Suggestions for the FTTN – National Broadband Network for Australia

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1 Executive Summary

The outcomes specified for the transformation of the communications industry by the Ministry are clear and simple, offering an opportunity to the Communications Networked IT Services industry to respond with innovative approaches to meet the objectives.

BT has worked in close collaboration with Ofcom the UK regulator and the Industry in UK to create the Openreach organization - whose primary purpose is to provide a national **open access** network. Since then BT has advised and assisted other regulators round the world on open access and functional separation issues and projects such as the functional separation in New Zealand, and the Singapore Government's iN2015 NGNBN project. The following suggested approach borrows heavily from our experience in the UK but specifically relates and is tailored to the Australian Government's requirements and the prevailing circumstances in Australia.

Some of the key factors for the success for this industry transformation project are:

a) Simplicity of governance and the creation of a single NBN infrastructure for all of Australia

b) Infrastructure built in anticipation of future demand as a national initiative.

c) Creation of an open access platform with a business model based on equivalence of access

d) Creation of an entity that is structurally or operationally separate from the incumbent carriers to operate the NBN infrastructure

e) Separation and independence to be accompanied by mandatory compliance with rules supported by a strict governance process to ensure adherence.

f) Treatment of the common communications infrastructure as a national asset while re-using existing infrastructure to reduce the cost to the tax-payer thus avoiding unnecessary civil construction

g) Monitoring the incumbent carriers and implementing regulatory measures so as to prevent anti-competitive actions by non NBN companies that would put the project at risk

h) Creation of a nationwide IT transformation programme to drive adoption of the project by the industry and government bodies together with an increased demand for high-speed services to reduce operational costs, encourage timely innovation and improve customer/citizen satisfaction index

i) Creation of a dedicated programme management office with industry professionals who have been involved in implementing/delivering open access/equivalence business operations

It is recommended that the Ministry and the Department of Broadband Communications and Digital Economy meet with key executives of companies running similar businesses around the world to get a better understanding of the challenges and possibilities.

BT is happy to host the Ministry and the DBC&DE executives in the UK for an information sharing workshop to understand BT's own experience in greater detail.

2 Introduction

The purpose of this paper is to provide input to the Minister's Panel of Experts as they prepare a request for proposal for the implementation of National Broadband Network (NBN). British Telecommunications Plc (BT) provides this input by drawing on BT's own experience in the creation of open access in the UK, and other engagements around the world, such as the Singapore Government's IN2015 project.

The Australian Government has concluded that Australia's broadband competitiveness must be addressed by a Government intervention, and has proposed investing up to $4.7bn in a National Broadband Network (NBN).

We understand that a new organization will be created to construct and operate the NBN through a competitive assessment process and with government involvement in the management of the company.

Key elements to enable the vision of a NBN for Australia include:

- It must be available on an open access basis, so as to ensure a firm basis for competition in broadband communications going forwards;
- It must avoid a digital divide in Australia, by reaching 98% of the population with speeds of at least 12 MB/s, at a price affordable to end-users;
- It must be constructed quickly (within 5 years) so as to maximise the benefits of the new infrastructure;
- It must offer an acceptable return on investment to its investors, including Government.

The commercial, competitive and regulatory structure established for the NBN will not only determine the success of the project, but will have a profound effect on the communications industry in Australia, with the potential to establish a framework for competition and innovation in next generation IT services.

BT appreciates the opportunity to present this paper to the National Broadband Panel of Experts, in response to its call for submissions to assist in its preparation of Request for Proposals documentation. The paper sets out a number of issues which BT believes it is crucial to address to ensure the success of the NBN project.

3 Critical Success Factors for the Australian NBN

The success of the NBN will be defined by rapid take-up, enabled by affordable, ubiquitous access, sustainability of the network and a high level of use. A viable commercial model, supported by an appropriate regulatory structure, is critical to success.

In particular, the model needs to address:

- whether and how to incorporate existing incumbent infrastructure into the NBN;
- how to ensure that use of the NBN is maximised to enable adequate return;
- the appropriate pricing model for services provided over the NBN; and
- How to ensure that the incumbent has neither the incentive nor the opportunity to undermine the commercial success of the NBN.

3.1 Delivering Open Access

The proposed NBN will consist of fibre infrastructure to nodes located in street cabinets, from where access will be provided over the existing copper/wireless broadband access network (or in the future, over other access technologies) to the customer premises.

In order to avoid the inefficient duplication of network infrastructure, the new network should incorporate existing assets of Telstra in the local access network, where possible.

There are a number of examples of publicly-funded, regional or metropolitan next generation access networks where the creation of open access is seen as crucial. However national projects to provide the same are relatively rare given the greater costs of ubiquitous delivery suitable for both rural and urban areas. Whilst Singapore's IN2015 is one of the first such projects, the island is a city state and therefore less challenging.

Experience from these projects suggests that there are several viable business models. These depend on local circumstances and can range from new competitors, supported by the Government, such as in Amsterdam, to regulated monopolies, such as the NetCo in IN2015.

In all cases the objective is the same – ubiquitous, affordable, fast broadband ensuring vibrant competition at the services layer and choice for end users. Underpinning this desire is the need for open access and the separation of the network provider from the retail service provider (RSP). BT has tremendous experience gained over a long period of time in both functional and structural separation models (see further below).

Open access can be delivered either by 'functional separation' (imposing an obligation of "equivalence" on a vertically integrated network provider to ensure all RSPs, including its own downstream business, are treated equally) or by 'structural' separation (the creation of separate companies with ownership controls, which prevent RSPs, including the incumbent's downstream businesses from having effective control in the NBN infrastructure). In each case, the aim is to avoid circumstances where the opportunity exists to take advantage of ownership of the underlying infrastructure to favour downstream business, thus removing significantly, both opportunity and incentive for anti-competitive behaviour or practice.

In the UK, BT has pioneered a functional separation model, where a form of open access is delivered under a tightly regulated regime of separation of BT's upstream and downstream lines of business acting under a principle of "Equivalence of Input". Equivalence of Input ensures that the same product is delivered to all RSPs on the same timescales, terms and conditions

(including price), and by means of the same systems and processes. BT, with Ofcom, has developed processes and systems to support equivalence and open access, including independent monitoring, information sharing restrictions, incentive structures, codes of practice, and equivalent systems platforms, which are now being imitated in other jurisdictions.

Whatever structure is adopted, the result for Australia would be the creation of an organisation fulfilling a similar role to Openreach in the UK: providing equivalent access to service providers over a strategic national asset, to ensure a vibrant and competitive downstream market.

The proposal above will allow a variety of RSPs to compete vigorously to deliver a range of broadband and broadband based services at affordable prices, to the advantage of the Australian consumer and economy. A number of RSPs competing on equal terms will maximise the use of the new network, increase the number of customers connected to it, and thus optimise the commercial return for NBN, and reduce the payback period on the network investment.

Operators such as Telstra/Optus/AAPT etc would compete as RSPs alongside other providers, buying access from the NBN to serve its end user customers.

3.2 Ensuring Financial Stability

There are a number of examples where investment in NGN, NGA or open access networks has failed to achieve commercial success. Based on experiences, and lessons from other projects of which BT is aware, it is recommended that the thinking of the Government should also address the following points to deliver a sustainable and financially successful outcome.

There are numerous models for funding such a project with differential risk/reward constructs which affect viability and overall cost. At the most extreme level, the Government can take on the entire risk of the project by guaranteeing returns. Whilst this will allow for very low interest credit, lowest cost to build and likely the cheapest solution, the high risks entailed may make such a structure unfeasible. Alternatively the Government may opt for simple fixed sum subsidy which will lessen the cost but ensure the bulk of the risk remains with the operator. Other methods of ensuring financial viability are Government sponsored campaigns to drive end users onto the network, possibly including vouchers, tax incentives and even delivery of anchor tenants.

The most expedient way forward in support of the Australian Government's aims may be to structure the financial arrangements to include a combination of the above, with all parties having some skin in the game, including the Government, which must take an active role in ensuring long term success. To ensure the most advantageous proposals and to allow ease of comparison, it is crucial that the RFP spell out the Government's intentions in the area of financial structure, including the means of funding operations going forward together with the regulatory framework which will apply.

3.2.1 Anchor Tenancy

The creation of the NBN should also help the Government deliver cost savings to the various government departments and ministries. A portion of the $4.7Billion that the government intends to invest would be returned by way of reduced costs in the national budget.

This could be achieved by Government agreeing to become an Anchor Tenant of the NBN. This could also help to reduce the retention times on costly, low performance legacy networks (ie; the time lapse prior to customers migrating to the next generation infrastructure) by increasing end user confidence in continuity, and thus increasing the attractiveness for investment in the project by the NBN operating companies.

Government can play a critical role in this through migration of traffic from public institutions such as schools and hospitals onto the new network. Migration to the new network will benefit public sector organisations through access to enhanced, cost-effective infrastructure and the ability to share services, providing enhanced e-services for their customers (e.g. e-access portals for public services, e-enabled health and education services etc).

This could have the potential to significantly de-risk investment in the NBN and accelerating the financial and socio-economic benefits of the project.

3.2.2 Effective and Rapid Access to New Applications and Services

BT believes that in parallel with the significant investment in new infrastructure it is of paramount importance that there must be a programme to stimulate demand for bandwidth through new services and applications. Examples of such applications and services include:

- Full service applications such as IPTV, Video on Demand (VoD), and Voice over IP (VOIP)
- Applications building blocks – capabilities used by service providers to build their services e.g. storage, session control etcetera.
- Applications enablers e.g. IMS, a network technology which underpins Convergence of Fixed and Mobile networks

Such services could be provided economically through the NBN infrastructure provider itself if costs are spread across many service providers, reducing cost and barriers to enter the market for new service providers.

3.2.3 Treatment of Legacy Infrastructure

A key driver for Government and potential bidders will be the ability of all parties to attract investment and deliver reasonable returns against such investment. From past experience the following factors are considered critical to the investment community who are interested in projects of this nature and will therefore improve the “bankability” of the Project to the financial and investment communities:

- Making use of existing legacy infrastructure where appropriate
- Avoiding duplication, thereby reducing cost to consumers and the extent of subsidy required
- Reducing the ability of the incumbent to compete unfairly
- The value of reusable legacy network to the incumbent needs to be recognised and accounted or compensated for

We recognise that the Government of Australia already acknowledges the need for re-use of existing incumbent legacy network assets. The extent and approach to accessing existing incumbent legacy network assets, needs to be made clear in the RFP.

3.3 Regulation

Regulation of the market – its form and function – will be critical to the success of the both the bid, implementation, and operation of the NBN, and also all other aspects of the telecommunications market in the future. We understand that the Government acknowledges the central role of regulation and intends to undertake a full review of the telecommunications regulatory regime

along side of the assessment of bids. BT supports this approach and concurs with the view that a review of the existing Australian telecommunications regulatory regime is timely: this would be the first comprehensive review the regime will have been subjected to since its enactment in its current form in 1997.

3.3.1 Regulating NBN for dominance

The new NBN infrastructure would create new upstream and downstream suppliers of broadband services which may be dominant. Strong regulation and obligations of equivalence are required covering pricing and non-pricing behaviours with appropriate legally binding sanctions and suitable incentives driving performance for rollout, efficiency and innovation, if the supplier is designated as dominant. In determining the position of dominance it is assumed that a proper market review of broadband service providers (including wireless) will be undertaken using competition law principles.

3.3.2 Independent NBN operating entity

Given the probable participation of the incumbent in NBN (re-use of existing infrastructure) and Retail Service Provider layers (dominant ownership of existing customers), it is appropriate that restrictions on involvement across these layers are implemented.

With BT's experience of having implemented the structures, systems and methodologies to deliver the UK objectives of equivalence, BT believes that there are certain obligations that only an independent entity can be entrusted with to deliver the objectives of the project and therefore, notwithstanding assets which are re-used, the operations of the NBN must be run by an independent party.

In our view arrangements to ensure such independence must be put in place, whether structural separation through ownership restrictions, or a requirement to ensure equality of access to all RSPs regardless of ownership and shareholding.

3.3.3 General comments on improving the existing regulatory regime

One of the key principles of the Australian telecommunications regulatory regime is that parties should be encouraged to negotiate commercially and only after a failure in negotiations, should one of the parties then be in a position to seek the regulator's intervention through a bilateral arbitration – the so called "negotiate/arbitrate model". There are few modern regulatory regimes that rely on the negotiate/arbitrate model. New Zealand's Telecommunications Act 2001 was also premised on the negotiate/arbitrate model. After experiencing this approach for the first four or so years, a government review of the practice acknowledged the futility of negotiations where one of the parties had SMP and the inefficiency of multiple bilateral arbitrations and recommended change. Amendments were enacted in 2007 that included a more directed undertakings approach where the regulator could require an SMP supplier to provide undertakings that are then finally determined by the regulator through a public consultation process. This is a process very similar to the reference interconnect offer (RIO) model much used in Europe and many other jurisdictions.

BT recommends the consideration of such changes to the existing regulatory regime, given the significant backlog of arbitrations before the ACCC and long delay and ensuing uncertainty that the negotiate/arbitrate model inflicts on the market. It would be helpful if the RFP spelt out the scope of regulatory reform to be considered and that this scope should be sufficiently wide to

ensure it addressed all significant aspects of the current regulatory regime, especially those which may impact on the risks and reward envisaged in respect of the Government's proposals.

3.4 Role of Incumbent

A number of countries around the world have embarked on next generation information and telecommunications infrastructure projects which are designed to deliver significant social and economic benefit to the citizens of that country.

For such projects to be successful, they must be embraced positively by the existing operators/marketplace, including dominant and non-dominant incumbents. The current and future role of the incumbent in any future, changed marketplace is critical to the success of such projects. Incumbents may see the projects as a threat to their livelihood, and be inclined to devote significant resources to price and non-price activities directed against the perceived threat.

If the incumbent retains separate assets in the network domain where the NBN entity operates, it would be incentivised to work against the NBN. In that case, it may be appropriate to consider a form of functional separation of the incumbent, following the precedent established in the UK and now New Zealand.

BT believes that the success of the UK model of functional separation is demonstrated through the market outcomes which have been achieved in the UK, including;

- increased competition in the Retail Service Provider sector,
- lower prices, and
- An increase in the range of services available to consumers.

For BT (as a national incumbent), it has also created regulatory and competitive certainty as a basis for investment decisions, enabling new strategic initiatives and business lines which have enhanced shareholder value. Therefore we see functional separation not as a parochial remedy imposed upon a vertically integrated dominant incumbent, but rather as a remedy which (together with appropriate obligations of equivalence) is able to deliver a set of outcomes which benefit the entire market.

The final details of any agreement concerning the separation of the incumbent (by whatever means) would need to be determined through detailed consultation

Separation, in whatever form, in its own right is not a sufficient remedy. The Openreach model includes strong incentives around compliance, and measures to ensure BT's execution of its obligations to deliver Equivalence of Input is independently monitored. Without the concept of "equivalence" the desired market outcomes would not have been delivered to the UK marketplace.

BT secured greater regulatory certainty and potential regulatory freedoms (in those areas that are now competitive) in return for the provision of greater transparency and certainty of fair treatment of all customers through the establishment of equivalence of input. Equivalence also gives the incumbent a powerful incentive to ensure its wholesale services are fully fit for purpose.

4 A Fit for Purpose and Future-proof Technological Design

4.1 Options for last mile access

The main challenge facing national deployment of broadband access infrastructure is the cost of providing service in outlying locations with low population density.

Providing high speed service in metropolitan areas is relatively simple and carries a lower cost than in dispersed and outlying areas, because the high density of accommodation results in short distances between customers' premises and existing network points of presence. These short distances enable high speeds to be delivered over existing copper local loop cable plant, avoiding the cost and disruption of deploying new outside cable plant. This also drives economy of scale and generates early return on capital investment, enabling widespread deployment of new types of technology, and at new locations, in order to improve the service experienced by customers, for example by further shortening loop length and increasing attainable speed.

In densely populated metropolitan areas, the cost of deploying new optical fibre cables to all premises may also be financially viable, enabling a further increase in attainable bandwidth by one to two orders of magnitude over copper local loop technologies.

In sparsely populated and outlying areas, alternatives to wired access may need to be considered.

Detailed financial analysis of geographic and demographic scenarios is required to inform objective decisions regarding the optimum technical solution for next generation access. The following descriptions summarise qualitative considerations regarding selection of access technologies.

4.2 Wireless options

4.2.1 Satellite access

The one technology which avoids the constraints of distance is satellite communication. This may be more appropriate than other solutions to serve some remote locations in Australia.

While this provides a mature and cost effective distribution mechanism for relatively high bandwidth broadcast media, eg. radio and television, it not well suited to use as a broadband access solution because it is a one way medium, highly shared between all users. Applications and services enabled by broadband access are interactive in nature, requiring support for unique user-dependent two way information flows. This requirement cannot be met adequately by low cost satellite-based access technology solutions.

The requirement to provide support for unique user-dependent two way information flows is particularly notable in the case of peer to peer file sharing. Peer to peer file sharing is likely to grow, as it is embraced by content providers with the addition of digital rights management technology to provide a highly efficient legal and regulated means of content distribution which avoids the need for investment in dedicated content storage and distribution technology.

4.2.2 Radio backhaul

Where existing cables could provide sufficient bandwidth from street cabinets or local exchange buildings to customer premises, but the cost of providing optical fibre cable from these equipment

locations to the core network would be prohibitive, another solution would be to deploy point to point radio systems from the core network to these locations, as is done with cellular mobile radio base stations. This may be more appropriate than other solutions to serve some outlying locations in Australia. However, unless sufficient backhaul capacity is provided, this could compromise service quality or speed, due to bandwidth limitations of the radio systems in the back-haul network.

4.2.3 Wireless access

Where distances are too long to use existing copper local loop cables to deliver high speed broadband access, and the cost of digging new cables to all locations required is prohibitive, the use of radio access technologies provides an alternative solution.

The broadband technologies that are currently receiving most attention as a broadband access solution are WiMAX, LTE and HSPA. In its latest guise, WiMAX has the potential to support mobile as well as fixed access, and this bridges the gap between higher speed shorter range Wi-Fi access at wireless hot spots and longer range, lower speed cellular mobile access solutions. The ability of these solutions to support nomadic access presents a market advantage over fixed access solutions which do not include integral support for wireless access.

Fixed WiMAX solutions are relatively mature, and can be used to provide relatively cost effective broadband access in locations where the cost of digging new cables to customer premises that would otherwise be required to achieve the required speeds would be prohibitive.

4.3 Wired options

Techniques are under development to accelerate and drive down the cost of cable laying. These are expected to increase the proportion of locations to which is will be economically viable to deploy optical fibre cable. These techniques include directional drilling, micro-trenching, radar based location of underground plant, and automated control of duct deployment equipment.

Optical fibre cables can provide lower whole life costs than copper cables in new build, therefore fibre cables are a better investment than copper cables in new build situations, and in situations where widespread renewal of loop plant is required, for example to enable higher speed service.

A key element in the low whole life cost of optical fibre local loop solutions is the very high reliability of optical fibre cables. This is proven in the case of cable systems deployed using fusion jointing techniques, but the long term reliability of optical connector technologies as an alternative to fusion splicing is relatively unproven. Therefore, the use of fusion jointing is recommended.

It is not economically viable to reconfigure optical fibre local loop networks which have been deployed using fusion jointing techniques in order to maximise their reliability. Therefore, it is essential for these networks to be engineered to support electronic systems that are capable of meeting all future requirements, in terms of capacity, configuration, and compatibility.

4.4 Future proofing the network

4.4.1 FTTP

Fibre to the premises has higher bandwidth and greater transparency than fibre to the cabinet, therefore it represents a more future-proofed solution for next generation open access (provided that an economical case can be made to fund its deployment).

The use of blown fibre microduct technology can facilitate progressive deployment of fibre, in order to reduce day 1 build costs. It enables incremental deployment of fibre in response to demand.

The use of passive optical splitters to share local loop fibre between multiple customer premises can help to reduce costs, while maintaining very high bandwidth, transparency, and future proofing. Passive optical splitters also have the advantage over active equipment alternatives of not requiring a power supply and requiring less stringent control of environmental conditions.

From day 1, the fibre loss budgets and specifications of equipment should ensure there are no obstacles to the deployment of equipment that makes use of spare wavelengths. This will avoid the need to change any of the day 1 network configuration or equipment to enable upgrade to WDM.

4.4.2 FTTN

Where FTTN is used instead of FTTP, the use of modular technology at street cabinets is recommended, in order to drive a low entry cost for deployment of new equipment, and to minimise the impact of future technology upgrades, such as a move from ADSL2+ to VDSL.

The use of an appropriate frequency plan can avoid the risk that deployment of DSL systems in street cabinets might damage the quality of service experienced using exchange based DSL systems which share the same cables to customer premises. The Access Network Frequency Plan adopted by Ofcom in the UK is a successful example of such a solution, without which such problems might otherwise occur.

4.5 Open Access Challenges

Requirements for open access include support for multiple service type, including support for shared wireless base stations, as well support for multiple service providers (SPs). The need to support these potentially conflicting service requirements creates a complex set of technology and operational challenges which can be resolved in different ways:-

1. Separate fibres could be deployed, to support separate electronics for each SP
2. Fibres could be shared by multiple SPs, by allocating separate wavelengths to each
3. Fibres could be terminated with electronics that enables bandwidth to be shared by SPs

Option 1 drives additional fibre cable cost. Option 2 drives additional cost in WDM technology. Options 1 and 2 drive additional cost in collocation hosting facilities at street cabinet locations, and duplication of electronics at these locations. Option 3 represents lowest cost of fibre cable plant and electronics, and is made technically viable by the transparency of the open access services facilitated by the very high bandwidths supportable over optical fibre local loop cables.

For this reason BT is progressing option 3 in the UK, under strict regulation by Ofcom to ensure open access, based on the principles of equivalence of input, in order to prevent disadvantage to other SPs.

4.5.1 NBN for broadcast

In situations where widespread use of broadcast TV content delivery is intended, broadcast or multicast technology in access aggregation equipment can be used to reduce the bandwidth required. This can enable bandwidth efficiencies to be achieved in all parts of the local network,

including back-haul bandwidth, local loop capacity, and network terminating equipment, depending on the number of users and channels, and the bandwidths involved.

However, mature standards are not yet available to enable available multicast channel selection functions of access aggregation equipment to be included as part of regulated open access services, therefore alternative solutions are being progressed as part of open access at this time. For example, BT Openreach has developed the FIRS services to enable broadcast content to be distributed as part of the Ebbsfleet FTTP deployment. This carries conventional TV and radio broadcast signals over a PON in the form of one way RF signals which are received at all customer premises using equipment that supports existing service providers' set top boxes.

Support for multicast channel selection as part of open access may emerge over time, if there is a sufficiently strong market requirement for it.

In the development of open access regulation, it is recommended that particular consideration is given to adoption of clear and compatible requirements for open access to TV content. Separation of regulation of access to TV content from open access telecommunications regulation risks failure to address market issues which may arise as a result of the convergence of TV content delivery with Broadband telecommunications, and in particular next generation Open Access.

4.5.2 CPE compatibility

CPE compatibility is a key requirement of open access, and this requirement can result in new technology not being deployed as early in an open access regime as might occur in the situation where the access technology is dedicated to a single service provider. This is a particularly important issue in relation to distribution of TV content over open access, especially if significant market demand for multicast channel selection within access aggregation equipment emerges.

If a next generation access technology can be deployed which delivers open access services of sufficient bandwidth to meet all future requirements for concurrent distribution of separate TV content to all end users, then this would avoid the complexity of supporting real time control of multicast channel selection within the next generation access aggregation equipment as part of the open access service. It would also enable eventual migration away from the current broadcast content distribution model, to one where all content can be distributed on demand. Options for evolution of next generation access to meet this objective are considered to be technically viable in the case of FTTP, but it is less clear that this objective can be met using FTTN without potentially costly upgrades to equipment in street cabinets.

It is possible that FTTN based on VDSL technology may work best when the DSLAM and CPE are matched, and therefore it may not lend itself to free choice of CPE.

4.6 Other factors to be considered

4.6.1 Retiring legacy products

Emulation of existing services on new technology can place serious obstacles in the way of next generation transformation which are disproportionate to the market priorities. It is recommended that any investment in next generation access is coupled with a review of product requirements, in order to investigate options for existing products to be replaced by suitable next generation products, in order to simplify, accelerate, and reduce the cost of migration to the next generation network.

For example, the market objectives of open access may be met most effectively by not placing the burden of emulating existing PSTN services in its entirety on the open access network operator. It may be advantageous to the market to allow the open access operator to provide services which enable service providers to support both existing PSTN service and next generation replacements.

It may also be appropriate to consider relaxing some of the service requirements placed upon the service providers by current regulation, in order to facilitate migration towards next generation replacement products, where this is in the best interests of the consumer. An example might include withdrawing mandatory requirements to support service features which are complex and expensive to emulate in the next generation network, but which are little used, and for which acceptable or improved substitutes can be provided as part of the equivalent next generation product. This would allow anachronistic legacy services to be withdrawn, clearing the way for next generation access.

4.6.2 The home environment

Consumer demand for next generation access to support future products and services will be heavily influenced by the development of technology and standards in the home environment. This is a complex area in which market dynamics are driving rapid innovation, and unpredictable changes of direction. In order to future-proof investment in next generation access infrastructure by ensuring open access, it is necessary to isolate the access infrastructure from the impact of these unpredictable changes. Therefore it is recommended that the next generation access infrastructure is specified to deliver simple transparent services that will be able to support the full range of future applications in the home, irrespective of the detail of the network connectivity and user devices that emerge in the home environment. This will ensure that service providers continue to be able to offer innovative new equipment to meet these rapidly evolving requirements, without being restricted by the capabilities of the next generation access infrastructure, and associated open access services