is likely to look like in the future. As you are probably aware, Dr Bradlow is what we might describe as Telstra's chief technology officer. It seems to us that he would be in a good position to give you the breadth of that understanding and then answer any questions that you might have. The other thing I should mention to you about Dr Bradlow is that he is also responsible for the Telstra research laboratories and therefore has a number of roles within the company as well as being, very broadly, our chief technology officer.

Dr Bradlow—Today, I am particularly trying to address question 3, which asks for a bigger picture of the future of our network. Also, to some extent, I will be covering issues raised in questions 8 and 35. Bill mentioned earlier that he is trying to avoid acronyms, but I am afraid this area is acronym soup, so I trust you will ask me questions as I go along if things are not clear. I will address part of the issue that was raised in question 3 as to how we prepare ourselves for future technology changes, and I will then talk about the big picture of the future of telecommunications. I will talk about the network in terms of three facets: the network today; the broadband solutions that we are delivering today in terms of ADSL, HFC and satellite; and then options for future network broadband solutions. I would like to deal with wireless solutions separately, because they are a particular class of technology. I will then talk about satellite solutions and end at that point.

Let me start off by addressing the question of how we plan for the future technologies that we introduce into our network. In formal terms, our plan is first of all driven through a top-down approach from Telstra's business strategy which feeds into the group known as Telstra technology. That incorporates a group that is responsible for the planning of our future technology and architecture and two groups that are responsible for the actual development and delivery of that technology. The Telstra research laboratories have a role in the planning phase in anticipating and testing the new technologies, and also in the development phase in assisting the introduction of those technologies.

Because of the key role the Telstra research laboratories play in how we address the future, I would like to cover a few key points about the labs. The prime objective is, and has been for the last 80 years, to do technology evaluation and testing of that new technology. The key is fitness for purpose of new technologies, because while many things are possible not that many things are necessarily desirable. The second aspect of that is that when we do introduce new technologies there are often gaps in terms of the provision from the vendors of particular tools that we might need to operate that environment. For example, we develop tools that enable us to assess the voice quality of voice and IP technologies when they come into the network. A third and important factor is that we do a lot of work on the human factors, particularly on how individuals and Australians in general will interact with that technology.

We also look for new opportunities in terms of product or service innovation that we can bring into Telstra services and at how we might commercialise those outcomes. We are looking for opportunities that are beyond today's current business scope and that are driven by technology changes. We are particularly focused on what we refer to as the next generation service environment, which is the way in which organisations—not only Telstra but all service based organisations—will deliver service to their customers. Finally, we have a component of work that addresses the long-term strategic positioning of our technology to seed the new intellectual property or the new skill base that we will need in the future.

As I said, Telstra research laboratories have been around for about 80 years. Actually, it is 80 years this year. We have approximately 290 people, and they have a fairly generic skill base. We cover virtually all aspects of telecommunications and many aspects of computing as well. We do have a strong focus on human factors as part of our overall research program. Adjacent to that, we have some technology development teams, one based in Sydney and another based in Launceston at the laboratory we established there in 2000, three years ago. That laboratory was designed to do two things: to be a technology development group but also to actually trial new technologies with a live customer base. We have approximately 1,500 customers in Launceston with whom we trial new applications. As part of the labs' role, we also have groups that focus on commercialisation, which is important in terms of capturing the value from our technology, and on how we acquire technologies from outside Telstra and TRL—for example, from universities and other research organisations. We have a strong involvement with three cooperative research centres.

One of the questions we always get asked, both inside and outside the business, is: how do we perform on an international scale? About five years ago we actually initiated an international benchmarking study against other telco based R&D labs. The slide I have here shows the groups that are involved in that benchmarking study. It is actually run independently of Telstra by a Melbourne based consultant, but it was our initiative to get this up. The group of labs involved is a who's who of the European and US telecommunications world. We particularly concentrate on the scope and size of activities in this type of industry on a global basis. The other participants, against our wishes, insisted that the results remain confidential. I can say that these benchmarking studies have given us a great deal of comfort about the way Telstra's research laboratories are operating and the scope and nature of the work we are performing on an international basis. So that was a bit about TRL and the planning. I would like to now talk about the future of telecommunications, unless you want me to pause for any questions as I go.

I would like to give you a big picture overview, as I said, of where telecommunications is heading. I want to start off with the connectivity layer, which is the bit that allows you to transfer the information from point A to B. It is generally accepted and recognised on a global basis that these networks will head towards all Internet protocol or IP networks. The challenge, as we move forward, is to make those networks into carrier grade networks. In today's world, IP networks are in fact enterprise level networks but are rapidly moving towards carrier grade. There are some key challenges that we need to address—

Mr Scales—Why don't you make the distinction between carrier grade and enterprise network so that people understand what they mean?

Dr Bradlow—The distinction is that, in an enterprise network, you have a network that is serving a particular organisation and the reliability is often achieved through, for want of a better term, the internal staff actually nursing that network and making sure that it achieves this purpose. In a carrier grade network, when you are dealing with the general public and you have 10 million customers, you have to ensure that the inherent reliability is built into the network.

In the industry, people talk about five-9s reliability, meaning that the network availability is 99.999 per cent as carrier grade; in an enterprise network, it is usually only three-9s—that is, 99.9 per cent. While that may seem to be a subtle distinction, the difference is the availability of many hours of outage per year, which you can cope with in an enterprise environment but you cannot in a carrier environment.

So for the challenges moving forward as to how you get to carrier grade, security is an issue that is an ongoing factor in the Internet world and is the subject of a huge amount of international activity. What I have called SLAs stands for service level agreements—in other words, how do you achieve that five-9s reliability and availability of the network? There are still a number of technical challenges around that particular issue. The third area is the network that we call the metro network, which is really from our exchanges back into the core of our network. In that environment today, three-quarters of the traffic that is carried in the metro environment is actually circuit switched traffic. In the future we expect, in an all IP network, that it will be predominantly packet switched traffic, and there needs to be an evolution of that particular technology.

As we move on, when we reach out towards the customer, broadband access is a key component of an all IP infrastructure. If you like, it provides the dial tone for an IP world. It is progressing pretty well in the same way on an international basis, and I will talk about that when I cover the network infrastructure. The other aspect of all IP networks that are being addressed today is mobile access. Again, I will talk about that, because in today's world the mobile access is predominantly a voice circuit switched infrastructure and we will need to migrate to a packet switched data infrastructure.

The vision is that over some period from now until many years into the future—and you will find as many opinions as there are people working in this field about how long that period is—we will move progressively to this all IP infrastructure. But, in a sense, the question is: how do we actually connect up the human beings that sit on top of that network?

The next major development that is taking place in the industry today is what is known as web services. There are various marketing names for that. Microsoft refer to it as .NET; others, like Sun Microsystems, refer to it as J2EE. This web service infrastructure, in effect, will allow the applications that sit on top of the telecommunications infrastructure to connect to each other. Some people refer to it as the second generation of the Internet because it is really the Internet for the applications as opposed to the Internet for the computing equipment. That is starting to be built out in today's environment. Telstra has taken a number of steps to address this and has an ongoing infrastructure build based around web services infrastructure, which I will not cover today because the focus of the questions was on the access network and that is where I will focus my time.

There is one other critical component; that is, the systems you use to actually deliver service to customers. While these are systems which we make intensive use of in our own environment, all enterprises are becoming service based enterprises and therefore these systems will be the key to the future generation of information infrastructure going forward. For example, these are things used for call centres and contact centres such as natural language speech recognition systems, web systems, emails et cetera—systems which really allow human beings to derive value out of the network infrastructure. So that is a very brief summary of the big picture of where telecommunications goes from here. The question said 100 years, which is probably a little longer than I am used to planning, but that summary shows the beginning of the journey for the next 100 years.

I would now like to switch to talking about the network infrastructure as it exists today and some of the issues relating to its future evolution. I will start off by working my way outwards towards the customer from the green line on this overhead, which represents the exchange boundary. To put it in terms that make it more real, this point over here in the network would be my local exchange in Glen Iris. Out of that exchange will come what we call a main cable—these are big, fat pipes filled with gas that have literally hundreds of pairs of copper cables in them. Those go down to points within the network which we call pillars, which are those torpedo like things on street corners. As you will notice on another slide, there are 88,000 pillars around Australia. Out of those pillars comes what we call the copper distribution network, which are bundles of copper pairs that go down individual streets and then peel off into individual households. There are roughly 10½ million of those pairs that end up in households. I emphasise thought that, in fact, the distribution network is designed with more pairs than that because you have to allow for a change in churn and for spare capacity. So overall there are probably roughly 12 million to 12½ million pairs in that distribution network going towards the customer. Then it feeds directly into the customer's house and the telephone is terminated at that point. So that is really looking at the access network going out from the exchange.

When I go back from the exchange boundary into the network, if you look at our architecture then you will see that we have about 5,000 of these local exchanges around the country. So each of those local exchanges would have in the vicinity of 10 to 20 main cables coming out of them. These local exchanges are what we call an RAU, or remote access unit. This really means that it is just a dumb rack which terminates the copper pairs and turns it into a digital signal that is then fed back to a computer system, if you like, which we call a local access switch. There are roughly 200 of those around the country. I will stick with Melbourne at the moment as an example. We would have a local access switch, say, in Frankston and another one in Deepdene. There are roughly 15 of them around Melbourne. Each of those would feed about 20 of these transport access points or remote access units off that local exchange. Then feeding back from those local exchanges, the exchanges are interconnected by what we call tandem switches. There would be about 20 of those around the country. I know that in Melbourne there are three of those: Lonsdale Street, Exhibition Street and a third one on St Kilda Road somewhere.

Mr Pinel—It is at Windsor.

Dr Bradlow—So there are three of those and they connect all the local access switches. That is the way the telephone network has been constructed in today’s environment. On this chart, from the green line forward it is an analog network; from the green line back into the network it is a digital network. One other thing I should have mentioned is that this same infrastructure serves both the telephony network and the ISDN network. As Bill has just mentioned, we have introduced an ISDN Internet product, which provides many of the features that people value in a broadband Internet service. Our customer surveys have shown that the key features are delivered through that ISDN capability.

Let us look now at ADSL. What happens with ADSL is that the industry has developed a way of sharing the spectrum in the twisted pair. The voice network is peeled out at the exchange. It goes into the normal voice infrastructure and into a data network through a box known as a DSLAM, which stands for digital subscriber line access module. In the same way, at the customer end there is a splitter that peels the data off onto a modem and then into a computer. It leaves the existing telephone service intact and unaffected once you have put a couple of filters into the telephone system. So effectively ADSL is a way of sharing the spectrum that exists within a twisted pair network. That will deliver—depending on the distance from the exchange and other factors like the number of bridge taps, the number of AM radio stations and a whole lot of confounding factors—a speed which will reach about 80 per cent of customers, in terms of the length of their line, at about 1½ megabits per second.

The other network which we operate and offer broadband services on is the hybrid fibre coax network or what most people think of as the pay TV network. This has a somewhat different architecture. In this case we have fibre coming out of the exchange into a box called an optical RF hub, which effectively converts those signals in the fibre onto a coax copper cable—it is not a twisted pair; it is a coax cable. Each one of these hubs will serve four of these coax cables. On this chart you can see that each of the hubs serves approximately 900 homes. That means that each of these cables serves approximately 200 homes. That is like a bus technology, so everyone just taps the same cable and therefore it is a shared medium. So while it is a way of delivering high bandwidth technology, it is a bandwidth that has to be shared between multiple users. For broadcast TV, that turns out to be a very convenient way of delivering a service because all users are sharing the same signal. That makes it very efficient, which is why the HFC network, unlike ADSL, can deliver video services as well as a high-speed Internet access.

Those are the wired options for today's technology. I would characterise those as delivering of the order of a megabit per second of high-speed Internet access downstream to customers. I want to emphasise that, in today's world and in the future as well, the amount of utility a user gets out of broadband is dependent on the access network, the intervening network that sits between the access and the content provider, and the content provider network. It is a case of the weakest link in a chain argument because the weakest link determines the user experience. Most of our studies show that the weakest links actually sit in networks that are overseas, in the content provider or in the pairing arrangements that exist overseas and are in fact well outside the control of Telstra or any other Australian provider. I hasten to emphasise that it would be a pointless exercise to upgrade the technology today unless the whole chain moved consistently. The whole global supply chain today is geared around those one megabit per second technologies. On the other hand, obviously with time one would expect that there will be a progression.

There have been various ways in which people have presumed that this progression might occur, and there has been a lot of research done globally and in Telstra on these new technologies into the future. So, in a sense, this is about anticipating what comes next. Looking at that architecture I have just shown you, there are about 88,000 of these main cables between the exchange and the pillar, but there are roughly 12 million to 13 million of these copper cables between the pillar and the home—and there is enough copper in those loops to apparently go to the moon and back 2,000 times, not that I have tried to measure it. So you can understand that there is a strong attraction to trying to use the existing bulk of our cable which exists between the pillar and the household. That distance usually is of the order of a kilometre.

The international standards organisation have developed a standard for what is called VDSL, which stands for very high-speed DSL or very high-speed digital subscriber loop. The proposal here is that you locate a unit, an optical network unit, at roughly the position of the pillar, which means that you have about a kilometre between that point and the customer. It turns out that the standards will allow you to deliver 22 megabits per second downstream and three megabits per second upstream. That can coexist with a symmetric service on other pairs in the same bundle that is six megabits per second in either direction.

To feed that unit you use optical fibres from the exchange, so you would end up replacing these main cables with optical fibres. While in some senses that seems to be an attractive proposition because you can do many things with 22 megabits per second downstream, there are two key disadvantages in this. As I mentioned, there are 88,000 street cabinets, and I cannot think of any telco in the world that has an appetite to put 88,000 active units out in the street. These things have all sorts of attendant problems; you have to power them, you have to cool them, they have fans and there are environmental considerations. You either have to bury them or you have to have them sitting out on people's street corners—and local residents object. So there are myriad reasons why there is a general distaste for that type of solution. The second reason is equally important. If you are thinking in terms of a future-proof architecture, you have to ask yourself: after many billions of dollars of investment how long will that investment be fast enough for? The general consensus on a global basis is that the simple answer is: 'not long enough'. So the notion of deploying VDSL is out of favour on an international basis.

The other alternative is to deliver another technology which is an all optical technology. This is in particular based on a technology called passive optical networks, or PONs as they have become known. The architecture here is fairly simple in that you distribute the signal over an optical fibre. In each fibre you can put in passive optical splitters. You can think of this as a blob of glass into which you weld other fibres. You can put up to 32 fibres off one of these blobs of glass. You can only put one blob per fibre, but you can then split that fibre into 32 other fibres. Those 32 fibres will go to individual households. That is obviously very attractive because there are no active electronics out in the field. The other thing that makes it attractive is that you can actually deliver broadcast video by using an extra colour down the fibre, or using so-called wave division multiplexing, to deliver video as it is done today either through analog or digital signals. The other thing is that it is upgradeable, so there is a certain amount of future proofing in this and you can envisage that, some time down the track in the future, you could deliver many gigabits to an individual household.

However there are a number of key issues in terms of when this technology gets introduced. The first is that you will notice that the topology of that network is somewhat different to the topology of our existing network. Therefore it would involve a totally new reticulation. Overseas estimates put the figure at various points as to how much that would cost, but it is estimated that roughly 70 per cent of the overall cost of the service goes into that reticulation. So it is a considerable disadvantage relative to the infrastructure in place today. The second thing which is absolutely critical is that the standards are evolving in this environment.

However, having said that, SBC, Bellsouth and Verizon, the so-called three sisters in the United States, have just issued a request for proposals for this type of technology—what they are calling fibre to the premises—because they have a regulatory situation which encourages them to deploy this type of technology. The current regulatory system requires them to unbundle their existing copper network, and they are competing with the cable companies, who are offering what has become known in the States as the triple play, which means the ability to deliver voice, video and high-speed data services to individual customers. The simple truth is that it is easier to put voice on the cable than it is to put video on the copper. So the RBOCS have an extremely competitive issue there, with some estimates saying that between 2006 and 2008 they will lose up to 15 to 30 per cent of their customers.

The second thing is that there is apparently a new regulatory ruling from the FCC which they say they still have to read the fine print of, and the fine print is apparently 800 pages. The people I spoke to in June had not had a chance to see it, but they believe that it will allow them to offer these services without having to unbundle this fibre network. When they do that, that will resolve the standards arguments. But until they have done that these standards are going to be an issue of hot debate. The current available standard is called BPON, but the expectation is that new standards EPON or GPON will be better alternatives for the future. Which one the RBOCS choose will effectively determine the shape of the industry because of their buying power and the scale they will effect—

CHAIR—That is A-OK with us.

Dr Bradlow—That will resolve the argument. That is a major inhibitor in terms of when that settles down. The third aspect is the cost of the so-called optical network unit that you have to put in the home. Obviously that cost has to be down at consumer levels. Today, that technology is based on some fairly sophisticated laser technology which is very hard to produce at cheap consumer levels. The RBOCS in their RFP—request for proposals—have set targets on what they expect those costs to be, but there is still not a great deal of clarity in the industry as to whether those targets are achievable. In a sense, there is still a technological barrier that has to be proven here as to whether it is feasible to get down to the cost levels that would make that technology available at a consumer level. At some point in the future that will happen, but how far into the future is still an open question.

If you ask me, ‘In 100 years time what will the network look like?’ if I had to place a bet on it—and especially as I will not be around to call it in—I would say that you could pretty well bet that the network will be universally based on that technology or some derivative of it. If you were to ask me, ‘How much of that technology will be there in five years?’ I would say that there would be very little—single digit percents, if that. Even for 10 to 15 years in the future, you have a long transition period before you start seeing that sort of technology being introduced. So there are a lot of open questions, but in terms of future direction that is definitely a route you will have to expect.

I will now switch from fixed infrastructure to wireless infrastructure and talk a bit about the wireless solutions that are either out there today or about to appear. I am afraid we are again heading into acronym soup, but let me start off with a technology which is known as LMDS. I cannot even remember what that stands for, but it is a high frequency microwave technology. It operates in the 27 or 40 gigahertz band. The spectrum in Australia has been auctioned and bought but, like in the rest of the world, its deployment here is at a relatively low level. That is for two reasons. One is that the technology requires line of sight between the exchange or base station and the customer, and in leafy suburbs that turns out to be extremely hard to achieve. We estimated that it would apply to fewer than 30 per cent of Australian suburbs. Because of that, there has never been a global standardisation. The current technology that is effectively required for this infrastructure is high-quality, military level technology and, unless you get a global economy of scale and manufacturing, you will never bring that down to consumer levels. So that technology has stagnated.

Because of that, the international industry has been working on a successor to that technology, which has been driven out of a standards organisation run by the Institute of Electronic and Electrical Engineers in New York, which is the American professional body, if you like. This is known as IEEE 802.16—as opposed to 802.11, which I will get to in a moment—and is being referred to WiMax. This is an important new development, so I will talk about it separately with another slide. I think probably most people by now are familiar with the notion of WiFi, which is a technology that has been standardised by 802.11—another committee within the same body. This is the wireless LAN, or HotSpot, technology. WiFi is designed to allow you to have a wireless tailed to a fixed network; it is not designed as a wireless network infrastructure. It has a range of roughly 50 metres and I can tell you that in my own house it gets less than about 20 metres, so it does depend on how many intervening walls and other factors you have in it. It is very much designed around enterprises making their floors wireless or homes making their environments wireless.

We have tested it as an infrastructure technology for particularly the rural environment. It could possibly operate in that environment. You can achieve up to approximately 12 kilometres of range with a substantially reduced throughput. From the nominated speed of 11 megabits per second your actual achievable throughputs are more like two or three megabits per second. As I said, you can get a range of about 12 kilometres but you do need line of sight. It only works in a line of sight environment for that type of application. I think that its deployment as an infrastructure will be very limited and somewhat niche, and it operates in an unlicensed spectrum bound, which means you cannot control other people interfering with the signal.

The other thing that has happened is that there are wireless solutions designed for mobile networks that are starting to operate at higher data speeds. The best known and most publicised is what is called 3G. It is an initiative that really arose out of Europe and Japan and is a sort of successor to GSM. It is referred to as WCDMA—or wide-band CDMA. It is a technology which offers data speeds of the order of hundreds of kilobits per second. I will talk about speeds in a moment with respect to the caveats that surround them. There is a competing technology group coming out of the United States, which has some really obscure acronyms starting with 1x. Today we deploy 1xRTT in our CDMA network, which is roughly a 100-kilobit-per-second technology.

There is a successor, which is called 1xEV-DO—standing for evolution data optimised—which will deliver of the order of a megabit per second downstream and roughly 100 kilobits per second upstream and therefore could be envisaged as an ADSL replacement technology. There is a potential successor to that, which is called 1xEV-DV—standing for data and voice—which brings voice back into the equation. That is starting to get some serious holds in various markets around the world—the 1xEV-DO at least, particularly in Korea and Japan and in the United States. There is a third group of mobile technologies emerging and today these are essentially a wild-card. Again the IEEE standards committee has been involved in these.

The group is called 802.20. It is a group that is just forming, so it will take some time before these standards emerge, but these are technologies that are optimised for Internet protocol—for the type of service you would deliver in a data environment. They have some extremely attractive features, both from a mobility perspective and from the point of view of filling in the fixed infrastructure. Going forward, one of the interesting things about wireless technology is, as everyone knows, Moore's Law, which says that the number of transistors you can put on a chip has doubled every 18 years, I think, since Gordon Moore coined the term in 1964.

Mr Pinel—It is every 18 months.

Dr Bradlow—Sorry; it is not Freudian, I promise you! The interesting thing about wireless technology is that the capacity per megahertz—in other words, per unit of frequency—has doubled every 2½ years since 1900, which is an astonishing figure in many ways, and we can foresee that same trend going into the future through things like smart antennas, mesh networks and so-called MIMO networks, which are multi-input multi-output networks. The reason is that, as computers get smarter, you can do more and more processing, and that allows you to basically fiddle about with the radio signal and get more and more steam out of that same radio signal. So we can see continuing advances in the radio technology, going forward.

But it must be recognised that there are laws of physics that you have to contend with and there are issues around the deployment of radio technology, so achieving wired equivalents is something of a challenge. There are issues like latency, which is the time for the signal to bounce back and forth. If you do not have low latency then you cannot offer services such as voice and

IP in that environment. It is a shared medium, so radio technologies work well in an environment where you have low uptake but, as soon as you start to get high levels of uptake, you start to load and stress the system beyond its capability. Spectrum availability is always going to be a limitation because, again, the laws of physics apply. Then there are issues around power limitations. Because of EME considerations, you cannot simply pump radio power into the atmosphere, and that will always limit the amount of capacity that you can put into any given radio system. So let me emphasise that radio systems, while they are very attractive for particular applications, are not a universal panacea as we go forward.

I did say I would say a few words about the so-called WiMax. This is the latest standard, which is very recent—hot off the press in the last few months—so we have yet to see any physical infrastructure or get our hands on it and test it ourselves; we have only been able to do paper based studies so far. This is a fixed broadband wireless access technology. As I have said, they have exploited the capability of computing techniques and their advances to do fancy things to the radio signals. They have also done some very important things like allowing this technology to operate in multiple frequency bands. You can operate it in lower frequencies, like 3.5 gigahertz, which means that you can achieve a non line of sight signal, so the disadvantage I mentioned of leafy suburbs is removed by that particular capability.

This technology is capable of achieving peak bit rates in the forward direction of about 63 megabits per second and upstream bit rates of between 128 kilobits per second and two megabits per second. I hasten to emphasise that that is peak bit rate and is shared amongst all users in the cell. The other thing is that it can achieve ranges of up to 15 kilometres or, if you have line of sight, up to 40 kilometres. Again, the caveat is that there is always a trade-off between speed and range—the longer the range, the lower the speed you actually achieve—and that trade-off is the subject of very complicated computer models which I am happy to go through with anyone who is interested but which are probably a bit too difficult to explain in this environment. The important thing about WiMax is that its service capability will offer broadband access capabilities that are comparable.

CHAIR—Just briefly, what are NLOS and LOS?

Dr Bradlow—NLOS is non line of sight and LOS is line of sight.

CHAIR—Thank you.

Dr Bradlow—The capabilities are effectively wire equivalent, similar to DSL. It offers quality of service support so that you can carry things like voice on these services and it also supports nomadic services for people like me who are moving around with a laptop that I might want to use to get online—for example, sitting in this room. This technology will support that. And it is rumoured although unconfirmed that Intel will be building this WiMax technology into their chips, just as today they build in WiFi technology, which means that at some point in the future one might expect all laptops to come out equipped with this technology, which will make it very attractive to nomadic users. So that is very much a case of ‘watch this space’ at the moment but it looks like a very exciting opportunity as we move forward.

From the wireless solutions, I would like to move on to satellites. While wired solutions and terrestrial wireless solutions will probably reach the vast majority of the population, there is a small percentage of the population that is going to be out of the reach of those technologies. In those cases, the only technologies that will satisfy those customers will be satellite based technologies. Today, for data services—and I am only talking about data services—we have two satellite technologies. One is the so-called one-way technology, where the downstream signal towards the user comes via the satellite and the upstream technology goes back via the telephone network or the ISDN network. That allows us to deliver roughly 400 kilobits down towards the user, which is the sort of speed that gives a broadband service. It is an effective broadband service, and it also has some other capabilities, like the ability to do multicasting or overnight loading of the users' PC so they can actually get information on demand for specific needs that they may have.

The other technology we offer is a two-way satellite service, where the upstream and downstream signals go via the satellite. Because shooting a signal up at the satellite is more expensive and more difficult than doing it via the telephone network, that, of necessity, is a more expensive technology. But it does allow the user an always on capability, so from the point of view of the user it has the look and feel, pretty much, of a cable or ADSL based solution.

Satellites have promised a lot but not delivered much to date. There have been a huge number of proposals around so-called broadband satellite solutions. Let me talk for a moment about so-called LEOs and GEOs. GEOs are geostationary earth orbit satellites. These are satellites that you plonk out at 36,000 kilometres off the equator, and it just so happens that they are fixed relative to the earth at that particular point. You can illuminate a fair proportion of the earth's surface with such a satellite. The problem with that is that there is a latency, or a turnaround delay, to shoot the signal back and forth between the earth and that satellite of the order of 300 to 500 milliseconds. That is an unavoidable requirement unless you can manage to increase the speed of light or the gravitational constant, neither of which is likely. So you have to live with that in that particular instance.

People have been attracted to the idea of putting a satellite in a much lower orbit, in this case about 1,500 kilometres above the earth. Then you would only have a 30 millisecond latency between the satellite and the earth, and that is much more comparable to a terrestrial based solution. Unfortunately, in that instance the satellite moves relative to the earth's surface, so to get continuous coverage you have to actually put a constellation of satellites up there. There have been some really interesting proposals to do constellations of satellites but they have literally never got off the ground. The reason for that is that to do a constellation of satellites you have to amortise that cost on a global market. In particular, the key market is the United States and the demand for that type of solution has just never materialised in the United States. It would be great if it did, but as things stand it has not and is unlikely to in the foreseeable future, as far as we are aware.

On the other hand, there have been a number of proposals for geostationary broadband satellites. These satellites do two things. One is that they use modern signal-processing and computing techniques to enhance the signal and can bounce signals up and down more effectively. The other thing they do is focus the signal into a so-called spot beam. The spot beam allows you to achieve a much higher throughput in that satellite signal. Unfortunately, from our perspective we would like those spots to be in very remote and obscure places, while the satellite providers want to point the spots at places like Sydney and Melbourne—which is not that much use to us. So an economically viable broadband satellite solution is still somewhat elusive, and there does not appear to be anything on the horizon as we speak that gives us a great deal of comfort that those solutions are in the very near future.

I will end off with one thing which is truly weird and wonderful, because you did ask for a 100-year view. There is a proposal called high-altitude platform stations—or HAPS, as they are known. I have a picture here—which I am afraid is a somewhat busy picture—that I took off a web site and the resolution is therefore not that great. You have a situation today where you have geostationary satellites which can illuminate big beams around the country. You have terrestrial based radio wireless systems that can illuminate spots around the country or give you coverage in populated areas. But the question is: could you actually create an intermediate solution with bigger than the terrestrial spots but smaller than the satellite spots and get that sort of high throughput?

There have been a number of proposals about putting up some sort of vehicle at about 100,000 feet or 30 kilometres. When I say some sort of vehicle, this has ranged from having planes that fly around in a continuous circle for hours and hours and then are swapped with another plane and helium balloons sitting out in the stratosphere at that speed to drones that operate off solar power. While that sounds like an extraordinary claim, apparently NASA have managed to launch such a thing. They have not proven it operationally, but it is proven to be technically feasible.

There are still some major technical challenges—for example, this thing is bouncing around in the stratosphere and you have to point a beam 30 kilometres down to earth. Of course, that beam is going to sway around like crazy on the earth’s surface, so you are going to need some very sophisticated signal processing techniques to achieve this—such as the science of how you develop those techniques and the technology of the computing environment to make that happen. One would assume that, with time and effort, those sorts of solutions will become viable. So somewhere in the longer distant future, I think you will see a wireless environment that offers all of those capabilities and it will be highly competitive with the wired environment on the ground in many ways. That is my big picture.

CHAIR—When do you run out of spectrum on something like that with wireless?

Dr Bradlow—The neat thing about these HAPS solutions is that, because they are up in the sky, you always have line of sight. There is nothing to impede you and therefore you can use those high frequencies up at the 30 to 40 gigahertz range, which today are essentially useless. There is one thing worth saying about those 30 to 40 gigahertz ranges: as I mentioned, you need complicated military technology to deliver it today, but one thing that might change that is that I believe collision avoidance systems in cars will probably operate in those spectral bounds. That will lead to the consumer level introduction of that technology over the next five to 20 years. So you may see this technology being consumerised and then you could put it up into one of these platforms.

Mr Scales—I hope that was of some help, because we were trying to anticipate what was in a number of the questions, recognising that the questions themselves, quite appropriately, showed signs of struggling to know what question to put. So we tried to some extent to anticipate what that question was and that is why we asked Hugh to do that. You might want to ask questions of us while Hugh is still here, because I do not think he is going to be here tomorrow. Unfortunately, you just have us here tomorrow.

Proceedings suspended from 4.39 p.m. to 4.52 p.m.

CHAIR—On behalf of the committee, I thank Dr Bradlow for that very interesting presentation, which has left my mind swirling with alphabet soup. I am sure I will recover eventually. I had a question regarding the second last comment in Mr Scales's original presentation which I might ask before we go to other issues. If I recall, your third last comment was basically about the issue of not expecting the same level of services right across Australia. Your second last comment was whatever we demand of Telstra we should demand of other network providers. I might be just a simple Queenslander, but as I understand it the vast bulk of the telecommunication network is provided by Telstra rather than by other networks, and the other networks are providing services off your network. Do you want to expand on the sorts of issues that you were touching on with that particular comment?

Mr Scales—Sure. By the way, I do not think there are any simple Queenslanders.

CHAIR—Thank you.

Mr Scales—The general point that we were trying to make was: it is becoming much more complex with regard to the service provider in Australia. It is true that, if one looks at the customer access network, Telstra is, for very good reasons, the prime provider and we have wholesale activities which allow people to link into that network. But even there we are not the only provider. SingTel Optus also has its own unique network, which it uses to provide various sorts of capabilities—fixed line capabilities, mobility and so on. They also buy some wholesale products from us. So with regard to fixed line products you are absolutely right. But mobility is a much more complex mix, where you have a lower cost of entry, a lower cost of exit, more players with their own networks, more players within the sector that are sharing networks and a greater opportunity to share networks between players while still maintaining competition. That was the general point that I was making.

If you go a step further and talk about data and think about some of the delivery mechanisms, that is certainly true. But with respect to ISPs, at the last count there were something like 600 or 700 individual Internet service providers. Obviously not all of them are large. In fact, most of them are quite small. But that is another blend or part of the mix. We were trying to make the relatively simple point—it is not a particularly profound point—that the network is not only Telstra. You do get these other players, depending on what the world looks like. Hugh was particularly painting an IP world. I am not suggesting this for one minute, but Microsoft, for example, sees itself as being a very big player in that IP world. There have been a whole range of scenarios that make companies like Microsoft as the central player in that revised world. It was that centre that we were really trying to alert you to.

CHAIR—Dr Bradlow, following out of your presentation, one of the issues which this committee has been really trying to play with over the course of this inquiry is how far the current network can be stretched in terms of plug-ins, add-ons and getting more capacity out of what is there before we need to move to the larger, more expensive options which I suppose are being developed. When we were in, I think, the CAN research centre in Brisbane, I was interested looking at some of the possible technologies for the expansion of ADSL beyond the current restrictions of the 3.5 kilometre rule. What is your broader view of the scope for extending the capacity or life of the current network as far out as we can in terms of those new technologies?

Dr Bradlow—There are two factors there. One is: can you squeeze ADSL harder? The answer is: yes, you certainly can. We have done some research in the labs on how much further you could take it. There is a complicated set of technical constraints which you have to live within, but there is potential to squeeze a little more out of it with current technology. They are not radical gains, but they are nevertheless potentially valuable gains. There is a new generation of technology coming onto the market called ADSL2+, which will give a bit more range and/or speed—there is always a trade-off there—and we have been investigating that. There are ways in which you might optimise the statistics of the infrastructure. This is a somewhat complicated point, but today the spectral sharing rules are done on a sort of common denominator basis and you could envisage that, with some clever modelling, you might be able to do it more efficiently. However, that has regulatory and other implications which would need to be investigated, so it is really a gleam in the eye rather than a fact as we stand. There is potential to squeeze a bit more out of the infrastructure as it stands, but I would hasten to add that we are not talking about orders of magnitude here. We are talking about percentage improvements, which I expect you will see over the next few years. Over the next one to five or six to 10 years, you will see those sorts of improvements. But let me emphasise the point I did make. If you take the end-to-end value chain content network infrastructure and access, there is a lot of life left in that access network, because ADSL and that generation of speed is probably what is going to be with us for a number of years to come.

CHAIR—I am no expert on ISDN but, looking at some of the evidence which we have received, I have to say it has been suggested that the ISDN product which is currently being rolled out by Telstra is not a particularly efficient way of delivering broadband, in terms of tying up the resource for some period of time. Do you see that as a product—even the new product that has been released—that would be there for a short period of time before the next generation of products comes through?

Dr Bradlow—I think ISDN is targeted particularly at customer groups where it is very difficult to service them with other technology and so you have to look at it in the context of those particular customers. You are right; it is a circuit switch technology, which means from a point of view of utilising network resources it is probably less than optimal. Nevertheless, the vast majority of our Internet traffic is delivered through dial-up today, which is equally wasteful in terms of network capacity.

The other thing about ISDN is we have done research on it in the labs and on the things that customers value, like the low latency that the instant connection capability ISDN delivers. In terms of that end-to-end throughput that customers are experiencing, the experience is not radically different from the ADSL generation today. People get fixated on the actual access speed—the actual bit rate that is advertised—but that is the peak rate that the line will carry; that does not reflect on the end-to-end experience, which is determined, as I said, by factors outside our network or outside our country.

CHAIR—Does Telstra measure those sorts of performances? When you hear of something advertised as 64 kilobytes per second—if that is the capacity of the line—are you able to inform customers in any reasonable way as to what actually is being delivered?

Dr Bradlow—Yes. We do measure it and we are very careful in our advertising to make sure we accurately reflect that.

Senator MACKAY—That was a really interesting presentation. Realistically, given the exigencies of the market and the emerging technological aspect, how far ahead can you plan?

Dr Bradlow—It depends. Our planning horizons are obviously determined—in an ideal world you would plan instantaneously on demand—by the lead times to introduce technology. For major infrastructure builds like a new generation of access, we look 10 years into the future. But it is a process of evaluation, decision and then planning and those flow through from 10 years in the future all the way to the present.

Senator MACKAY—Currently how far ahead have you planned?

Mr Scales—We are looking at most of those technologies now. For example, with something like EV-DO we would always look at it and ask ourselves whether it is the right technology for us to introduce today. If not today, when? If not today, when is the best time to make that evaluation? A more recent and well publicised one is 3G. We have been on the record as saying we are not going to be a first adopter of 3G but we are watching that all of the time. Clearly the announcements that have been made by Hutchison over the last day or so about their performance and so on are something that we are continually looking at and trying to understand.

But then if we think of our fixed line capability that has a different sort of planning horizon. It was implicit in the point that Hugh made that we can see that for a reasonable time—the next four, five or maybe even 10 years—copper is still going to be part of our system. So we can then, with some degree of certainty, begin to plan on how we might enhance that and what additional features we might want to try and put into the fixed line network that we think customers might want, not only now but into the future. So it does vary a bit, I must say.

Dr Bradlow—To address something specifically, we have passive optical networks in trial in our labs today. These are lab trials, so we are testing. stuff that may come in over many years time.

Mr Scales—In addition to that, if you take fibre to the home as an example, we have experimentation going on right now on fibre to the home.

Senator MACKAY—That is right. My point, and what I take from your presentation, is that things are changing and there is an element of redundancy in technology as new technologies emerge. Given that you have all sorts of different things happening in a global situation, how far ahead can you realistically plan infrastructure investment? Do you have any comments on that?

Dr Bradlow—I think that your point is valid. We are continuously reassessing our future plans anyhow, so we may be planning for a five- to ten-year horizon, but we are reassessing the validity of those plans on an annual or monthly basis, based on new input that we continuously get.

Senator MACKAY—But how can you effectively future proof for these different levels of technology when it is unclear at this point what is likely to emerge in terms of the various layers?

Dr Bradlow—It is extremely hard to future proof. You would have to be very brave to say that you could build a future-proofed network in today's environment.

Mr Scales—That is the environment which we are living with all of the time. If you ask us, 'Can you see six months out?' then the answer is yes. If you ask, 'Can you see 12 months out?' then the answer is also yes, but with a bit of greyness. However, the question 'Can you see two years out?' is becoming more difficult for us, particularly given the point that Hugh has made. There are a number of very good people doing great work in this area that are saying that in two years time we will see a huge change in the way in which the IP protocols will become an important part of any network. That is likely to happen very quickly, because—using my earlier analogy about Microsoft—while we are planning, they are planning too.

Senator MACKAY—I agree. I do not think you can. I am obviously a layperson, but the question that strikes me is how you can determine a lump of money now which will potentially future proof when you do not actually know what the future is going to look like.

Mr Scales—That is the environment. You are absolutely right—it is very difficult to do.

Dr Bradlow—We can go in certain directions though. For example, for the past 120 years the telephone network has been a circuit switch network, and I am willing to predict that for the next 100 years it will be a packet switch network. I am pretty confident about Internet protocol in that direction. But when it comes to the tactical decisions around individual technologies, it is changing rapidly and it is very hard.

Mr Scales—I think that the other element of that is people's demand. If we look back over a relatively short period of time, people were generally quite comfortable with dial-up capabilities for their narrowband. As they came to understand the power of high-speed Internet, so-called broadband, we saw this rapid desire to have it for all sorts of reasons. Some of those applications take us by surprise. We look at them and say to ourselves, 'We would never have predicted that that is something that people might demand.' We can look at it from a supply side and, comfortable in our offices, think that that is the way we might need to supply. On the demand side, that is nowhere near as predictable. The blend of those two makes it a very unclear world for us and others like us that are trying to plan for the future.

Senator MACKAY—In your opening remarks, you talked about capital expenditure. How can you plan five years ahead, for example, with respect to some of the emergent technologies that Dr Bradlow is talking about? How do you do that?

Mr Scales—When we think about our capital expenditure spend, it is divided into a number of categories. We can see relatively clearly—which is obviously germane to this inquiry—what we will need to maintain the network over the next 12 to 18 months; we can predict that. It may fluctuate up or down a bit—and I am sure that we will get into more detail about that over the next day. However, what becomes much more difficult for us to predict are the big licks of investment like we were talking about earlier with something like 3G, 2.5G, 1xRTT and so on, and whether or not that is going to be the right technology; whether demand is going to be there—if consumers will want what those technologies will deliver. That is a slightly different bucket of money—if one can describe it that way—that we might be allocating but then not allocating and being a bit more careful about. Without going into any details, we have made some decisions that have said, ‘We will go and implement technology X,’ and then two months later we have said, ‘No, we won’t.’

Senator MACKAY—I can imagine.

Mr Scales—That is going on and being reviewed all of the time.

Senator MACKAY—The issue is that this notion of future proofing that is being kicked around is not static. The future itself is not static. That is a non sequitur.

Mr Scales—That is correct—it is not static.

CHAIR—Coming back to this theme of squeezing things out of the network, I have been interested in some of the evidence which has been presented to us from various players as the committee has moved around regarding whether Telstra’s policies of pricing long-distance voice and even long-distance ISDN services on a distance basis reflect the cost and, more importantly, whether over time technologies are coming on board to reduce the cost of longer distance carriage. I was particularly interested in the evidence from Agile Communications, for example, that they are able to have a flat price for all calls regardless of distance. I wonder whether the technology is actually allowing you to reduce the costs of long-distance calls—both voice and data—even with the current network? I am not sure who that question goes to.

Mr Scales—Leave that question to me, I think. The whole issue of the appropriate pricing for a service like telecommunications is a pretty complex one. We have models going on all the time to try and help us to understand what type of return on investment might be needed for any technology given the fact that, for any service, we are enhancing that technology almost daily. We will often be putting different Internet protocols in many of those technologies, so how we price it is a very interesting and tricky issue. That is on the cost side, if you can put it that way. The second element of this is on the regulatory side. The regulator is often a bit concerned about how aggressively we price, as our competitors are very concerned about how aggressively we price. That is another set of issues.

A third set of issues is around to what extent you want—as you do with most goods and services—to send a signal about usage. For example, take data and compare that to, for example, local calls. There is no doubt that, as we know, we are priced in Australia for an untimed local call. But I think most people who have looked at this—and we are not arguing for any change in this, by the way; far from it, but I am trying to get to the heart of your question—recognise that an untimed local call means you can get overuse of a system and then have to have overinvestment in a system. You then have to ask a public policy question that overrides that and asks: if you do not want to have overinvestment for a whole range of reasons and because of overuse, what might be the right pricing mechanisms that you have to put in place? I think it is all of those elements that we are trying to always manage and blend when we think about our pricing approach.

CHAIR—I know we will get into these areas when we start with the more specific questions, but whilst we have Dr Bradlow here I was trying to work out whether there is a technological element of these. The other part of that pricing issue was—

Mr Scales—To give completeness I should say that, in talking about, for example, voice-over IP, Hugh, you might want to just talk about the broad economics and the technology of that because to some extent it does go to the heart of the point you are making.

Dr Bradlow—I think one key issue is that, if you look back 20 years, the cost of transmission was a dominant element of the cost of delivering a long-distance telephone call. In today's environment, of course, the cost of transmission has fallen dramatically due to advances in fibre optics. The elements that probably tend to have a bigger influence on cost are the interconnection arrangements and pairing and all the other issues that go into making sure that a call gets delivered from one point to another. There is no question that the economics of a call have changed as a result of the change in the underlying technologies, but that does not mean those costs disappear entirely.

Mr Mullane—I think it is worth noting that there is a huge existing investment in long-haul transmission in Australia. There are 5,100 exchanges which all have transmission connections back to other points of the network. That investment, if you like, is depreciating over time and that depreciation appears as a cost that has to be covered off. There is a huge base of cost there in the transmission system. The new systems that go in are cheaper, so over future years those costs will continue to fall. They fall faster on the thick routes than the thin routes because there is a greater traffic capacity which you can amortise it across. But there are some fundamental economics that you cannot ignore there.

CHAIR—The economics of broadband fascinate me. I know we are going to conduct a separate inquiry into that subject so I will leave most of that until later. It is an issue I will return to again and again when we conduct that inquiry. Because we started using broadband a bit late in this country—two to three years behind other countries—are costs reducing for the provision of broadband such that Telstra would be in a position to start reviewing the download and upload limits and things like that at some point?

Mr Mullane—We do review prices from time to time and we have had some downward movement on megabyte charges once customers exceed their plan usage. My expectation would be that that direction will continue, not cease. There are three major components of the cost of the transmission. Firstly, there is the international piece. Secondly, there are the backhaul pieces of the transmission, if you like, which I referred to before in relation to getting out to all those exchanges. Thirdly, in just the DSL broadband network we have something approaching 1,000 exchanges now, every one of which has multimegabit-per-second links connecting them, generally back to a nodal point for the Internet network. More than half of those exchanges are not in metropolitan areas, so there is a huge transmission investment in the DSL network. Also, that investment tends to be shared by some of our other business data type networks. Then you have the access network, which Hugh really focused on in his presentation.

The sorts of changes we expect in the future need to cover off all of those components. Right now we are at a point very close to the completion of a tender for new ADSL multiplexer equipment. I am expecting the results of that to be announced publicly soon. As an outcome of that, we expect that the cost of the ADSL multiplexer equipment we purchase from here on will decline, but it is just one component of the total cost. The cost of the transmission and all the costs that go into housing and powering the ADSL equipment are all there. The cost of the customer equipment is there. There are lots of cost pools in broadband networks.

Dr Bradlow—I might point out that other carriers have download limits as well. For example, Bell Canada have them, and for exactly the same reasons as us: 2½ per cent of the users generate 50 per cent of the traffic. So there is this sort of tragedy of the commons where the greediest 2½ per cent degrade the performance for the rest of the population.

CHAIR—My final question, at least in this area, relates to wireless technology. Again I am interested in the notion of spectrum and when we actually run out of spectrum, particularly in places like Sydney or Melbourne, and whether that is a significant limitation in respect of the further development of the various wireless technologies and what that may mean for the rationing of spectrum or whatever.

Dr Bradlow—You can always trade off the use of spectrum against infrastructures. One of the fundamental things that has driven that improvement in the use of spectrum that I mentioned over the last 100 years is frequency reuse, which means effectively cellular technology and being able to reuse the same spectrum over and over. If you run out of spectrum, you have to put in more base stations in order to reuse that frequency more often and, of course, that has attendant problems of its own. The limitation is more on the ability to deploy base stations and the cost of doing that than necessarily the spectrum itself. Of course, if there were more spectrum available, you would not have to have that same imperative.

CHAIR—Because I do not quite understand this issue, could you explain to me, if we go down the wireless route of expanding user spectrum and wireless, at what point radiation issues come into play as a concern generally.

Dr Bradlow—We have an active research program on electromagnetic emissions which is ongoing. We investigate each new radio infrastructure deployment in detail. We ensure that the actual measurements of the radio signal are accurate, and then we rely on the advice of experts such as the World Health Organisation, which monitor the bioscience of EME. The advice is that there are no known effects at the levels within the standards to date, but we continuously monitor that. We check each new technology as it is brought in. We have no reason for concern about anything we have observed; nor have we been advised of any concern.

Senator MACKAY—I have a couple of final questions for Dr Bradlow as he is not going to be here tomorrow, and we can then progress to the other questions. Dr Bradlow, given the increasing homogeny of, for example, the European Union, where you have more generalist regulations et cetera emerging, have you done any work on the technological impact that that is likely to have on the EU as a trading bloc and therefore impact on where we go technologically? You talked about Canada and the US; I was wondering whether you have looked at the EU at all.

Dr Bradlow—There are two good examples of that. The first is GSM, which effectively was a European wide initiative of exactly the nature you described and was an enormous success obviously. This had a huge impact on our mobile networks and those of another 168-odd countries. But then there is 3G, which is exactly the same initiative repeated, but it looks far less promising, as we stand today. Yes, it will have that sort of impact, but it is one of these things where you have to be extremely careful because a regulatory driven imperative is not necessarily something that customers want. Going back to what Bill was saying earlier, the markets spring all sorts of surprises in terms of what people will and will not do with it.

Senator MACKAY—That is right. What I am getting at is that, in terms of your 100-year overview, at some point in the development of various technologies there has to be a level of cooperation between governments on the one hand and telcos on the other hand, otherwise nobody is going to bother putting that level of investment in, unless they get something out of it.

Dr Bradlow—The problem is that basically three major economic entities are trying to juggle for position: the Americans, the Europeans and the Japanese. In a sense, we will have to adopt the standards that emerge from one of those major groups. In the case of wireless, for example, we have adopted standards from two of those major groups. They are always going to be seeking a commercial imperative for their own industries. We just do not have the scale to play of that nature, so inevitably we are going to be driven in terms of economies of scale by one of those three major groups.

Senator MACKAY—That is right. For the Europeans, as I said, the regulatory regime is becoming flatter and flatter as the years go by. I am not quite sure how much you can look at that and then determine what the future is going to look like. Am I making any sense?

Dr Bradlow—You are. You can take a guess at it, but it will be a dangerous guess. Looking back at some of the standards that went round ISDN, they were very much driven by the Europeans. They were almost driven on a global scale, and we ended up with something that it took years and years for the market to accept, because they put too much technology in for 10 to 15 years ago. It is great for now, but it was not so great 10 or 15 years ago. You have to be very careful in how you match those pan-European style initiatives against the needs of Australian consumers. They do not necessarily have a good fit.

Mr Scales—I think there are also levels of this regulatory story. There is the technical regulation and technical standards. The point that Hugh made is absolutely right and is almost made self-evident by the very size of this nation. However, we can do things at the margin. For example, we have been suggesting to some of our colleagues in New Zealand that we ought to get a degree of synergy between a number of our standards and regulations across the Tasman. That would make good sense for all of us.

Senator MACKAY—Our own little free trade agreement.

Mr Scales—It could well be.

Senator MACKAY—A tiny, incey-wincey one.

Mr Scales—You can do things at the margins. Similarly, we have a very respected seat at the table in lots of these discussions. One of the important roles that TRL plays is to ensure that we have the technical capability to have a seat at the table. Whether it is around issues to do with international allocation of spectrum or some of the more technical standards that Hugh has been talking about, we are able to play in that space and, because of our capability and experience in this country, make a contribution even on that international stage. Clearly, it is not as great as that made by the Japanese or those from the United States or continental Europe, but it is still there.

Then there is another layer, which you might call broad economic regulation. There we are learning as a nation about what does and does not work by watching what goes on in the US and seeing some of the impediments that are created by what is a somewhat convoluted and confused regulatory framework, as distinct from what we might see in some parts of Europe where there is more understanding about how to think about broadly based competition policy and how it applies. I think there are a number of levels of that.

Senator MACKAY—Yet it is contended that in Europe it is becoming increasingly anticompetitive because of the increasing size of that trading bloc, with another 10 countries or so coming into the European Union.

Mr Scales—Anticompetitive in what way?

Senator MACKAY—In that it is potentially monopolistic.

Mr Scales—It looks to us from this distance—and you might be able to comment more than us—like a highly competitive market, when we see the number of players operating in that market. Some of them are very powerful and large. Think about Vodafone.

Senator MACKAY—But there is a flattening regulatory regime occurring, from a government perspective. That is what I am getting at.

Mr Scales—I want to go on to one other point that you raised earlier about high-speed Internet capability, pricing and so on. There are two elements to that pricing discussion. One is what from a consumer perspective you might almost describe as the fixed cost of entering that particular market. Those prices are going down quite rapidly. When we looked at the take-up of, particularly, broadband or ADSL, one of the things we observed was that people were saying, ‘It costs us a lot to get into this market.’ Hence, we have introduced the ability for people to self-install, which brings some of those up-front fixed costs down quite considerably. That may not of itself seem to be particularly relevant, but we are finding that it is. That is encouraging more people to move into that market. So there are a number of levels of the cost story here in addition to just the cost related to the infrastructure that one puts in place and the normal variable, or operating, costs that go with simply providing that service. Our expectation is that the cost of entry is likely to decline, probably quite rapidly, as we learn a bit more about it and as consumers become much more comfortable about self-installation and so on.

Mr Rix—If I could add a little bit onto that: what we then attempt to do through the use of technology, and I think the Internet assistance program has been a success in that, is instead of having somebody go out and deliver these types of services, we have continued now to build helpdesks to support the advancing technology. So customers not only come in via voice these days; they obviously come in and are able to use the Internet, check out their own speeds or look at their own internal cabling, wiring or modems et cetera. They are the types of programs that we are building behind the scenes as opposed to the old days of just a fixed cost for every line. So the support mechanisms are helping us lower our cost structures with regards to that.

Senator TCHEN—Dr Bradlow, earlier when the chair discussed with you the possible radiation effect in the increasing number of base stations to overcome the crowding of a frequency spectrum, you said Telstra is continuing to monitor the standards being adopted internationally. This committee actually carried out inquiries about two years ago into potential radiation effects. At that time, the evidence given to us, in summary, was that there seemed to be no ill effect, and the committee so found. But during the inquiry we heard that at that time Telstra was sponsoring some research into the radiation impact on some biological specimens. Can you tell the committee whether Telstra is still continuing to sponsor or carry out this type of research?

Dr Bradlow—Yes. Let me just clarify, though. We do not carry out research on the biological aspects. We work with partners to do that because we do not have the biological expertise. Our expertise is in terms of the actual radio waves, how they penetrate and so on. We have just been successful in joining a consortium that is going to be established as a centre of expertise by the NHMRC on EME issues. We are supporting part of that activity, and we continue to sponsor various forms of research of that nature—working in partnership with research organisations is probably a better way of describing it, where we help them construct the experiments in terms of the actual radiation characteristics and then they do the biological assessment independently of us. In fact, the study you were referring to was a follow-on study from the so-called Adelaide mice experiment which found that the two groups were actually no different in the sense that it refuted the results of the previous study.

Senator TCHEN—Have you found any significant outcomes out of your continuing association with this type of research?

Dr Bradlow—No. We still have not received any advice or seen any studies that we believe would indicate that there is a change in that position.

Senator TCHEN—Thank you.

Mr Scales—Maybe I should add one other point, and Hugh may want to jump in on this one as well. The board is very concerned about this issue because it is a serious issue for Telstra, to make sure that we understand where the research is going in this area. In fact, there is a board subcommittee that monitors this on a regular basis at the board level because we see this as being a very important issue for general governance—and Hugh is involved in that, of course.

Dr Bradlow—As we explained actually to that Senate inquiry, we have a structure which monitors EME issues. It has senior management and board level membership at the top level to oversee the process and to make sure that if there are any implications they are visible at the top level of the company.

Senator TCHEN—I have an associated question related to mobile base stations, which is actually on a different issue. During this inquiry the committee has received various submissions complaining about mobile phone coverage. However, we have also heard in other evidence that there are all sorts of town planning and other legal obstacles involved in the establishment of mobile phone towers. Has this conflict in community expectation had any impact on the operational capabilities of Telstra and the other providers?

Mr Scales—I think you highlight a very difficult dilemma for us and other companies that are involved in providing mobile services. There is no doubt that there is an increasing demand for high quality mobile coverage, and we are doing our best to provide that. On the other hand, it is also true to say that local communities have been quite concerned and very vocal about whether companies like Telstra and others can put up mobile towers, and we do find it difficult to meet both demands.

We do have, as you would probably know—and when I say 'we' I mean the community—means by which we try and resolve these conflicts. For us, the conflict at first might be the local government area, and now there is a well defined set of protocols around how we work with local government to resolve these disputes. It might be, for example, having a mobile phone tower not where we wanted it but where the local government might prefer it to be, so we might be wanting to shift those around. But even when we get through that process, we often get the community saying, 'It's all very good for local government to agree to that. We won't agree with what the local government agreed to.' Then we go to another stage of disputation and concern. I think it is fair to say that, in some parts of Australia, the provision of mobile coverage can be delayed by months, if not years, as a result of that. So we do find this dilemma, and I know some of my colleagues have had experience with that. Don, do you want to make any comment on that?

Mr Pinel—We generally end up in agreement with the local authority about what they see the community needs and what we need to do to provide the service. As Bill says, elements of the community are still unhappy about the proposal. That consultation with the community at the lower level can become quite drawn out and contentious, and in a very small number of cases it can actually prevent us and other carriers from proceeding. The number of cases where that happens is extremely small—I could count them on less than one hand.

We strive to work as closely as we can with the representatives of the community—that is, the local council—and with the members of the community to make sure we get as much information to them about things such as EME. It is a real community concern and we try to educate and inform with the best information that we have available from the resources that Hugh has access to. We also work on other aspects of community amenity and lifestyle too. Some people just do not want mobile phones in their community for various reasons. These conflicts become extremely contentious within some communities, and really it needs the community to resolve those with us acting as, if you like, an honest broker to try to put the issues on the table and reach some resolution. But, as I say, in a very small number of cases both us and our competitors struggle to reach a resolution.

Dr Bradlow—Can I just make a comment about our process, because it is actually world leading. We have developed a piece of software to give the community a complete understanding of the levels of radiation they will experience as a result of a base station deployment relative to what they had previously. That software has been adopted all over the world now by other carriers who have adopted our process because they recognise that that sort of transparent process in dealing with the community has been an important way of overcoming some of the inhibitions regarding base station deployment.

CHAIR—I have some quick questions about the Telstra research laboratories generally, and I am not sure whether it goes to Mr Scales or Dr Bradlow. What is the financial commitment that

Telstra is making to research now? How does that compare with three, five or even 10 years ago? What is the expectation for that commitment into the future?

Senator MACKAY—I was just going to ask that question.

CHAIR—Do you have better wording for it?

Senator MACKAY—No. I was going to say, ‘What is Telstra’s R&D budget?’

Mr Scales—It is an important question. Hugh can give you the exact details of the budget; my recollection is that it is around $150 million for the research lab itself. But maybe I can answer that question more broadly than that. We have come to understand that we need to be involved in the latest research around the world in this area. If we were to try to cover every area of research, as you have seen from Hugh’s presentation today, we could not do it if we had 3,000 researchers. Our strategy is to try to create, to use a nice Marxist word, a cadre of very valuable and capable people who we think are the very best in their field in Australia, who not only can understand in detail what is going on in the world at large but are so respected, to use that word I used earlier, that they have a seat at the international table where research is happening. We need people who can do that for a start, so a group of people in Hugh’s area are involved in simply understanding, monitoring and being a part of the international debate, and that can be issues that are immediate and it can be issues that are 10 and 15 years down the track.

We have a second very important role for Telstra research. It even, to some extent, goes to the heart of some of the questions that you were asking of Margaret Portelli earlier—that is, we have some quite specific requirements here in Australia that may not be necessarily the requirements elsewhere. For example, the research lab does quite a bit of work in the disability area to try to make sure that we can in fact introduce new products and modify existing products, but it makes sure that we can do so while meeting a range of standards. That is a range of work. Another range of work is about the almost immediate application of technology to meet customers’ needs.

Another bunch of work almost goes to the heart of saying, ‘How do we understand what customers need?’ In fact, Hugh’s people are probably some of the best when it comes to what we describe as ‘data mining’, which is getting whole bunches of data. Imagine, we put out 100 million accounts every year; we have 10 million lines, as we were talking about earlier; and we have literally six million customers, with all their needs. We need to try to understand from that what that is telling us about their needs. Hugh’s group has created just data mining—mathematical modelling and so on. So we have a strong commitment to it, but it is a commitment that goes broader than the research labs themselves. It is not only that; it is about how we work with universities; it is how we work with other research laboratories around the world; it is how we link also with our suppliers. Nortel and we often go hand in glove when looking at what might be issues that affect both of us. Hugh, you might want to take that up.

Dr Bradlow—Just to address your particular question about actual budgets, Telstra’s research budgets over the last few years—or certainly the years that I have had visibility over, which is the last five to eight years—have fluctuated between $160 million and $230 million, or thereabouts. The fluctuation is actually determined by what projects are on the go at the time, so there is no particular correlation that I have been able to discern with time. About three-quarters of that budget is spent outside TRL itself. As I showed you in one slide, both research and development are going on within the Telstra technology group and then, as Bill has pointed out, we have activities with suppliers and other research agencies, like universities. About one-quarter is spent within TRL and then the other three-quarters would be spent on the development of large projects that are on the go. As I said, it fluctuates according to what those projects are. We have had some big lumps—for example, during the time we were working on the JORN project. That was a big lump of money, and then we innovated that project and it became a lesser sum. Then we had another big project that came through and it went up. So it is very hard to draw a correlation.

Senator MACKAY—Does Telstra have any formal commercial arrangements with other telcos with respect to R&D? Presumably you do not sit in splendid isolation, as you say.

Dr Bradlow—No. The only thing we do is participate in that international benchmarking consortium. From an R&D perspective, that is the only formal arrangement I can think of. I would have to give that some thought, but I cannot think of any off the cuff.

Mr Scales—We often get the benefits of research and development through our suppliers. Suppliers often come to us and say, ‘We’ve done this piece of research, we’ve applied it in this piece of technology and we think it might be of use to you.’ So we get it from that direction. But I am not sure that we do have any arrangements; I cannot think of any at the moment.

Dr Bradlow—We have many informal links that I can think of, but I cannot think of where we have actually signed an agreement to say, ‘We are going to collaborate on this.’ I just cannot think offhand.

Senator MACKAY—I wonder why not. There just has not been the need?

Mr Scales—I think you have asked a really important question. It is partly to do with the way in which the industry has developed and changed over the last 15 years. Take the point you made about Europe. Until quite recently, most of the European telecommunications companies were primarily government owned. They operated in relative isolation. If you look at the US, you see there has been quite a significant change in the structure in the US with the break-up of telecommunications and, as Hugh was talking about earlier, the various baby Bells that are now all round the place. It is now maturing in a way which we may not have seen over the previous decade, and we may get a lot more collaboration.

We work with other telecommunication companies on some of the soft sciences. We are always exchanging ideas about, for example, how to organise structure, what HR systems look like and the extent of contracting in or contracting out. We try to understand those things, and we have quite elaborate relationships with companies like Eriksson and other components suppliers, on the one hand, and people like Vorizon and others, on the other. There are different levels of collaboration. I think it is just a stage in the historical development of the sector.

Senator MACKAY—But what about the fact that commercialisation has already occurred? Compare Telstra and BT. Commercialisation in Telstra occurred a lot earlier. Does that stop a collaborative commercial arrangement between telcos?

Mr Scales—No, it does not. I am not, quite frankly, trying to say that I know the answer. I am really trying to think through what some of the reasons might be.

Dr Bradlow—We do certainly talk to them about it, but we have never had an agreement take off in my time at Telstra that I can recall. One of the things that has changed is that in the precompetitive era a lot of those collaborations were done through the standards bodies. In the competitive era, all sorts of other factors came into play. As Bill says, there are not necessarily inhibitors as to why we should not do it. It just has not happened.

Mr Scales—One of my colleagues has passed me a note. They are very nervous about something I said. I know that it would not have been misinterpreted, but Senator Mackay raised the issue of future proofing earlier. My colleagues were concerned—and I know she would not have been doing this—that Senator Mackay was putting that in the political context of the more contemporary and somewhat jargonistic view that there is around future proofing in Australia. Of course, we were not talking about that when we were talking about what Dr Bradlow was speaking about. I am sure that Senator Mackay was really asking us that question in its broadest sense. Senator Mackay, I interpreted you as saying: to what extent can you be sure of what the future looks like? That is as distinct from saying: can you ensure that the network will work well?

Senator MACKAY—Yes and no, actually. We might explore that a bit tomorrow. The whole notion of how you can future proof when the future is not static is utterly germane to the debate we are about to have, I think.

Mr Scales—That is fine. I am quite comfortable about answering that in that context.

Senator MACKAY—I understand.

Mr Scales—I did not want to mislead the committee into thinking that I was answering a particular question in a political context when I was really answering it in a much broader, technical context. I am sorry if I have in any way misled you on that.

Senator MACKAY—No, that is fair enough.

CHAIR—That is fine. That completes our questions on the big picture and the middle-sized picture—

Senator MACKAY—Tomorrow is for the nitty-gritty.

CHAIR—at which point we will get to the very small picture tomorrow.

Committee adjourned at 5.50 p.m.