

Next Generation Services for Older and Disabled People

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prepared for



Advisory Committee on
Older and Disabled People

by



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Foreword

The broadband world is moving fast.

It was only 18 months ago that Virgin launched its 50Mbps service¹ and BT was trialling next generation services in Ebbsfleet, Kent². Now, for many, next generation broadband is starting to be a reality.

Across the UK, BT expects to make fibre-based broadband available to four million premises by the end of 2010³. By mid-2012 BT plans to have invested up to £1.5bn to deliver super-fast broadband to 10 million lines - about 40 per cent of its network.

Virgin, meanwhile, is planning a 100Mb service by the end of the year, and the continued trial of a 200Mb downstream - and 20Mb upstream - service via its cable network.⁴ A 50Mbps trial, using telegraph poles⁵ to bring next generation digital services to consumers who currently live beyond the reach of Virgin's existing fibre optic network, is also under way.

This is all very impressive, and it's clear that many of the benefits this technology affords - including multiplayer online gaming and faster downloads for music and TV programmes - will be welcomed by many consumers.

However, Ofcom's Advisory Committee for Older and Disabled People (ACOD) has been concerned for some time that the wider applications of this technology remain relatively untested. They certainly enjoy a much lower profile.

With that in mind, ACOD commissioned i2 media research to look at the products and services which next generation broadband offers, focusing on those that could particularly benefit older and disabled citizens and consumers.

This report brings together for the first time examples of a wide range of applications that this technology has the potential to deliver. Some of these can be delivered only by next generation networks, whilst others can be delivered through more reliable and consistent broadband connections at current speeds, with more sophisticated, richer applications possible via next generation networks.

Now that we are all going to be working for longer, and there is a desire to tackle worklessness and encourage the economically inactive to become economically active once more, technology can help people who are often at the periphery of our society - such as disabled or

¹ <http://pressoffice.virginmedia.com/phoenix.zhtml?c=205406&p=irol-newsArticle&ID=1235740&highlight=>

² <http://www.insight.bt.com/news/Faster-broadband-coming-to-Ebbsfleet-Valley/>

³ <http://www.btplc.com/News/Articles/ShowArticle.cfm?ArticleID=FD7AF15E-4B97-4DE1-BBA0-996AE0981AF5>

⁴ <http://phx.corporate-ir.net/External.File?item=UGFyZW50SUQ9NDMwMDN8Q2hpbGRJRD0tMXxUeXBIPtM=&t=1>

⁵ <http://pressoffice.virginmedia.com/phoenix.zhtml?c=205406&p=irol-newsArticle&ID=1401380&highlight=>

older people – to play a more active role in the economy and in their local communities. It can also play a role in helping people remain independent, living in their own home, for longer. For younger disabled people it can play a key role in ensuring their lives are as diverse and media-rich as their non-disabled peers. Text messaging has revolutionised the lives of young deaf people on the move in the past decade. Next generation broadband has the potential to deliver the same impact in the home.

Services such as remote health monitoring and consultations, mentoring and befriending schemes, home and community security initiatives, teleworking and life-long learning programmes are just some of the areas in which next generation broadband could deliver wider societal, economic and community benefits to older and disabled people, as well as to society as a whole.

Historically, industry has been slow to recognise this.

As a result, many of the products and services outlined in the report have yet to become mainstream. A number have been part of pilots and trials, whilst others remain in development. We believe that this research shows that there are markets for companies who can offer products and services tapping into the health, work and leisure needs of older and disabled people.

ACOD encourages industry to look at the examples in this document and consider the potential for their wider deployment, so that everyone can benefit from next generation broadband.

Jo Connell

Chairman

Ofcom Advisory Committee on Older and Disabled People

Executive Summary

1. This paper reports a research study conducted by i2 media research, commissioned by Ofcom's Advisory Committee on Older and Disabled people (ACOD), on *next generation services* for older and disabled people.
2. Throughout this report we use the term 'next generation services' (or NGS) to refer to new and improved telecommunications services that use the speed and capacity of next generation networks (NGN, or high speed internet networks which make use of a range of innovations to provide benefits to users) and are delivered to users via next generation access (NGA; or high-speed data connections to people's homes.)
3. The study involved desk research and interviews with experts in relevant fields.
4. The objectives of the study were to identify and report: (i) details of new and near-future NGS that have the potential to benefit older and disabled people's lives, (ii) how existing services could be enriched as a result of faster broadband connections, (iii) the potential benefits from such services, and (iv) the risks and challenges to the realisation of these benefits.
5. The services within scope were: (i) those that require high bandwidth to the user, for example, to deliver high definition video; (ii) those that require high connection speeds between people (for example, video conferencing services); (iii) those that are likely to require higher speed and capacity networks when multiple services and users are using the network at the same time, to ensure sufficient reliability for the services to work; and (iv) those that extend the functionality of existing products and services in a world of super-fast broadband.
6. Consistent with this scope, amongst the many services discussed in the report the reader will recognise some services, or components of services, that are available today. These have been included for three reasons. First, some such services will need to migrate to next generation networks over time – and for some services this migration will raise challenges in itself. Second, whilst today's broadband networks may support current numbers of users accessing current services (e.g. high-definition video streaming, or internet-based video and voice conferencing), when greater numbers of users attempt to access such services, current network capacity will limit users' quality of experience. And third, whilst various components of some of the services included in the report may be available today, the roll-out of higher speed, and higher capacity, next generation networks will support innovations and extensions in the services that may offer potentially greater benefits to older and disabled people's lives than current services provide. The list of over 100 research and development projects and services presented in Annex 2 clearly identifies those that are currently available, and those that remain in research and development.
7. The research is of relevance to ACOD, given its remit to: *"seek to identify issues affecting the communications sector of interest to older and disabled people, both collectively as a Committee and individually as Members, with particular reference to the sectors where they have particular knowledge or expertise; to provide advice to Ofcom about general and specific issues concerning the communications sectors relating to older and disabled people; [...] to provide Ofcom with advice on matters relating to its responsibilities for the promotion of media literacy affecting older and disabled people; to contribute to Ofcom's annual report to ensure the work of the regulator within the communications sector on issues relating to older and disabled people is reflected."*

Key findings

8. The opportunities and potential benefits to older and disabled people offered by NGS are manifold. Future services promise a world in which such services may help older and disabled people to achieve greater social and economic inclusion and engagement.
9. Such benefits cannot, however, be taken for granted; there are substantial risks, challenges and barriers to the effective implementation of NGS. Addressing the challenges is essential if the potential positive impacts of NGS on the lives of older and disabled people are to be realised.

NGS have strong potential to benefit older and disabled people's lives

10. The project identified a broad range of potential benefits to older and disabled people from NGS, in all areas of life including health and wellbeing, work and education, leisure, and other day-to-day activities. They can be categorised as follows:
 - a. Improved access: Better accessibility (for example, products and services designed to be used by a wide range of people including people with disabilities), improved usability (providing more usable, relevant, convenient and efficient products and services), and the potential for more affordable services. Note that cost considerations were also identified as challenges (see 14c below).
 - b. Increased participation: Given improved access, older and disabled people would be able to participate more in work and education, and in social and community activities, providing more options for social engagement and reducing social isolation.
 - c. Improved wellbeing: Older and disabled people's physical and psychological health and wellbeing stand to benefit through access to products and services designed to: (i) improve compliance with medical regimes, (ii) provide easier ways for professionals to provide care services for end-users, and (iii) improve users' sense of security and safety.
 - d. Richer entertainment: As relatively heavy consumers of entertainment media, older and disabled people could benefit through access to more realistic and natural displays (e.g. high definition, 3D television) and interactions (e.g. digital games), and more personally relevant content.
11. Detailed descriptions and examples of the potential benefits of NGS to older and disabled people are provided in chapters specific to each of:
 - a. health and wellbeing;
 - b. work and education;
 - c. leisure; and
 - d. other day to day activities.

Challenges to realising the potential benefits of NGS

12. A discussion of the challenges, identified by the project's expert interviewees, that need to be overcome for the potential benefits of NGS to older and disabled people to be realised is presented within the report. If such risks and challenges are not adequately addressed, then the potential benefits of NGS may not be realised.
13. In summary, risks and challenges can be categorised as relating to:
 - a. Accessibility: If NGS are not accessible, usable, affordable, desirable and

available to older and disabled people, then their benefits may not be realised.

- b. Logistics: Key logistical challenges relate to: (i) seamless technical integration (so there are not technical barriers to users accessing products and services), (ii) effective coordination and integration of services, and (iii) a need to move from trials and pilots of new services to implementation.
 - c. Impact: The project identified three categories of risk: (i) increased isolation (for example, if face-to-face care were to be replaced by a NGS), (ii) increased dependence (for example, an NGS might tempt users to rely on a service to do things that they would otherwise be capable of doing for themselves), and (iii) excessive reliance on electronic systems (e.g. back-up, security, quality of service for life-critical services).
14. To conclude, NGS offer many potential benefits to older and disabled people, but the realisation of the benefits depends on effectively addressing the challenges.
15. In addressing the challenges, the following issues were highlighted by the project's expert interviewees as important:
- a. Infrastructure: there is a need to ensure that adequate and reliable network infrastructure and connectivity is available to enable users to access NGS;
 - b. Usability and accessibility: there is a need for internationally coordinated work to support the development of NGS and products that are accessible and easy to use for people with a wide range of abilities. Key considerations here relate to:
 - i. supporting the adoption of best practice in product and service research and development (e.g. following user-centred design principles);
 - ii. the regulatory and legislative environment: ensuring that it supports the development of usable and accessible products and services;
 - iii. standards for interoperability: so that personalised interfaces (meeting different user needs) can be easily integrated with NGS and with products;
 - c. Cost: ensuring that potential beneficiaries are not excluded from the benefits of NGS on the grounds of affordability. Considerations in relation to cost may include supporting competition amongst product and service providers, and making social tariffs available;
 - d. Implementation: more coordinated mobilisation of and interaction between stakeholders (government, health services, social care services, regulators, service providers) is likely to be necessary to minimise the logistical risks to the realisation of the potential benefits of NGS for older and disabled people.
 - e. Motivating consumers: a major challenge remains - encouraging consumers who have not yet embraced current generation broadband to adopt and use broadband and associated services. A high proportion of non-adopters report that they have no interest in the internet^{6,7}. In line with the Government's digital participation activities, awakening this interest is an

⁶ Ofcom (August 2009). The Communications Market Report: The Market in Context.
http://www.ofcom.org.uk/research/cm/cmr09/CMRMain_1.pdf

⁷ e.g. see <http://www.consumerfocus.org.uk/assets/1/files/2010/02/Broadband-Minded.pdf>

important consideration.

Note: An extended summary is provided in Annex A to this report.

1. Introduction

This report summarises desk research and expert interviews⁸ conducted by i2 media research for Ofcom's Advisory Committee on Older and Disabled People, on next generation network (NGN) services for older and disabled people.

Throughout this publication we refer to such services as *next generation services* (NGS). By NGS we mean new or improved telecommunication services that make use of the speed (20 Mbps and higher) and capacity of NGN⁹.

NGNs are high speed internet networks that make use of a range of technical innovations to provide benefits to users. Data and services are delivered to users via next generation access (or NGA; high-speed data connections to people's homes.)

Effectively, NGNs are able to transmit all types of data (e.g. text, video, voice) across one core 'internet protocol' network using 'data packets'. Because NGN are able to offer users access to different service providers, they are able to support increased mobility through the ubiquitous and consistent provision of services to users.

NGA is used to refer to high-speed connections between premises (homes or businesses) and the main network (NGN). Technologies that provide NGA include fibre-to-the-cabinet, fibre-to-the-home, and LTE (Long Term Evolution, or 4th generation mobile networks).

1.1 Aims

The key objectives of the research were to identify and report:

- i. details of new and near-future NGS, those that will become available in the next 5 to 10 years, which are based on exploiting the technologies possible via NGN and which have the potential to benefit older and disabled people. The emphasis in this work is on services that can be delivered, rather than the technologies that will deliver them;
- ii. potential benefits from such services, and
- iii. risks and challenges to the realisation of potential benefits to older and disabled people.

1.2 Scope

1.2.1 Service characteristics

We include in our report services that are either available already, or may be available within the next 5-10 years (i.e., in the lifetime of an older person aged 65+ years today). Developments on a longer timescale have been reviewed in a separate recent project for Ofcom¹⁰.

⁸ with experts from industry, 3rd sector, government, regulatory, and academic backgrounds.

⁹ A Next Generation Network (NGN) is "a packet-based network able to provide services including Telecommunication Services and able to make use of multiple broadband, Quality of Service (QoS)-enabled transport technologies and in which service-related functions are independent from underlying transport-related technologies". In principle, NGN offer unrestricted access by users to different service providers. [ITU-T, 2004, accessed 11/11/09 online: http://www.itu.int/ITU-T/studygroups/com13/ngn2004/working_definition.html]

¹⁰ 'Assisted Living Technologies for Older and Disabled People in 2030', report for Ofcom by Plum Consulting; available here:

The brief from ACOD for this report was to provide a “succinct and accessible summary outlining the range of services already available, as well as those in development.” The focus of our report has been to gather and summarise descriptive and factual information on current and potential services, not to evaluate future prospects for the services.

The scope of the review includes any services which may have specific value for older and disabled people, because of their particular characteristics – not only those services which have been designed specifically for older and disabled users.

Relevant service areas/themes initially identified by ACOD included: ambient assisted living and tele-care services; tele-medicine and tele-health; wellbeing services; communications; work-related services; entertainment services; educational services; personal communications services and multi-media services; and others. This range includes services available both inside and outside the home, and those that rely on wireless connectivity. Details of projects and research activities about the services in scope (listed above) were gathered into ‘fact sheets’. A summary of these activities is provided in Annex B.

Whilst the primary focus of the review has been on services available in the UK, a range of relevant and leading-edge international activities have also been included.

Where possible, the report comments on current consumption habits as potential drivers for the adoption of new services. We have highlighted factors that will encourage use; these include: relevance, ease of transition to a new service, and instances where social, educational and entertainment-based services may pave the way for use of other services.

In this research, services have been considered which:

- a. may improve a citizen’s wellbeing, participation and general quality of life across various dimensions such as health, wealth, entertainment, and social interaction;
- b. may support older and disabled people’s transitions to and from work;
- c. are culturally relevant (meaningful) to the UK’s population of older and disabled people (this is particularly important as our review has included material from international and European projects); and
- d. have potential to offer new and improved products and services, even if they build on current service provision¹¹.

1.2.2 Network requirements of services considered in scope

NGS have been considered within scope if they meet the following different sets of network requirements:

- (a) high bandwidth¹² to the user; for example, services that deliver high-definition video;

http://www.plumconsulting.co.uk/pdfs/Plum_June2010_Assisted_living_technologies_for_older_and_disabled_people_in_2030.pdf

¹¹ services which do not offer a new, improved or enhanced service (i.e., offer simply an alternative or equivalent to an existing service) have been considered out of scope

¹² Above 20MBs

- (b) require high connection speeds between people (for example, video-conferencing services);
- (c) are likely to require higher speed and capacity networks when multiple services and users are using the network at the same time, to ensure sufficient reliability for the services to work; and
- (d) extend the functionality of existing products and services in a world of superfast broadband.

The services reviewed here encompass a wide variety of technology innovation (e.g., novel interaction interfaces such as gesture and voice recognition) and these are mentioned, where relevant, in the context of the service descriptions. Whilst some of the services we have identified are better described as service *groupings* (for example, health and wellbeing services), we refer to all of them as 'services' throughout.

Consistent with the project scope, amongst the many services discussed in the report the reader will recognise some services, or components of services, that are already available today. We have included these for three reasons. First, some such services will need to migrate to next generation networks over time – and for some services this migration can raise challenges in itself. Second, whilst today's broadband networks may support *current* numbers of users accessing current services (e.g. high-definition video streaming, or internet-based video and voice conferencing), when greater numbers of users attempt to access such services current network capacity will limit users' quality of experience. And third, whilst various components of some of the services included in the report may be available today, the roll-out of higher speed and higher capacity next generation networks will support innovations and extensions to these services which may offer potentially greater benefits to older and disabled people. The list of over 100 research and development projects and services, presented in Annex 2, clearly identifies those that are currently available, and those that remain in research and development stages

1.3 Method

The research was conducted in two phases. In the first phase, desk research identified the potential benefits of NGS to older and disabled people across a range of domains (e.g. health, entertainment, work and education).

We used a wide range of published reports and articles from academia, industry, the European Commission, government, regulatory bodies and other sources to identify and summarise key features of services (new and in development) that were relevant to the scope defined above. The initial desk research was conducted between October and December 2009. Additional searches were conducted throughout the project to augment our background literature, and to ensure that interviewers were aware of activities in which the project's expert interviewees were involved.

In the second phase a series of videoed interviews was conducted with 15 stakeholders from industry, charity and not-for-profit (3rd sector), government, regulatory, and academic organisations (see Appendix 1). Interviewees were selected to ensure a good spread of expertise across the range of topic areas identified in the desk research, and representation from around the UK. Each interview lasted between 40 and 90 minutes.

The interviews were semi-structured and broadly covered the following areas:

- current service provision (availability; types of user; types of benefits and positive/negative feedback from users and service providers), and
- future service provision (how expansion of service over the next 5-10 years was envisaged; future benefits; future risks; service drivers and barriers).

The majority of the interviews were conducted face-to-face and two were conducted via video conferencing facilities. All participants gave informed consent to have their interview recorded on video and for the public release of any video clips and quotes that would identify them.

In addition, Ofcom invited a range of other stakeholders to provide written responses to a short series of questions, drafted by i2 media research (see Appendix 2).

Nine organisations supplied responses. The themes from these responses have been analysed, and are consistent with those derived from the desk research and expert interviews. Where the respondent indicated they were willing for their response to be published, we include the response in Annex C to this report.

1.4 Report structure

Chapter 2 provides a short summary of a number of key social and technological trends identified as relevant background in the desk research and as identified by project interviewees in phase 2 of the project.

It also discusses the key implications of these trends: the potential for improved accessibility as a result of personalisation; priorities for accessibility of NGS; and standards and interoperability.

Chapters 3 to 6 provide detailed descriptions of the services identified by the research; in particular, what the services are, and how they could benefit older and disabled people. NGS identified within the project are presented within a framework of areas of people's lives; namely:

- (a) health and wellbeing (Chapter 3);
- (b) work and education (Chapter 4);
- (c) leisure (Chapter 5); and
- (d) other day-to-day activities (Chapter 6).

Chapter 6 covers a broad range of services, relating to e-commerce, e-government, and navigating the physical world (wayfinding). There is some overlap in services for assisted living across the chapters on *other day-to-day activities*, and *health and wellbeing*. This is because assisted living services and applications can have direct health and wellbeing benefits (e.g. reminders to take medication reduce the risk of physical illness as a result of not taking it) and can also make day-to-day life simpler for service users.

For each service area, benefits and examples of potential future use are provided. Each chapter ends with a section on the challenges to future service provision that are particularly relevant to that service area.

More general risks and challenges to realising the potential benefits to older and disabled people from NGS are discussed in Chapter 7.

Finally, Chapter 8 provides a summary of the report and conclusions.

2 Social and technological context

Summary

This chapter provides a short summary of a number of key social and technological trends identified as relevant background in the desk research and by project interviewees in phase 2 of the project.

Social and demographic trends relate to our ageing population and the increased number of people with access requirements paired with increased expectations for participation in society.

Relevant technological trends relates to the move towards more communications service content being distributed via internet protocol through NGN. Trends discussed here include:

- a. Cloud computing;
- b. Software as a service;
- c. Personalised interfaces;
- d. Ubiquitous mobile; and
- e. Multi-modal/high-presence display systems

2.1 UK social and demographic trends

2.1.1 Ageing population

A trend well recognised and reported elsewhere is that the UK population is ageing¹³. Relative to earlier generations, people today live longer, and lead more active lives along the way. This demographic trend presents a challenging set of economic and service delivery requirements. One implication of the trend is that people will have to work longer to support themselves. This suggests a growing market for more personalised technology solutions for working – both in the office and from home.

A related trend is the greater care needs of an ageing population. With age-related cognitive and physical decline, experts predict an increasing need for innovation in the way health and wellbeing services are provided in the future. As the quote below shows, technical and service innovation will need to be part of the solution.

“...so we know that in the UK and in Europe, we have an ageing population and will need to look at the potential and capability of technology. And whether that's smart robots, or smart monitoring, it will have to be thought about more seriously.” (Stephen Dodson, DC10plus Network)

¹³ National population projections 2004-based, National Statistics © Crown Copyright 2006, table 3.2 (Actual and projected population by age United Kingdom 2004-2031).
www.statistics.gov.uk/downloads/theme_population/PP2_No25.pdf

A trend evidenced by smaller household sizes¹⁴ is that of greater family dispersion¹⁵. A risk arising from this trend is that face-to-face family involvement becomes less prominent in health care.

"The smart home has to be a reality for people, especially as we have some extended families running off to Australia." (Stephen Dodson, DC10plus Network)

2.1.2 More people with access requirements, and increased participation

Innovation in the spheres of assistive technology and personalisation (where services and their interfaces can be adapted to users' needs and abilities), and supportive legislation (for example, regarding diversity) could result in an environment which is more supportive of people with disabilities being active in world of work. As this trend becomes more established, it is likely that people with disabilities in the world of work, and bodies representing their interests, will expect fair access to the tools and functionalities available to people without disabilities.

2.2 Relevant technology trends

A technology trend, and the motivation in part for the current project, is the move towards more communications service content being distributed via internet protocol (IP), delivered via next generation networks (NGN).

NGN and NGA will deliver higher-bandwidth broadband to consumers' homes, thereby potentially removing the 'delivery challenge or bottlenecks' that has, to date, limited the extent to which multiple media services can be delivered to users without degrading others' media experience. The trend towards higher-bandwidth broadband (through fibre to the cabinet and fibre to the home) will mean that rich, interactive and personalised multimedia services can be delivered to consumers. Current examples include internet-based TV catch-up services (e.g. BBC iPlayer, ITV Player, 4OD, Demand Five and Sky Player).

2.2.1 Cloud computing

The development of higher-bandwidth networks will speed up, and sit alongside, the move towards cloud computing. Here, data storage (and back-up) and complex processes (e.g. to generate graphics, or customise audio for a user) can be performed remotely from the end-user (in server centres) and delivered in real time via high-capacity networks.

This development provides two benefits. First, it will support increased mobility because users will be able to access cloud-based services from anywhere. Current examples include Gmail and Dropbox. Second, personalised services will be receivable on simpler, potentially cheaper, devices, as more complex processing (such as graphics to enable the delivery of sign language to end-users) can take place on computers located on the network.

2.2.2 Software as a service

Software as a service (SaaS) is already technically feasible and will be enhanced by NGN. Current examples include games-on-demand services,

¹⁴ http://www.statistics.gov.uk/downloads/theme_social/Social-Trends40/ST40_Ch02.pdf

¹⁵ Manthorpe, J. (2001). Caring at a distance: learning and practice issues. *Social Work Education*, Vol. 20, No. 5, 2001

where games run on company servers whilst being played in users' living rooms. Another example is Google's recently launched Chrome Operating System (OS). In Chrome OS, standard office software functions (word processing, spreadsheets, calendars, databases etc.) are available via Google servers. The software in this example sits on Google's servers, not on the end-user's device, and the interface on the end-user's device displays changes in the application in real time. To the end-user, the experience should be comparable to running software locally (on the end device), whilst offering increased reliability and mobility.

2.2.3 Personalised interfaces

Work is ongoing on developing standards for the portability of interface preferences from one media device to another (e.g. ETSI, SNAPI¹⁶) and, of related interest, projects geared towards open standards for accessibility. Both these areas are of interest; previous research conducted by i2 media research for ACOD has suggested that standardisation is needed to enable manufacturers and service providers to improve the accessibility of their products and services to older and disabled people¹⁷. Such standards are also needed in the context of NGS. Relevant subsets of personalisation include speech requirements (input and output), visual, auditory and gesture preferences.

2.2.4 Ubiquitous mobile

In today's mobile telecommunications market, contextually relevant (location-based) services are increasingly popular. Such services include those that can help users to navigate and orient themselves in physical space, and socially (e.g. finding nearby friends using Google Latitude). Although only a minority of UK consumers currently have access to a smartphone, sales are increasing rapidly¹⁸. The substantial development and marketing activity in the smartphone market (with Apple, Microsoft, Google, Palm, RIM and others investing in operating systems for smart mobile devices) points to a future of high penetration of such devices. This will have a knock-on effect on network requirements - for example, to enable multiple users in a cell to view the same video on their handheld device. As we discuss later in this report, there are multiple services in development that will rely on next generation mobile networks, and will have the potential to benefit older and disabled people, as recognised by our interviewees.

"There's lot of buzz again in the market about mobile this year. [...] In areas like news, sport and weather, it is because people need that immediacy and when they're out and about they really need to access our services on the go [...] and location sensitive services as well." (James Micklethwait, BBC)

"I also think now the mobile application device will probably be the main device out of the home, and it would also be able to monitor your health signs, so it would become an amazingly powerful tool." (Stephen Dodson, DC10plus Network)

¹⁶ Special Needs Application Program Interface. See <http://www.snapi.org.uk/>

¹⁷ Freeman, J. & Lessiter, J. (2009, June). Exploring how manufacturers, suppliers and retailers address the needs of older and disabled people: what are the barriers and drivers? Research report for Ofcom's Advisory Committee on Older and Disabled people

¹⁸ Gartner, 2010, reported on <http://techcrunch.com/2010/02/23/smartphone-iphone-sales-2009-gartner/> (accessed May 11th 2010)

“I feel that the mobile phone is where lots of [telehealth] services need to sit [...] ...if we constrain them [telehealth services] to the bathroom or bedroom we are undermining their potential appeal or use.” (Simon Roberts, Intel Corporation)

2.2.5 Multi-modal / high-presence display systems

A final technology trend worthy of note is the increased availability of ‘presence’ systems¹⁹. These are mentioned here because they are important in several of the application/service areas discussed later in this report, including health and wellbeing, work and education, leisure and other day-to-day activities.

Visual display examples include high-definition video, 3D video, and ultra-high definition video. Innovation is ongoing for displays in other modalities too, including touch and natural multimodal interfaces. These innovations include wearable technologies and reactive textiles, which are items of clothing or accessories that have advanced electronic sensors and technologies built in.

These developments all point to a future incorporating richer, more immersive and engaging augmented and mixed realities, offering more usable and useful possibilities for NGS for older and disabled people.

¹⁹ The term ‘presence systems’ is used in this report to refer to technologies that enable users to feel connected to spaces or people which are remotely located. Such systems typically make use of high quality video/graphics and audio links.

3 Health and wellbeing

Summary

The project identified a number of nascent trends in the provision of future health and wellbeing services which are, to some extent, dependent on NGN to develop further. These include:

- a. Remote interaction: user engagement with health and wellbeing service professionals via media (text, voice, video);
- b. TV as communication interface: several ongoing projects and activities are exploring the TV as a familiar interaction tool through which older and disabled people can interact with health and wellbeing services;
- c. Activity, health and wellbeing monitoring: multiple ongoing initiatives are focused on the development of services to monitor users' vital signs and activity levels. Such services have the potential for application in relation to daily monitoring of existing diseases and problems, and also for early warning of a person becoming unwell.

For older and disabled people, potential benefits of such health and wellbeing services include:

- a. prolonged independent living;
- b. increased physical and psychological health and wellbeing; and
- c. increased sense of wellbeing and security.

In addition, such NGS in health and wellbeing have the potential to offer the benefits of more efficient, cost-effective, and targeted delivery of services to older and disabled people.

Research detailed throughout this chapter indicates there is a range of health and wellbeing services, likely to become more widely available in the near future, that are radically different to the forms of health service provision that are currently offered. Many of these health and wellbeing-related products and services can be enabled without NGN. Indeed some of the services described below are currently available to and used by some service users. However, without NGN it would not be possible to deliver enhanced, high quality, reliable and integrated (joined up) health and wellbeing services to all service users. For these reasons, the activities discussed in this chapter are considered within scope.

“If you’re just transmitting health data it doesn’t require high bandwidth. It’s only when you want to try and do [...] video conferencing, remote telemedicine that you need bandwidth or bandwidth improves the quality of the actual service that you’re able to deliver. So it’s low cost and that everything is available, anytime anywhere.” (Graham Worsley, Technology Strategy Board)

3.1 Current context

Traditionally, the relationship between the health service user and the service provider is face-to-face, often requiring mobility of the service user to reach the health professional physically. Alternative arrangements are possible for people with difficulty in mobility (e.g. home visits, free transport).

Self-management of medical conditions is important and relies heavily on motivation, understanding and adequate cognitive ability to remember health-related regimes (e.g. taking medication; following rehabilitation exercises). Less frequent professional support in managing conditions can be provided (e.g. weekly physiotherapy sessions).

Personalisation is one of the proposed reforms to the health service²⁰. Personalisation aims to encourage a new focus on early intervention and prevention; promoting general wellbeing and a more holistic approach to practice (e.g. nutrition; physical exercise; cognitive behavioural therapy; mental stimulation; emotional and psychological support).

There is also a trend towards increased responsiveness to service users' needs (e.g. more flexible appointments at different times of day; appreciation that educating people about their health condition can be important to prognosis; timely responding to emergency situations; NHS Direct²¹).

The NHS is currently undergoing radical change, partly in response to the likely increase in the population of older people over the coming decades. Services will be under more pressure than ever. Facilitating better self-management of a person's health from home which enables more independent living (i.e., preventative services) is central to the new vision for health service provision²². This approach is anticipated to improve outcomes for older service users as well as providing a more efficient use of resources in supporting the long-term treatment of chronic conditions²³. Information and communication technologies (ICT) delivered over NGN could provide solutions to enabling better self-management of health from home.

"A lot of that care could be done outside the hospital but the current way our systems are set up, people tend to have their family doctor GP and then the hospital, and there's not a lot in between. And it's our view there could be more done just using ICT to change that care paradigm." (Niamh Scannell, Intel Corporation)

3.2 Future service provision: potential trends and benefits

User needs in health and wellbeing are likely to be met by a range of services including telehealth monitoring, telecare, and wayfinding/navigation.

There are a number of general trends in future health and wellbeing service provision that are noteworthy such as remote interaction, using more intuitive communication interfaces, such as the television and wearable technologies. These technology-based health products and services have the potential to

²⁰ Ministerial Concordat launched 10th December 2007. "Putting people first: a shared vision and commitment to the transformation of adult social care"

²¹ <http://www.nhsdirect.nhs.uk/> (accessed: 22/04/10)

²² Department of Health (July, 2009). "Prevention package for older people resource." (see: http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_103146)

²³ Department of Health (October, 2009). "Putting the case: Older people's prevention services."

deliver a wide range of benefits (e.g. more efficient, cost-effective, and targeted delivery of services) particularly for older and disabled people.

Promoting supported yet independent living and health management from home tends to prevent hospital admissions, facilitate earlier hospital discharge, reduce the number of check-up appointments and admissions to care homes, and improve quality of life and patient satisfaction with health services. There is some evidence to support these intended outcomes^{24,25,26}. For instance, the Scottish Government's Joint Improvement Team (JIT) evaluation²⁷ (January 2009) estimates that in Scotland over a one-year period, telecare services have saved 5,668 hospital bed days because of speedier hospital discharge, 13,870 facilitated by a reduced number of unplanned hospital admissions, and 61,990 care home bed days through avoiding the need for people to enter care homes. This totals over 81,000 bed days saved by telecare services. Furthermore, users of the telecare services reported feeling safer (93%), more independent (around 66%), and felt their families were now less worried about them and reassured that help is not far away when needed (87%). This was consistent with carers' experiences who reported that they felt the telecare services reduced pressure and stress on them and provided peace of mind (75%).

Comprehensive, quantitative evaluations of the benefits of telehealth and telecare services are still in progress through pilot studies. However, there are numerous anecdotal reports of benefits from patients that are consistent with the above findings. These include increased peace of mind and freedom; improved ability to manage health conditions (e.g. through greater understanding of their health condition and the creation of valued routines in doing so) and improved communication with health service staff^{24,26}. Some of our interviewees also reported the benefits of which they were aware.

"...the benefits [of telehealth services] come in different forms; some people are very committed to the view that this adds quality of life, it provides independence [...]. Some others, given the enormous budgetary pressures, are looking for economic benefits. So you'll find some large case studies that show, for example, in the social care environment, the idea that you can keep people living at home, perhaps with a learning disability or simply an older or vulnerable person where we could delay or avoid a move into residential care. There are cases out there that show you can get a factor 3 return on your investment simply by providing an alternative home-based care environment." (Steve Sadler, Tunstall Group)

Overall, the technologies could enable users to enjoy a better quality of life by removing unnecessary concern, and could reduce the sense of vulnerability associated with leaving the security of the home when affected by a chronic disease²⁴. Importantly, these types of health services have potential to free-up increasingly valued face-to-face contact for those who need it most.

²⁴ Department of Health "Whole System Demonstrators : An overview of telecare and telehealth (http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/documents/digitalasset/dh_100947.pdf: accessed 27/11/09)

²⁵ Harper (2008). "Innovative Practice In Using ICT: Working Together To Improve The Patient Journey" (http://www.dhsspsni.gov.uk/roy_harper_presentation_waterfront_belfast_22_-_01_-_08.ppt#12: accessed 27/11/09)

²⁶ <http://www.tunstall.co.uk/assets/literature/Managing%20Long-Term%20Conditions%20-%20Nottingham%20PCT.pdf> (accessed: 27/11/09)

²⁷ <http://www.jitscotland.org.uk/action-areas/telecare-in-scotland/telecare-publications/> (accessed: 27/11/09)

"I think its aim, and I think it's a laudable aim in terms of cost effectiveness and efficiency, really is that where services can be moved away for people to access them online [...] then that would and should release resources for those people who need that face-to-face – the most vulnerable." (Stephen Dodson, DC10plus Network)

The trends in this service area and the range of more specific health service devices, technologies and corresponding benefits are described below. In practice, the devices are often pooled together in trials to provide a personalised care programme.

3.2.1 Remote interaction

In general, ongoing projects indicate a trend towards more remote, rather than local face-to-face, interaction with health and care service professions. Their aim is to support a more efficient health care delivery system.

Services such as VoIP (using text, audio and/or video) and sending picture files (of symptoms) through, for instance, internet-connected television sets are envisaged (e.g. Technology Strategy Board funded projects: *TV-based Video Telephony Platform for Assisted Living and Tele-Health* and *VIRTEX - Virtual Extra Care*: see Annex B). Remote interaction has the potential to reduce the number of face-to-face check ups. Video connections between the health service user and the provider can be used to bridge the important gap created by communicating remotely, as indicated in the following quote:

"You mention earlier about teleconferencing or videoconferencing – my personal observation of the clinical staff I have worked with is, they like to see the person, they like to see the patient. I don't know what cues they go off but they take a look at you and they go, 'hmm, you're not well today, right?' They need that visual, personal connection with the patient [...] I do think human beings need to see the person they're speaking to, to really develop strong relationships." (Niamh Scannell, Intel Corporation)

Remote interaction may be particularly useful for older and disabled service users living in rural areas or in locations where health centres are difficult to access because of personal (e.g. mobility impairment) or transport reasons.

"I would like to see virtually a cloud health system, which by most people can access their health data, health needs with local hubs or local clinics that can provide additional expert advice. I would like to see this rolled out to rural communities where the ageing population is going to be even greater than that, and already is poorly served." (Stephen Dodson, DC10plus Network)

Services that enable users a choice in their preferred communication methods (e.g. text, audio, video), such as VoIP, could also improve access for people with different communication requirements.

"...one area where we'd really like to see a big improvement is within healthcare – provision and access of services through that way [email]. So if you can make an appointment as well to see an audiologist through the computer or thorough television on demand, that makes your life so much easier if you're deaf or hard of hearing than having to struggle through a telephone

conversation or write a letter and then find out it got lost.”
(Emma Harrison, RNID)

3.2.2 Television interfaces

As noted above, television, rather than more 'computer-like', interfaces are the chosen interface for remote interactions in numerous projects focused on the delivery of health (and other) services, often with older people in mind (e.g. NEXUS TVTM²⁸; see boxed example). This is largely because in general older people are less likely than all UK adults to access and use the internet²⁹ and non-adopters in general cite low interest in, and inadequate knowledge about, how to access and use it (e.g. menus, dialogs)³⁰.

NEXUS TVTM intends to use interactive digital TV to deliver health care services along with tele-commerce and entertainment. The project aims to address a variety of older people's medical needs. These include: to send photographs of medical symptoms to a doctor; re-order prescription medicines using a barcode scanner on the remote control; reminders to take medication; and easy access to information (e.g. local primary health care and NHS Direct).

Compared with internet-connected computers, the television is an almost ubiquitous media technology in people's homes; it is a more accepted and familiar device. Some interviewees in this research perceived television as a well-suited alternative medium to the traditional computer device for NGS in health and wellbeing.

“...the Technology Strategy Board is investing in pilot projects around how the set-top box can also provide telecare and telehealth initiatives. Directgov currently has a platform on digital television and I think that that could be expanded and extended. I think that people will see the power and the growth of the capability of the set top box in their own homes, you know, grow exponentially over the next 3 to 5 years.” (Stephen Dodson, DC10plus Network)

However, there is debate in the literature, and emerging from our interviews, as to whether the television remote control is a suitable and usable interaction device for older and disabled people (see Chapter 7).

3.2.3 More accessible communication systems

New communication systems tailored to individual requirements are in development (e.g. *Assisting the elderly and disabled generation using a behaviour modelling intelligent system* (AEGIS) project: see Annex B) supporting better accessibility to information and communication devices for

²⁸ <http://www.oceanbluesoftware.co.uk/docs/OBS-Nexus-TV-090709.pdf> (accessed: 27/11/10)

²⁹ Ofcom (October, 2009). UK adults' media literacy. http://www.ofcom.org.uk/advice/media_literacy/medlitpub/medlitpubrss/uk_adults_ml/adult_ml.pdf

³⁰ Pitt, J. (March, 2010). Broadband minded? Overcoming consumers' barriers to internet access. <http://www.consumerfocus.org.uk/assets/1/files/2010/02/Broadband-Minded.pdf>

people with different impairments (visual, hearing, mobility, cognitive, speech, and mobility).

Improvements to video and audio quality, enabled through NGS in health and wellbeing, could provide more realistic interactions, enhancing the sense of presence ('being there') with the doctor. Better video quality can also support the use of sign language and lip reading, and improves access to non-verbal communication. Where video cannot be accessed by the service user (e.g. with a visual impairment), developments in explicit emotional overlays (e.g. combining physiological and face recognition data to provide information about mood and emotion, e.g. *Psychologically Augmented Social Interaction Over Networks* (PASION) project: see Annex B) have scope to become accessible in non-visual forms.

Remote yet rich communication channels with health service professionals could benefit people where physical mobility and travelling is problematic (e.g. rural location, transport issues, disability), and for people with difficulty finding their way around often complex and unfamiliar health care environments (e.g. people with sight loss, memory or other cognitive disabilities).

3.2.4 Improved physical health management and wellbeing services

There is a range of technologies already in some health service users' homes either as standalone devices, or as more complete 'systems' in pilot studies (e.g. Whole System Demonstrator³¹). The packages use technologies that can be classified either as monitoring devices that measure vital signs, activity and movement, or as other physical wellbeing monitoring tools.

Vital sign monitoring

Vital sign monitoring devices have been developed and include devices that measure trends in blood pressure, weight, blood oxygen and glucose. The devices are often 'separate' but packaged together on a personalised needs basis.

Vital signs can be remotely monitored automatically and continuously (e.g. via wearables) or intermittently. For instance, the VIRTE_x project (see Annex B) has explored the use of health booths in a shared supported housing space for residents to measure their own blood pressure. Smart toilets, which have been on the market for several years (e.g. WellYoull), have been designed to analyse urine samples for health indicators such as sugar level, albumin and blood^{32,33}.

Currently, there is extensive activity across a number of Primary Care Trusts (such as Nottingham³⁴, Sheffield^{35,36}, and Swindon^{37,38}) and in the Whole System Demonstrator trial in exploring how to better manage a range of chronic health

³¹ e.g. <http://www.dh.gov.uk/en/Healthcare/Longtermconditions/wholesystemdemonstrators/index.htm> (accessed: 27/11/09)

³² <http://www.cnn.com/2005/TECH/06/28/spark.toilet/index.html> (accessed: 15/01/10)

³³ <http://www.globalaging.org/health/world/toilet.htm> (accessed: 15/01/10)

³⁴ <http://www.tunstall.co.uk/assets/literature/Managing%20Long-Term%20Conditions%20-%20Nottingham%20PCT.pdf> (accessed: 27/11/09)

³⁵ <http://www.sheffield.nhs.uk/annualreport0809/7.php> (accessed: 27/11/09)

³⁶ <http://www.sheffield.nhs.uk/annualreport0809/12.php> (accessed: 27/11/09)

³⁷ <http://www.prlog.org/10111255-swindon-pct-launches-mainstream-telehealth-monitoring-service-for-copd-patients.htm> (accessed: 27/11/09)

³⁸ http://www.swindonpct.nhs.uk/the_board/board06/board_sept06/item_90a_telehealth.pdf (accessed: 27/11/09)

conditions. In the boxed example below, Steve Sadler (Tunstall Group, a partner in the Whole System Demonstrator Trial) describes some of the devices and services offered to service users in this trial.

Whole System Demonstrator

In what is possibly the world's largest telehealth and telecare trial, the Whole System Demonstrator (with around 6,000 users across Cornwall, Kent and Newham) uses two way communication to support effective feedback between health and social care monitoring centres and service users, providing reassurance that health care professionals are aware of their physical state and are available to communicate with them when necessary.

"...we provide equipment to people in their own homes or sometimes on the move. That equipment usually has a set of peripheral devices associated with it that are specific to their health or care needs, through for example blood pressure kits, weighing scales, glucometers for somebody monitoring their diabetes, all the way through to smoke detectors, flood detectors, door alerts for monitoring a relative with an Alzheimer condition. Those peripheral devices would map to your individual need and usually would be communicated via a hub device. It's the job of that hub device to get the data across a telecommunications network to the 'far end'. The 'far end' could be a family member or a carer, or more often than not, it would be an intermediary service provider – someone who 24 hrs a day, 365 days a year, is providing remote support and reassurance. This can be for real time alerts, such as smoke detection for a fire, through to a clinical nursing environment providing triage of your vital signs that alerts to a declining condition, perhaps in your diabetes or congestive heart failure. What Tunstall provides is everything from the equipment and peripheral devices in the home to assistance with the delivery the supporting services at the 'far end'." (Steve Sadler, Tunstall Group)

Health conditions that have received the most attention to date (e.g. in the Primary Care Trust pilots) have included chronic heart disease, chronic obstructive pulmonary disease (COPD), and diabetes. Professor Gail Mountain, one of our interviewees, described the devices used in one of her projects that offer telehealth services for people with heart disease.

"The SMART2 project is into the third year now. We have a prototyped device [...] to help people with congestive heart failure to self manage their condition, through the device registering their vital signs and suggesting the amount of activity that a person might engage in that day. Our project is focused on the level of physical activity - we had to focus on one aspect of life, to include everything was just impossible. [...] We are using commonly encountered technology like mobile phones, touch screen computers, sensors, accelerometry, and working on how they can be configured together to create an intelligent system." (Prof. Gail Mountain, University of Sheffield)

Studies that quantify the benefits to physical health outcome are not yet widely documented, and qualitative, anecdotal evidence is more common. However,

there are some positive findings. For instance, research indicates that users achieve greater control over their glucose levels (without increasing low blood sugar levels) with personal continuous glucose monitoring³⁹.

The currently narrow range of conditions managed in these types of telehealth trials could be extended through NGS to other health conditions with full roll-out to all health service users, as indicated by this interviewee's comments.

"There's definitely a consumer market potential. Where you don't qualify for government-funded support, or where the need is for self care then we look for applications and technology that are familiar, perhaps the mobile phone, and in the home, your TV, your PC. However, where health needs are more specialised in terms of functionality or the user interface, it can be harder to map these standard technology platforms." (Steve Sadler, Tunstall Group)

Developments are also under way in designing user-accepted, non-stigmatising wearable technology. For instance, the Sensium-enabled digital plaster (developed by Toumaz Technology in partnership with Imperial College London) measures temperature, heart rate and respiration. An objective of recent research with this digital plaster has aimed to ensure that the data quality was comparable to the standard obtained with formal monitors⁴⁰. In another example, the New Dynamics of Ageing Project (see Annex B) is developing non-stigmatising, smart wearable technology designed to both monitor vital signs and promote "optimal, safe exercise" to enhance wellbeing.

In the more distant future, there is speculation that implanted technologies may be available to more accurately monitor vital signs (e.g. organ monitors, cancer detectors)⁴¹.

Activity and movement monitoring

Devices have been developed and deployed to monitor a user's movement, activity or location. These hold particular benefit for users who are prone to falling, which is more common in later life, by being able to detect, at an early stage, possible causes for a fall. In one of the project interviews, Intel relayed that health clinics that specialise in falls and blackouts can be difficult to access so these technologies can be used to improve wider access to this type of service. Other movement detectors include epilepsy sensors.

Some types of bed occupancy detectors and room monitoring/occupancy detectors can learn users' daily patterns of movement and provide alerts when their routine is changed (e.g. if someone tends to take half an hour to prepare their lunch but has not left the room for an hour, this may trigger an alert). For instance, the Emergency Monitoring and Prevention (EMERGE) project (see Annex B) uses activity and movement monitoring in addition to vital sign data to notify health professionals/emergency services where the data indicate deviations from normal routine.

Data can also be used (in combination with vital signs) to support or enhance a level of independent living that is adaptable to users' changing needs. This can

³⁹ <http://www.medicalnewstoday.com/articles/170943.php> (accessed: 27/11/09)

⁴⁰ <http://www.toumaz.com/public/news.php?id=91> (accessed: 27/11/09)

⁴¹ Kustanowitz (Spring, 2004). Personal medical monitoring devices. http://www.cs.umd.edu/hcil/iHealth/personal_device.htm (accessed: 27/11/09)

reduce premature dependence on technology (e.g. Hermes project: see Annex B).

Other movement monitoring devices include location-based (wayfinding) services (e.g. Buddi system in Whole System Demonstrator). These can support physical wellbeing, when the user is prone to forgetfulness and getting lost, by sending a signal to carers when the user travels beyond a designated 'safe zone'.

Ultimately, monitoring devices, as part of a wider care programme, could help support reduced admissions to care homes, promoting more independent living in people's own homes⁴².

Other physical wellbeing monitoring

Other devices monitor other types of health data, providing alerts about the home environment (e.g. safety detectors) and self (e.g. sensor to monitor when the bed is wet). Some can offer lifestyle reassurance and nutrition advice (e.g. the Open Architecture for Accessible Services Integration and Standardisation (OASIS) project: see Annex B) based, for example, on existing medical conditions (e.g. diabetes)⁴³. For instance, the FitBit Tracker⁴⁴, is a clip-on device which monitors the number of calories burned and physical steps taken. The data is provided to the wearer of the device.

Games such as the Wii Fit have generated a lot of interest from researchers exploring whether people are more likely to engage with physical exercise programmes when presented in a more game-style context. Recent research⁴⁵ suggests that this is the case: people who cycled in a videogame context were more likely to continue with the exercise regime than people who used only a 'low-tech' exercise bike without a videogame context.

A range of automated home environment communications to alert service users and others (e.g. carers) that there is a safety or security risk are relevant to mention here, in addition to the section on 'other day-to-day activities' (see Chapter 6). For some users, particularly those with memory and/or sensory impairment, there are clear potential physical wellbeing benefits from environmental monitoring devices, for instance, providing reassurance that the user and their possessions are secure. These include detectors and sensors for: floods (e.g. bath overflow), extreme heat (e.g. pan left on hob); gas/carbon monoxide leaks, and windows/doors (locked/unlocked). Pillow alerts can be provided where a security or safety risk is identified when the user is sleeping. Other environment sensors ease activity around the home and make life simpler. Examples include sensors to open and close doors automatically, regulate ambient temperature, smart toilets that open and close their lids, and easier-to-use appliances (such as EasyLine+ for white goods). For example, STREAM Safe and Sound is an 'always on' system providing sensors for movement, door and temperature control to promote independent living⁴⁶.

⁴² http://ec.europa.eu/information_society/activities/einclusion/docs/ageing/overview.pdf (accessed: 27/11/09)

⁴³ e.g. 'Dr J says' application, part of the Aware Home Research Initiative of Georgia Tech
<http://awarehome.imtc.gatech.edu/research/chronic-care-management> (accessed: 27/11/09)

⁴⁴ <http://www.fitbit.com/> (accessed: 27/11/09)

⁴⁵ Rhodes, R., Warburton, D., & Bredin, S. (2009). Predicting the effect of interactive video bikes on exercise adherence: An efficacy trial *Psychology, Health & Medicine*, 14 (6), 631-640
<http://dx.doi.org/10.1080/13548500903281088>

⁴⁶ <http://www.connectyorkshire.org/news/general/305632> (accessed: 27/11/09)

There is a range of projects exploring these types of technologies in smart homes (e.g. Mpower; Health Hub, Persona: see Annex B).

Developments in the area of preventative services/early detection are also relevant, including technologies that monitor a range of personal health, movement and other data to identify early stages of disease, or health conditions that might otherwise go undetected⁴⁷. Relevant research projects in this regard include Elder Games, Persona and EMERGE (see Annex B). Research at Intel to monitor falls and blackouts has already been noted, and Niamh Scannell (Intel Corporation) describes why this area is important:

“A fall is usually a symptom of other things that are going on and so by the time you’ve had an injury you’ve probably had many other falls before that, or trips or stumbles [...] so you’ve been on a decline that hasn’t been observed, so by the time you get to be admitted you’ve broken a leg or an arm or need stitches or whatever it is – you’re well on that path.” (Niamh Scannell, Intel Corporation)

Intel is also researching the potential for technology to help older people train themselves to maintain attention using bio-feedback tools. Key considerations for this type of product were simplicity and ensuring validity of the method:

“We were trying to see how you could use something very simple at home [...] a little sensor [...] [and] we can gather the data to see if it’s actually working.” (Niamh Scannell, Intel Corporation)

Other in-home rehabilitation therapeutic services are being developed. These include exercises that are adaptive to user requirements/abilities. Examples include the Gait Trainer project⁴⁸ and the i-Stretch⁴⁹ project (reaching task therapy) (also see Annex B).

The resultant data from any of these types of device are sent directly to health professionals where significant changes in the data can be automatically detected, prompting a response. In some instances any data signalling an emergency can also trigger an alert to carers. Some health service packages (e.g. Whole System Demonstrator) also include means of easily gaining access to the user's home in the event of an emergency (e.g. a key-safe outside the home). As illustrated in the quote below, some telehealth systems are also interactive, probing their users about their subjective health state.

“[some telehealth systems] try to provide an intelligent health interview, not to the quality you would receive from a nurse visit – that’s a skilled intervention – but to try and supplement that service. In other words maybe only one nurse visit in three needs physical attendance, the others by remote monitoring.” (Steve Sadler, Tunstall Group)

3.2.5 Improved psychological health management and wellbeing

The areas of improved social connectedness (online) and serious games for monitoring and maintaining physical and mental agility are relevant to improved psychological health management and wellbeing.

⁴⁷ http://www.intel.com/healthcare/hri/pdf/proactive_health.pdf (accessed: 27/11/09)

⁴⁸ <http://kn.theiet.org/magazine/issues/0917/gait-analysis-0917.cfm> (accessed:27/11/09)

⁴⁹ <http://www.computing.dundee.ac.uk/staff/jessehoey/research/istretch/index.php> (accessed27/11/09)

There are numerous opportunities for internet users to join online communities or to establish their own group for people with similar health concerns, demographics, or illness. Reaching out to others with similar needs for support could benefit the health of the person, as indicated by traditional patient group forums set up in hospitals. The opportunities for linking with others have grown with the increased popularity of social networking sites and groups. For instance, online users can join specialist groups within existing social networking communities like Facebook, or dedicated sites such as MyCancerPlace⁵⁰, Sagazone⁵¹, Finerday⁵² and Jive⁵³.

'Brain fitness' applications have become common in the general gaming market and numerous projects are currently under way to explore the potential of brain training to reduce the speed of decline in cognitive functions that naturally occurs with age (e.g. Vital Mind and OASIS projects: see Annex B). Again, for many of these applications and projects, the television has been embraced as an acceptable medium for the target user group through which to 'play' these types of serious games.

3.2.6 Improved motivation and self-management of health (information, reminders and motivational tools)

"There are plenty of case studies out there that show that through access to health trend information, people can improve their own health expectations." (Steve Sadler, Tunstall Group)

At the most basic level, health service users in the future are expected to be more empowered through greater access to information^{54,55}. Provision of specialist information about health and medical conditions is becoming wider and more comprehensive, and further developments in this area are anticipated in the future with the semantic web/web 3.0⁵⁶. The semantic web represents the next evolution of the World Wide Web. To search information, the web currently relies on 'keyword' matches; in the future, the meaning of the information sought and other information available from potentially relevant sites should be better understood by the technology, enabling more accurate, tailored and useful health information/service searching⁵⁷.

Satisfying information needs, as required, can result in better health management benefits^{58,59}. As described in Chapter 2, for people with particular access needs, more flexible and personalised formats could become more

⁵⁰ <http://www.mycancerplace.com/> (accessed: 23/04/10)

⁵¹ <http://www.sagazone.co.uk/> (accessed: 23/04/10)

⁵² <https://www.finerday.com/> (accessed: 23/04/10)

⁵³ <http://jive.benarent.co.uk/> (accessed: 23/04/10)

⁵⁴ <http://www.dh.gov.uk/en/Healthcare/PatientChoice/BetterInformationChoicesHealth/index.htm>

⁴⁸ Masai, C.M., Suarez-Balcazar, Y., Cassey, M.Z., Kinney, L. & Piotrowski, H. (2007). Internet access and empowerment: A community-based health initiative. *Journal of General Internal Medicine*, 18 (7), pp. 525-530

⁵⁶ <http://www.w3.org/2001/sw/> (accessed 23/03/10)

⁵⁷ Berners-Lee, T., Hendler, J., & Lassila, O. (May, 2001). The Semantic Web: A new form of Web content that is meaningful to computers will unleash a revolution of new possibilities. *Scientific American* <http://www.scientificamerican.com/article.cfm?id=the-semantic-web>

⁵⁸ http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/documents/digitalasset/dh_100947.pdf (accessed: 27/11/09)

⁵⁹ <http://www.tunstall.co.uk/assets/literature/Managing%20Long-Term%20Conditions%20-%20Nottingham%20PCT.pdf> (accessed: 27/11/09)

readily available, and information that was traditionally difficult, time consuming and expensive to obtain could, as with other areas of information access, become more easily accessible. As the following quote indicates, sometimes information alone can prevent accidents. In this example, simply knowing that it's best to wait a moment after getting up from a lying-down position could prevent a fall. Wider and targeted access to this type of helpful information, which could be better enabled through NGS, could benefit some older people.

"If [older people] knew that when they're lying down they should just sit up for a moment and wait [...] let their blood pressure stabilise and then go into the bathroom [...] there's no piece of technology for that." (Niamh Scannell, Intel Corporation)

Users could be more empowered though increased understanding of health, illness and wellbeing. This could lead to improved compliance with health management, as indicated by one of our interviewees below, as it promotes shared responsibility between health care professionals and the service user. This in turn could result in better prognoses.

"There's a likelihood that we'll be more engaged or involved with the management of our conditions in the future, making people more equal partners in their own health behaviours." (Simon Roberts, Intel Corporation)

Improved, convenient access to sensitive (personal/medical) information is also of benefit to people who might otherwise shy away from speaking to a medical professional (e.g. about 'embarrassing' problems), and for people who require an intermediary to support their communications with others (e.g. people who rely on sign language). Improved accessibility of information and alternative forms of communication with health professionals should reduce this hurdle.

"Men usually don't go to the doctors, by and large, until it's critical. So we know that people search for more information, so simpler information may break down fears about potential conditions." (Stephen Dodson, DC10plus Network)

The provision of reminders and alerts can increase general compliance with health management, such as taking medication or keeping appointments⁶⁰. This may be particularly useful in cases where people are less motivated, or able, to take an active role in managing their own health (e.g. general age-related cognitive decline, dementia, learning difficulty, and psychological disorders such as depression and schizophrenia). For instance, to enhance compliance with taking (the correct dose of) medication or keeping medical appointments, a range of services are in development and the television set has been used as the interface in many of the projects (e.g. VIRTE_x project). The STREAM Personal TV (IPTV service) set up by Hull City Council offers health and lifestyle advice whereby each user can get a personalised experience with recommendations specific to their needs. In some systems, users are provided with a device to generate their own recordable reminders (e.g. in the Whole System Demonstrator).

⁶⁰ Witter, J., Steele, A., McEwen, D. & Mehler, P. (2002). The Effect of Computer Generated Appointment Reminders On Compliance With Clinic Appointments. The Internet Journal of Medical Simulation and Technology. 1(1)
http://www.ispub.com/journal/the_internet_journal_of_medical_simulation_and_technology/volume_1_number_1_71/article/a_study_of_contrast_detail_detectability_of_computer_generated_test_objects.html

The types of messaging can range from managing existing illness to supporting health and wellbeing (e.g. smoking cessation programmes⁶¹) by prompting people to engage with day-to-day tasks that would compromise health and wellbeing if they were not followed (e.g. automated reminders for food provisions: Easy Line Plus project - see Annex B). Reminders could offer particular benefits to people who have difficulties with remembering.

In terms of motivational tools, gaming is relevant and has potential to engage and motivate whilst informing about health-related issues through entertainment. This has potential to support people who may have difficulty comprehending complex information about health conditions. Using a gaming context, levels of information could be graded (basic through to more advanced information) and retention of information is likely to be facilitated through entertaining repetition.

Engaging, entertaining and motivating games can also be used as tools to support people with limited mobility (e.g. following a stroke) in rehabilitative exercises (e.g. Motivating Mobility project, REPAIRS: Realistic Environments for Personalised And Interactive Rehabilitation Systems project: see Annex B).

Until recently, people suffering illness and disease previously might have had difficulty finding similar others to share information and experiences. As noted above, online communities can now provide a platform to enable mutual support. Some projects, including the one described below by Stephen Dodson (DC10plus Network), have illustrated how targeted information and support programmes can have beneficial effects for community building.

“An innovative project in Birmingham is called ‘A Healthy Way to Learn ICT’. This provides the Pakistani and the Bangladeshi community with easy to understand information about diabetes. At the same time it supports the adoption of ICT [and language] skills. [...] This can have the knock on benefit of improving community cohesion.” (Stephen Dodson, DC10plus Network)

3.3 Challenges to future service provision

There are a number of challenges that are specific to this type of service provision, including issues around the nature of the data (sensitivity data, security, priority), interoperability of devices, and managing user perceptions and experience of health monitoring services (e.g. social isolation). Other challenges that relate (although not exclusively) to health and wellbeing services are discussed in Chapter 7.

3.3.1 Quality of NGS

Reliability of service in the health and wellbeing context is more critical than in other service areas (e.g. leisure), as poor service reliability is potentially life-threatening (e.g. IBM research: Health Management, Monitoring and Fault Localisation for Middleware Systems⁶²). As some of our interviewees emphasised, the network on which the data for these types of health services is carried needs to be reliable and secure and have high bandwidth (NGN).

“[...] there is a need for high bandwidth, a need for symmetrical connections, because people are working peer-to-peer, and a

⁶¹ <http://www.thecommunityguide.org/tobacco/cessation/providerreminders.html>

⁶²

[http://domino.research.ibm.com/comm/research_people.nsf/pages/vijamann.pubs.html/\\$FILE/dsom2006_final.pdf](http://domino.research.ibm.com/comm/research_people.nsf/pages/vijamann.pubs.html/$FILE/dsom2006_final.pdf) (accessed 27/11/09)

need for reliability – for the transmission of sensitive data.” (Dr. Paul Timmers, European Commission)

Furthermore, the network should be designed to allow some types of data to take precedence over less critical data, as indicated in the quote below:

“Whilst we could naively say that everything will be delivered through a high bandwidth channel, the reality is that we need to be smarter in terms of our system design, we need to think about how we use these networks.” (Steve Sadler, Tunstall Group)

One major concern in this area, flagged by several interviewees, is that some analogue health and security monitoring systems that are already on the market and in use in people's homes may not work with the new network infrastructure. This has important implications for service users' health and safety, and must be addressed.

“The dilemma we have is that new digital networks threaten the assumed stability of the existing analogue connections and we need to accept that as an issue to help us move forward.”
(Steve Sadler, Tunstall Group)

Furthermore, as illustrated in the quote below, interoperability of devices will be a key challenge for delivering a seamless experience to users, and for a coordinated and comprehensive information base for health service staff to use⁶³.

“If you look at the barriers and challenges on take-up of assisted living technologies then the absence of interoperability between devices and the lack of standardisation is one of the major issues.” (Graham Worsley, Technology Strategy Board)

3.3.2 Protection of health data for NGS

Health service data provided over networks do not currently fit well with current confidentiality laws. One of our interviewees (from RNID) raised this issue, which was brought to their attention by complaints from their members. They sought clarity on how service providers could reconcile the fundamental conflicts with legislation, particularly in the future.

3.3.3 User and provider perceptions and attitudes to NGS in health

As many of our interviewees emphasised, socialising has an important role in maintaining good health and wellbeing.

“... there is evidence that people are happier as social animals [...] when you begin to think about telehealth, you need to think about how you also preserve the benefits that were gained by going to see the doctor...” (Prof. Alan Newell, University of Dundee)

Some users perceive that telehealth services will result in increased isolation⁶⁴. This may be particularly concerning for those who value face-to-face contact

⁶³ http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/documents/digitalasset/dh_100947.pdf (accessed: 27/11/09)

⁶⁴ Hanson, J. & Percival, J. (2006). Differing perspectives on telecare: an attitudinal survey of older people, professional care workers and informal carers. In: 3rd Cambridge Workshop on Universal Access and Assistive Technology (CWUAAT), 10-12 April 2006, Cambridge, UK. <http://eprints.ucl.ac.uk/3834/> (accessed: 27/11/09)

and need it most. This is a risk that needs careful management, not least in users' perception and acceptance of the service. Most interviewees asserted that technology should not intend to replace face-to-face contact for health care services.

"I don't think technology, telecare, telehealth care should replace human contact. [...] But the reality is there are going to be less young people relatively to the number of older people so there won't be the same number of people to provide the care for the older people." (Niamh Scannell, Intel Corporation)

Niamh Scannell also suggested that other service areas not covered in this report, such as improved transport services, are important in ensuring that older and disabled people have better opportunities for mobility, so that face-to-face contact can be supported.

The rationale for delivering health care in such new and seemingly radical ways needs careful and clear communication with health service professionals and users alike. The quote below emphasises this need for new management processes and styles.

"The challenge relates to infrastructure [...] Policy makers saw cost savings being the driver without taking sufficient account taken of the resources required to create the infrastructure and change the way things are done. In order to embed new technology we need to start educating health service professionals for the future." (Prof. Gail Mountain, University of Sheffield)

To accept this alternative delivery of health and wellbeing services, people will need to trust the technology, and the benefits need to be clear to users. For instance, the Ambient Intelligence for the Networked Home Environment (AMIGO) project aims to develop attractive end-user services that will demonstrate how prototype applications relate to everyday life (see Annex B). The importance of communicating the benefits of NGS in relevant and meaningful ways was highlighted in our interviews:

"[older people] are not afraid of technology, but if they haven't used PC-based technology through their lives, they are not clear of what it can do for them." (Niamh Scannell, Intel Corporation)

Similarly, the technology must be usable by all users (health professionals and service users) to ensure effective use of the systems, which is of paramount importance in a health context. Interactive devices, interfaces and outputs should be easy to understand and use. For instance, the Service-oriented Programmable Smart Environments for Older Europeans (SOPRANO: see Annex B) project focuses on designing interfaces for assisted living services that are easy to use for older people.

Finally, whilst the aim of many of these new services is to support and enhance people's health and wellbeing, there is a real risk that the technology will make people's abilities redundant; people may become prematurely reliant on the technology⁶⁵. Technology that learns and adapts to users' changing abilities is

⁶⁵ http://www.intel.com/healthcare/hri/pdf/proactive_health.pdf (accessed: 27/11/09)

desirable to users,⁶⁶ and developments towards this type of adaptive technology should reduce this risk.

⁶⁶ Morris, M & Lundell, J. Ubiquitous computing for cognitive decline: Findings from Intel's Proactive Health Research. http://www.alz.org/national/documents/Intel_UbiquitousComputing.pdf (accessed 27/11/09)

4 Work and Education

Summary

The project identified three key developments in the provision of future work and education NGS, including:

- a. Increased participation: the project identified multiple services in the research and development stage, and many already in use, that have the potential to enable older and disabled people to participate more easily in the spheres of work and education. These include services that support greater remote presence (e.g. feeling involved in a work or study situation through high quality audio-visual interaction devices) and enable access to shared information resources (e.g. using the cloud).
- b. Reduced social isolation: flexible and adaptable use of new communications services and tools has the potential to increase older and disabled people's access to working and learning, helping to overcome the potential less-desirable aspects of working and studying at a distance from colleagues. New tools and services enable users to share information about their current situations (for example, how they feel or what they are doing) via communications devices, and to work collaboratively on documents.
- c. Improved access: for study and work, searching for and accessing information has become easier through the internet, and the trend is likely to continue with ongoing developments in easier and more intuitive online search and information access, and NGS and applications that will rely on it. Increased distribution of digital forms of communication can render material more accessible to those with disabilities because the form of the content can be more flexibly delivered according to users' needs (e.g. text, speech, video).

Potential benefits of NGS in work and education for older and disabled people support improvements in their quality of life, and include:

- a. greater financial independence;
- b. more independent living;
- c. improved psychological wellbeing; and
- d. an improved sense of self-worth.

In addition, NGS in work and education have the potential to support older and disabled people to contribute more to society and for longer – whether in paid or voluntary capacities. This is an important potential benefit for them, to older and disabled people given current plans to extend the retirement age, and the likelihood of large numbers of older people having to live without adequate pension provision. And for society at large it is beneficial to make the most of the knowledge and experience of older and disabled people.

This chapter outlines a range of technological developments and services in the area of work and education. Compared with the current provision of services in these areas (summarised in Section 4.1), the trend is towards remote participation in work and education; more flexibility in work and learning patterns (access to work/education content anywhere, any time); and improvements to the quality of those remote interactions and participatory activities (e.g. through video). In the education sphere, opportunities are increasing for users to also produce their own content.

As with health and wellbeing services, many of the near-future products and services are developments of existing ones. Broadband speed is currently a limiting factor on the extent to which these existing services can be enhanced (e.g. with video) and provided in good quality for everyone. One of our interviewees used an example of weather disruption to the transport system to illustrate how increased demand on the current network results in poor quality of service for people working from home. With NGN, these technological hurdles could be overcome.

"... when we had 5 million people trying to work from home [because of travel problems as a result of snow], the system was just woeful, on and off all the time." (Stephen Dodson, DC10plus Network)

4.1 Current context

4.1.1 Exclusion faced by older and disabled people

Only around half of disabled people are employed, and employment prospects are typically associated with low pay and low-skilled jobs⁶⁷, reducing people's financial independence. Loss of the social contact associated with participation in work and education can increase social isolation⁶⁸.

Currently, the UK's default retirement age for state pension is 65 years (Pensions Act, 1995⁶⁹). People who wish to continue to work beyond this age have the right to make this request. However, non-profit organisations (e.g. Age UK) are campaigning to remove the possibility that older workers can still face age discrimination and be forced to retire when they are 65 years old⁷⁰.

Discrimination, lack of flexibility by employers about where and when to work, and poor access to ICT can all influence the roles that older and disabled people have in work and education. Furthermore, older people tend to have lower (electronic) media literacy⁷¹ than younger people^{72,73}. Compared with their younger counterparts, older people are less likely to own media technologies (e.g. mobile phones, the internet), and are less likely to use the internet as

⁶⁷ Parkcar, G. (2008). Disability Poverty in the UK. Leonard Cheshire Disability. <http://www.lcdisability.org/?lid=6386> (accessed: 24/03/10)

⁶⁸ <http://www.citra.org/wordpress/wp-content/uploads/Social-Isolation.pdf>

⁶⁹ http://www.opsi.gov.uk/acts/acts1995/ukpga_19950026_en_1

⁷⁰ <http://www.ageuk.org.uk/pages/campaigning>

⁷¹ Ofcom define media literacy as, "the ability to access, understand and create communications in a variety of contexts". http://www.ofcom.org.uk/advice/media_literacy/of_med_lit/whatis/ (accessed: 23/04/10)

⁷² Ofcom (April, 2006) Media Literacy Audit: Report on media literacy among older people. http://www.ofcom.org.uk/advice/media_literacy/medlitpub/medlitpubrss/older/ (accessed: 24/03/10)

⁷³ Ofcom (October, 2009). UK Adults' Media Literacy. http://www.ofcom.org.uk/advice/media_literacy/medlitpub/medlitpubrss/uk_adults/ml/

frequently, or for as many purposes. Older people are more likely to cite lack of motivation and interest in, or relevance of, using the internet^{72,74}.

In Ofcom's *Consumer Experience* report (2008)⁷⁵ research with people with a learning disability revealed that home internet access was not widely owned or used. Non-ownership was attributed to "low literacy levels, cost and a perceived lack of need" (p. 50). For people with a visual impairment, access to the internet was limited by the costs of software to enable access to computers and the internet, and lack of opportunity to try out software before purchasing it. As reported in the *Consumer Experience* report (2009)⁷⁶, whilst around 90% of 40 research participants with upper body dexterity and mobility impairment had home access to the internet and high levels of use, installing and setting up internet-related (and other communications) equipment posed a bigger problem for these respondents than using it.

4.1.2 Flexible working and learning – current pros and cons

There has been more a recent trend towards acceptability of home-working in some occupational fields allowing workers some flexibility around other life demands (e.g. children and family, health service appointments)⁷⁷. Home working is useful for people with mobility and other impairments that may restrict access to some jobs because of problems with accessing public transport.

However, being physically present (at place of work or study) can increase overall engagement with the establishment and its users (colleagues, staff and students), enhance team working, and can increase awareness of other benefits offered by the establishment (e.g. extension of social networks and social/leisure interests)⁷⁷.

Technology, with the advent of email, online 'chat' and VoIP type applications, is increasingly narrowing the barriers previously associated with working from home. However, there are other issues for home-working that still need consideration. At home, ergonomics may not be optimal, remote technical support may not be as adequate as working in the office, and extra costs (electricity, heating) may fall on the worker⁷⁸. In terms of team working structures, it may be more difficult to manage staff at a distance and to maintain cohesive team structures⁷⁹. This may result in some exclusion to people working from home. In many ways, current technologies are not yet able to fully support the sense of being in the office or in an educational class⁷⁹.

4.2 Future service provision: potential trends and benefits

The needs of people in work and education are likely to be met by a range of services including services that support communication preferences (e.g. VoIP

⁷⁴ Ofcom (June, 2009). Accessing the internet at home: A quantitative and qualitative study among people with the internet at home by Ipsos Mori
<http://www.ofcom.org.uk/research/telecoms/reports/bbresearch/bbathome.pdf> (accessed 23/04/10)

⁷⁵ Ofcom (November, 2008). The Consumer Experience 2008: Research Report.
<http://www.ofcom.org.uk/research/tce/ce08/research.pdf>

⁷⁶ Ofcom (December, 2009). The Consumer Experience 2009: Research Report.
<http://www.ofcom.org.uk/research/tce/ce09/research09.pdf>

⁷⁷ Gareis, K., Hanhike, T., Ylöstalo, P. (2007). eWork and pro-active work organisation: Reaping the benefits of ICT-based forms of working. Paper for the 12th International Workshop on Telework (ITA 2007) Lillehammer, August 28-30. <http://www.empirica.biz/publikationen/documents/gareis+hanhike+ylostalo.pdf> (accessed: 03/12/09)

⁷⁸ <http://www.silicon.com/management/hr/2009/11/17/does-your-business-really-need-an-office-39650565/>

⁷⁹ <http://www.eto.org.uk/faq/faq03.htm>

services); enable access to and sharing of resources (Cloud/VPN); and enhance the quality of communication and training/learning experiences (e.g. 'presence' - improved video, teleconference, virtual work/education spaces).

In the interviews for this research, general visions for future work and education were provided, as illustrated below.

"Where the bandwidth becomes important for us is being able to do your job from home, to have less of a distinction between home and the work place. This will benefit people who maybe aren't able to use offices in a traditional sense, or to carry on working longer." (Simon Mycock, BT)

"They also need to get [super-fast broadband] to rural businesses. It reduces environmental impact if people are able to work from home, more effectively, more reliably, and more innovatively. And it could reduce costs by millions." (Stephen Dodson, DC10plus Network)

4.2.1 Increased participation in work and education

A number of factors may contribute to increased participation in the work and education domains for older and disabled people who may have been previously excluded because of their abilities and needs.

Technologies are enabling efficient and flexible working and learning patterns. This allows workers and learners who are older or disabled to work around their needs and preferences, for instance, by travelling at off-peak time, and around important health-related appointments. In turn, other benefits include reduced travel times and related expenses. Technologies now offer users opportunities to be remote recipients of information – to acquire new abilities, and retain/practice existing skills (e.g. LearnDirect⁸⁰) – as well as create new content (e.g. education courses) for others' consumption (e.g. the virtual learning environment, Modular Object-Oriented Dynamic Learning Environment (MOODLE)⁸¹). With this flexibility afforded by technologies, wider work and learning opportunities are possible (e.g. not just those that are locally available) meaning that access is not restricted by a person's level of mobility.

Virtual private networks (VPNs) are (cloud-based) services that support home working and so could contribute to more flexible working practices in the future. NGN will overcome some logistical problems with current broadband speeds; for instance, improving download/upload speeds for VPNs in accessing and sharing documents electronically, and remotely. A wide range of VPN services is available⁸² and once VPN performance is optimised for the faster bandwidths enabled by NGN, increased competition between providers and more choice for the user are likely.

Alternative communication channels (personalised for ability and preferences) could be easier and cheaper to access with the wider provision of software as a service, whereby software enabling access (e.g. text to speech) is available anytime and anywhere.

⁸⁰ www.learnirect.co.uk (accessed: 03/12/09)

⁸¹ <http://moodle.org/> (accessed: 03/12/09)

⁸² http://www.vpntools.com/vpntools_articles/vpn-business.htm (accessed: 03/12/09)

Employers' changing attitudes towards working practices (supported by legislation such as the right to request flexible working⁸³; outlawing age and disability discrimination in the workplace^{84,85}) and changing attitudes (and possibly legislation) towards working beyond retirement⁸⁶ are also facilitating older and disabled people's participation in employment.

In the education sector there are trends towards flexible learning that may be better able to meet the 'when and where' needs of older and disabled people, improving their work-life balance (e.g. Open University⁸⁷, National Extension College⁸⁸, LearnDirect). In general, distance learning schemes are now more common, and many universities are expanding into wider content offerings in this regard.

There are many programmes that, and projects exploring how to, better support learning of the internet for e-education services. For instance, e-Learning for Seniors Academy (eLSe) is a project that aims to develop and test an ICT (information and communication technologies) -based education environment designed specifically to meet the needs of older people who have little or no prior ICT experience⁸⁹.

In another initiative, the European Digital Older Learners (EDOL)⁹⁰ project targets the over-50s and aims to introduce older people to computing using an online community approach. The project has two active 'student groups' in Norfolk.

Other projects and centres relevant to encouraging inclusion of the ageing population in the work and education information society include SENIOR LEARNING⁹¹, eSangathan⁹² and the Centre for Research into the Educational Applications of Telematics (CREATE)⁹³ (see Annex B). Whilst not exclusively related to teaching older people ICT skills, the recently completed Seniors in Action project⁹⁴ (2007-2009) is still relevant here. It aimed to harness the skills and expertise of older people to share their specialist knowledge (e.g. mathematics, poetry, organic farming), encourage participation, and act as informal educators of younger people. Both traditional face-to-face and ICT-based contexts were used in the project, which helped to familiarise older

⁸³ http://www.direct.gov.uk/en/employment/employees/workinghoursandtimeoff/dg_10029491 (accessed: 24/03/10)

⁸⁴ http://www.direct.gov.uk/en/Employment/ResolvingWorkplaceDisputes/DiscriminationAtWork/DG_10026429 (accessed 24/03/10)

⁸⁵ http://www.direct.gov.uk/en/DisabledPeople/Employmentsupport/YourEmploymentRights/DG_4001071 (accessed 24/03/10)

⁸⁶ Age UK (2010) Agenda for later life: Our five year ambition for public policy. http://www.direct.gov.uk/en/DisabledPeople/Employmentsupport/YourEmploymentRights/DG_4001071 (accessed: 24/03/10)

⁸⁷ <http://www.open.ac.uk/> (accessed: 03/12/09)

⁸⁸ www.nec.ac.uk/ (accessed: 03/12/09)

⁸⁹ <http://www.arzinai.lt/else/index.php> (accessed: 03/12/09)

⁹⁰ <http://www.theforumtrust.co.uk/research-and-innovation/european-digital-older-learners--edol-.htm> (accessed: 03/12/09)

⁹¹ <http://82.223.160.93/site/Output%201%20-%20Senior%20Citizens%20elearning%20needs%20report.pdf> (accessed: 03/12/09)

⁹² <http://www.esangathan.eu/> (accessed: 03/12/09)

⁹³ http://www.elearningeuropa.info/directory/index.php?doc_id=5215&doclng=6&page=doc (accessed: 03/12/09)

⁹⁴ <http://www.ecose.org/seniorsinaction/> (accessed: 03/12/09)

people with new communication tools. There is evidence that older people who get involved with online courses find new purpose and excitement in their lives⁹⁵.

Technologies and applications are available that allow people not only to be passive recipients of information but to also produce their own material (e.g. educational content) to share with other interested recipients. However, this assumes that older and disabled people will have the ICT skills to use these types of applications and services.

Some web-based applications make it easier for people offering education content to create their own online websites (e.g. Moodle). Theoretically, this should better enable older and disabled people to produce educational content in forms suitable to other people with similar accessibility and information needs and requirements. Indeed, there is increasing production and availability of communications and courses directly relevant to older and disabled people (e.g. Eldercare online⁹⁶, The University of the Third Age (U3A)⁹⁷).

Through improved access to work and education, and also through user-generated content, older and disabled people could be enabled to participate more in society. This could promote better representation of older and disabled people in work and education.

4.2.2 Reduced social isolation & higher social participation

Flexible practices can increase older and disabled people's access to working and learning. However, working and studying at a distance from colleagues and fellow students can have less desirable impacts. These include poor cohesion with team-mates, difficulties managing other staff from a distance, increased likelihood that communications about goals are not clearly understood (mutual feedback), and a poorer sense of affiliation with the establishment and all its other activities (e.g. the coffee room, the Students' Union)^{98,99}. These can all lead to increased social isolation and difficulty 'fitting in' with the culture. Arguably, however, social isolation is already an issue for many older and disabled people in the current work and education spheres¹⁰⁰.

It is likely that NGS can go some way to mitigating these less desirable qualities of flexible work and study. Such enhanced services have the potential to improve social and community engagement in these contexts, involvement in which is associated with the enjoyment of being part of a group¹⁰¹. As Dr. Paul Timmers noted, these types of social benefits from inclusion in work and education have wider economic impacts:

"...For example, older workers can stay in employment, or people with disabilities can work more conveniently. And how

⁹⁵ Swindell, R. (2002). U3A online: A virtual university of the third age for isolated older people. *International Journal of Lifelong Education*, 21(5), 414-429

⁹⁶ <http://www.ec-online.net/> (accessed: 03/12/09)

⁹⁷ <http://onlinecourses.u3a.org.uk/> (accessed: 03/12/09)

⁹⁸ http://management.silicon.com/itdirector/0.39024673.39650565.00.htm?s_cid=455 (accessed: 03/12/09)

⁹⁹ Gareis, K., Hanhike, T., Ylöstalo, P. (2007). eWork and pro-active work organisation: Reaping the benefits of ICT-based forms of working. Paper for the 12th International Workshop on Telework (ITA 2007) Lillehammer, August 28-30. <http://www.empirica.biz/publikationen/documents/gareis+hanhike+ylostalo.pdf> (accessed: 03/12/09)

¹⁰⁰ <http://www.leeds.ac.uk/disability-studies/archiveuk/Barnes/bcodp.pdf> (accessed: 24/03/10)

¹⁰¹ Swindell, R. (2002). U3A online: A virtual university of the third age for isolated older people. *International Journal of Lifelong Education*, 21(5), 414-429.

much will that deliver for the economy?" (Dr. Paul Timmers,
European Commission)

On a practical level, working remotely but concurrently with other workers on the same document is possible with some applications (e.g. Groove Virtual Office¹⁰²). Opportunities are also available for remote access to multiple PCs (e.g. GotomyPC.com) and working on the move (M-Learning.org). NGS could enable everyone to enjoy these enhanced facilities.

In terms of communication with others, NGS could enable wider availability and better quality of VoIP (currently limited by bandwidth) for free or lower cost communication. The addition of video, text-relays, multi-user group chat and other enhancements to VoIP applications could allow for more accessible and natural interactions between colleagues and fellow students. In addition, access to professional online networking sites (e.g. LinkedIn) could improve with NGS.

Further developments in context-sensitive (personal and environmental) applications could enable more intuitive interactions at a distance. For instance, the Pasion project (Psychologically Augmented Social Interaction Over Networks: see Annex B) is exploring the implementation, and social interaction effects, of sharing group members' physiological, social and location-based data. In one work-based application (using a modified Skype application called Skypas), group members are provided with each others' data in meaningful ways (e.g. to indicate their emotion, location (quiet/busy), and social communication styles, such as likelihood of reciprocal interaction and social dominance). The project is exploring how the provision of these social cues affects group dynamics and behaviour in a work context. This and other types of new services could offer particular benefit to people who have difficulties with inferring emotion and behaviour from others' non-verbal cues, by making social behaviour more explicit.

Education establishments are beginning to have more of an online presence, offering more than merely educational material, and more visible and accessible links to other activities offered by the establishment that enrich people's work and education experiences beyond their core motivation to *be there* (e.g. virtual 'tours' around the campus of a University¹⁰³).

Improvements to video, presence (e.g. 3D) and real-time services (e.g. viewing live graduation ceremonies) create possibilities for virtual classrooms, offices and virtual university systems (e.g. Second Life¹⁰⁴). These could enable more realistic shared experiences, that are better able to capture the essence of *really being there* (presence) with others (social presence). This has the benefit of reducing exclusion from colleagues and fellow students. As the quote below indicates, these types of enhanced video applications will require superfast broadband enabled through NGS.

"[For a] business to business HD video call, if you want that real 'there in the room' experience you need an enormous amount of bandwidth..." (James Micklethwait, BBC)

4.2.3 Increased independence

Ultimately, increasing older and disabled people's access to work and education has the benefit of increasing financial independence and improving self-esteem.

¹⁰² <http://office.microsoft.com/en-gb/groove/default.aspx>

¹⁰³ <http://www.campustours.com/> (accessed : 24/03/10)

¹⁰⁴ <http://secondlife.com>

For some groups of older and disabled people, improving opportunities to be successful applicants in work and education is being explored. The impact of edutainment (where education content is presented in an entertaining context) and serious games applications are being developed with the aim of preparing people for work. For example, the Game On Extra Time project¹⁰⁵ is exploring how to better train and support people with learning disabilities to get and keep a job, and to promote independence using a games-based learning approach.

Innovative techniques to train and improve skills using virtual reality game applications could become more accessible in the future. As with services in health and wellbeing, the television is being exploited as a more familiar interface for learning services (e.g. Vital Assistance for the Elderly Project (VITAL): see boxed example below).

Self-learning at home: Vital Assistance for the Elderly project

"VITAL will develop a tele-education platform that will allow the presentation of multimedia courses specifically designed for the elderly: cooking, household activities, etc. As opposed to existing practice in the iTV world, the platform will be generic and will allow the presentation of multiple titles within the same application. The client application will consist of a sort of multimedia blackboard that can be commanded using voice or the remote controller. The client interface will support resizable fonts according to the user preferences, text with audio feedback, etc. The server side will include tools for easy creation and management of the courses. The system may automatically suggest and subscribe users to the courses according to his profile. A course searcher will be also included. The platform can be used to deliver all sorts of multimedia material; such as: documentaries, movies, etc. The objective of this application will be to provide education for self-caring, self-learning/self-satisfaction and entertainment."

(source: <http://www.ist-vital.org/applications.html>; accessed 04/03/10)

These types of developments can increase opportunities for older and disabled people to engage in lifelong learning which could improve employment prospects and independence in later life particularly with respect to increasing expectations of participation in work beyond 'retirement'.

4.2.4 Easier search and access

For study and work, searching for and accessing information has become easier through the internet, and that trend is set to continue with semantic web, which could enable more accurate, tailored and useful information searching¹⁰⁶ (web 3.0/semantic web: see Section 3.2.6).

Increased distribution of digital forms of communication can render material more accessible to those with disabilities, because the form of the content can be more flexibly delivered electronically according to users' needs (e.g. text, speech, video). Enhanced alternative formats of information delivery are improving with audio/voice based interaction, video, text, and interactive

¹⁰⁵ <http://goet-project.eu/> (accessed : 27/11/09)

¹⁰⁶ Berners-Lee, T., Hendler, J., & Lassila, O. (May, 2001). The Semantic Web: A new form of Web content that is meaningful to computers will unleash a revolution of new possibilities. Scientific American <http://www.scientificamerican.com/article.cfm?id=the-semantic-web>

message boards for sharing information. NGS could facilitate a less compromising, more reliable and better-quality provision of accessible information that is currently limited by restricted bandwidth. Software as a service could enable wider availability of software (e.g. text to speech) that facilitates access to online content. Personalisation and customisation have the potential to improve efficient information search and access.

Some work- and education-related content may have previously been difficult to access without good mobility or helpful library staff, or because the material is rarely available. Access to digital books and electronic papers and documents has widened choice, availability and access. A new method of removing the complexity associated with direct use of a computer to search and access books is in development, as illustrated by this interviewee's quote:

"We are looking at a system that replaces the current talking book service, taking it online rather than CD based. [...] This will provide users more flexibility in accessing their talking book content, via streaming or downloading, so they can listen to them when they want." (Steve Tyler, RNIB)

4.3 Challenges to future service provision

There are a number of challenges specific to this type of service provision that need to be overcome in order to reduce the risk that users will not benefit from their implementation, such as data security, ensuring that the quality of remote working and learning is evaluated, and that these services are presented in contextually relevant and accessible ways to target groups of older and disabled people. Other challenges that relate, though not exclusively, to work and education services are discussed in Chapter 7.

4.3.1 Data security in NGS for work and education

Security of data exchange and access (e.g. through VPNs) is an area that is receiving considerable attention, as companies and users demand protection of their data, which may be sensitive for a variety of reasons. This may limit the widespread adoption of VPNs for flexible working practice. For instance, in a recent study, Forrester Research found that around half of over 2,000 businesses surveyed (in the UK and elsewhere) cited security and privacy concerns as their main reason for not using cloud computing¹⁰⁷.

4.3.2 Quality of user experience of NGS for work and education

Whilst services that enable working from home clearly improve access to work for older and disabled people, there is a risk that the work/education needs of such workers and students may be easier for managers and teachers to forget when located remotely. Training is important for people who interact with older and disabled people in work and education contexts, to ensure that they are able to meet their users' needs. Reliable and valid feedback mechanisms need to be in place when working or learning at a distance. Such regular evaluations should reduce the risks of accessibility issues and of poor understanding/appropriateness of material being delivered. Progress should be monitored, to enable motivational support, and to ensure the home environment is ergonomically suitable. As the following quote illustrates, establishing and maintaining mechanisms to feedback and act upon users' issues with

¹⁰⁷ <http://www.net-security.org/secworld.php?id=8565> (accessed: 03/12/09)

technology-based services is important to ensure continued accessibility in an environment where technology is continually changing.

“There’s a focus on getting older people up to speed with technology. But tomorrow’s technology is going to be as tricky for me when I’m 65 as today’s technology is for today’s 65 year old – it is an ongoing issue and we have to build in mechanisms to support people using it.” (Steve Tyler, RNIB)

Throughout this chapter, we outline examples of projects and services that are exploring and developing educational courses to be contextually relevant to end-users. However, this user-centred design approach, where users themselves can inform the direction of service development, even in the earliest ‘concept’ stages, is still not a widespread practice. Services that are designed to be more appropriate, relevant and engaging to older and disabled users are likely to facilitate progress in this area.

5 Leisure

Summary

In reviewing future NGS provision in the domain of leisure, the project identified that there are likely to be richer, more accessible and engaging entertainment options that enhance current services. Key potential trends in this regard relate to:

- a. More engaging entertainment: the project identified services in research and development, and some already available, that have the potential to entertain and engage older and disabled people more than do current services. These include services that support higher fidelity audio-visual presentation (such as 3DTV and HDTV), that incorporate interaction (e.g. games services, with the service and/or other users) and services that are more tailored to the user's interests (e.g. based on previous viewing behaviours).
- b. More life-like remote social interaction: building on current remote interaction services (e.g. instant messenger, voice over internet protocol [VoIP]), future remote social interaction services could include information overlays that make explicit, when communicating with others, information about oneself and others; information that can ordinarily be gauged in face-to-face contexts. These richer experiences could enhance social presence (a sense of being there, with others) and have potential benefits in reducing older and disabled users' sense of social isolation. They may also offer particular benefits to people with social communication difficulties such as people with autism or Asperger's syndrome (e.g. reading other people's non-verbal communication).
- c. Better access to leisure services: based on the trend towards increased personalisation, and the capacity for augmentation of standard services (for example, with audio-description or sign language), there is the potential for services to become more accessible to older and disabled people.
- d. Lower cost access to leisure services: the growth in popularity and prevalence of software as a service (SaaS) has the potential to enable older and disabled users to access applications (e.g. communication tools such as VoIP) and content (e.g. games) at lower cost than is possible at present. This offers particular benefits to these groups, as they tend to have low incomes with limited prospects for income generation.

Potential benefits of future NGS in leisure for older and disabled people support improvements in their quality of life, and include:

- a. improved quality of entertainment, a key consumption domain for older and disabled people, more so if housebound; and
- b. reduced social isolation, resulting in improved psychological wellbeing.

Over the next 5-10 years, there could be many opportunities to improve and enhance social life and leisure with the roll-out of NGS. The faster network

could provide richer, more accessible and engaging entertainment options that enhance current services such as broadcast television (see 5.1, Current Context). Some new services in this area have the potential to succeed as they build on leisure pursuits that are already valued; for instance, television is more frequently used by older people relative to all adults¹⁰⁸. There is also great potential for reducing social isolation through services offering more life-like and accessible remote social interactions (e.g. social networking). Furthermore, the costs of ICT-enabled leisure services are expected to decrease with the wider availability of software as a service.

As described in previous chapters, many of the near-future services covered here are extensions of existing services. Increased use of high quality video data and high quality two-way real time communications (e.g. video conferencing-like services) can become bandwidth intensive. The current infrastructure struggles when everyone wishes to use these services at once. Implementation of NGS will be better able to deliver these bandwidth-hungry services. This chapter describes some of the current activities and services typically associated with 'leisure', followed by a selection of trends and likely near-future services that hold potential benefits for older and disabled users. The benefits, however, are mitigated somewhat by a number of challenges in leisure service provision. Challenges specific to leisure services are outlined at the end of this chapter.

5.1 Current context

For many people, interaction with others is an important component of leisure; for instance, watching films as a family, socialising with others at the local pub, and sharing personal interests (e.g. book clubs).

5.1.1 Socialising

Communicating with others as part of a leisure activity (e.g. for socialising, 'catching up', and having shared experiences) is more likely to be limited for older and disabled people for a number of reasons. Older people may have more difficulties than others in getting out and about, restricting the extent of face-to-face contact with others. Living in remote areas can exacerbate the social isolation, if neighbours, friends and relatives are not within easy or comfortable physical reach. Disabilities can have profound effects on communicating with others, posing particular difficulties for meeting new people, and for communicating with others who do not have a similar disability (e.g. hearing impairment).

The popularity of online social networking opportunities is increasing: the number of users and the amount of time spent on these sites is growing year on year¹⁰⁹. These have the potential to widen peoples' social circles, find people with similar interests, and increase social interaction, as social exchanges can be conducted from the comfort of one's own home.

Mobile technologies such as mobile phone text services have revolutionised communication opportunities for people who are deaf or hard of hearing¹¹⁰. Texts are easy to access and create, overcoming the hurdles associated with

¹⁰⁸ Ofcom (April, 2006). Media Literacy Audit: Report on media literacy among older people. http://www.ofcom.org.uk/advice/media_literacy/medlitpub/medlitpubrss/older/ (accessed: 24/03/10)

¹⁰⁹ <http://blog.nielsen.com/nielsenwire/global/led-by-facebook-twitter-global-time-spent-on-social-media-sites-up-82-year-over-year/> (accessed: 26/04/10)

¹¹⁰ <http://www.ofcom.org.uk/research/tce/ce07/annex5.pdf> (accessed: 26/04/10)

traditional telephony for deaf users. However, in a 2007 Ofcom research report, people who were deaf or hard of hearing cited the high cost and lack of text tariffs as barriers to take-up of mobile communication services¹¹⁰. Furthermore, in general, people aged over 60 (compared to younger people) were much more likely to report having 'no interest' in sending text messages with a mobile phone¹¹¹. Whilst texts are not real time, instant messaging applications that were previously restricted to fixed PC devices enable synchronous (real time) and symmetrical (two-way) communications. Ofcom reported that 'communication' (including emails, chat rooms and instant messaging) was the only internet function or activity that a majority (62%) of internet users aged 60 years used at least weekly¹¹¹. Provision of these applications is extending to mobile devices (e.g. instant messaging through Facebook, Skype with 3 and Apple). These offer accessible communication benefits for people who are deaf or hard of hearing, anytime and anywhere. Indeed, those with a hearing impairment reported that the internet improved the quality and extent of communication, and as such, it could be the most important communication service development for this group¹¹⁰.

There are still many usability and accessibility problems, however, with off-the-shelf communication devices. There is a tendency for products to be designed as compact devices with small and poorly contrasting buttons and button labels, making them difficult to use for some older people and those with dexterity or visual impairment (e.g. for mobile phones¹¹²). Some older and disabled people require adaptive devices to be able to access the communications technology at all (e.g. minicom, text-to-speech software for email access).

5.1.2 Television and radio

In-home leisure and entertainment typically centres on television and radio. These media offer highly-valued leisure content for many older and disabled people. These groups typically spend more time at home than non-disabled people and under-65s because they are less likely to be employed or have retired. Regular use of television and radio is higher among people aged 60 years and over, compared with all adults¹¹¹. For radio, consumption among the over-65s is higher for people with, than without, a visual impairment¹¹³.

Digital broadcasting of radio and television content can offer numerous benefits to the consumer in general, and particularly older and disabled people, as they are likely to spend more time at home. These include more choice (e.g. increased channels), control (e.g. time series recording) and improvements to video quality (e.g. HD, screen size, convenient flat screens, LCD/plasma displays). Provision of subtitling and audio description has improved access to these services for people with visual and/or hearing impairment, though with the increased volume of content, provision is arguably not wide enough.

Extensions to the traditional broadcast model of delivering content through the internet have enabled even more opportunities to consume video and audio content more flexibly. These include services such as 'over the top' (internet-

¹¹¹ http://www.ofcom.org.uk/advice/media_literacy/medlitpub/medlitpubrss/digitalifestyles/ (accessed: 26/04/10)

¹¹² Kurniawan, S (2007). Mobile phone design for older persons. *Interactions*, 14, pp24-25. <http://delivery.acm.org/10.1145/1280000/1273979/p24-kurniawan.pdf?key1=1273979&key2=8517549621&coll=GUIDE&dl=GUIDE&CFID=83350408&CFTOKEN=38764848> (accessed: 24/03/10)

¹¹³ Freeman, J., Lessiter, J. & Ferrari, E. (2009, February). Research report: Are you really listening? The equipment needs of blind and partially sighted consumers for accessible and usable digital radio. http://www.gold.ac.uk/media/i2_RNIB_AreYouReallyListening.pdf (accessed 24/03/10)

delivered)¹¹⁴ video/video on demand (e.g. BBC iPlayer, DemandFive, 4OD); web video sites (e.g. YouTube, Google Video, Fancast etc) and video through other websites (Facebook, MySpace). Content is moving onto mobile platforms for ever more convenient (anywhere, anytime) consumption. However, access to content through mobile devices for many older and disabled consumers remains a challenge. Access is not widely enabled; not all phones are designed to deliver this kind of content, and usability of many mobile phones (particularly for older and disabled people) is poor because of a tendency to use small handsets, screens, and small buttons¹¹⁵. Some positive efforts have recently been made with captioning for online content. Google's automatic speech recognition has been combined the YouTube caption service to improve accessibility of online video¹¹⁶. Whilst the accuracy of the captioning needs to be improved (incorrect words are sometimes displayed), these active efforts by the industry are a step in the right direction.

5.1.3 Gaming

Video gaming is now enormously popular as a leisure pastime. Nielsen (2008) reported that around 23% of all UK adults reported being active gamers. However, the UK demographic profile of gamers is skewed towards the younger generations (e.g. 78% of 16-19 year olds reported using video games compared with 6% of people aged 50 and over)¹¹⁷.

According to the Interactive Software Federation of Europe, the industry generates more revenue than either the cinema box office or video rentals¹¹⁸. Game content is available through consoles, the internet, and mobile phones. Developments in interaction devices such as gesture-driven devices have been found to be more intuitive and natural compared to more traditional gaming interaction devices (e.g. mouse)¹¹⁹. Whilst much game content is currently not largely targeted at older generations, there are a number of gaming sites for people with visual impairment (e.g. www.gamesfortheblind.com, www.blindadrenaline.com, <http://www.vipgameszone.com/>) and hearing impairment (e.g. www.deafgamers.com, www.valvesoftware.com).

5.1.4 Out-and-about leisure

Leisure activities outside the home can be wide and varied depending on location, and many require good social connections to find out about activities, the ability to find the location of activities (wayfinding), and the need to be physically present in order to engage with them. This increases the importance of, and reliance on, communications media and transport services to engage

¹¹⁴ Content delivered that is independent of the network operator, in contrast to IPTV (see Glossary)

¹¹⁵ <http://www.useit.com/alertbox/mobile-usability.html> (accessed 26/04/10)

¹¹⁶ <http://googleblog.blogspot.com/2009/11/automatic-captions-in-youtube.html> (accessed: 23/11/09)

¹¹⁷ Nielsen Games (2008). Video Gamers in Europe 2008 (prepared for the Interactive Software Federation of Europe) http://knihovnam.nkp.cz/docs/ISFE_Consumer_Research_2008_Report_final.pdf

¹¹⁸ <http://www.isfe-eu.org/index.php?PHPSESSID=2age9l4bp4uvfjmrvb96hg9ev3&oidit=T001:13a6822a85ec66ddd301a010aa3bca57> (accessed 26/04/10)

¹¹⁹ Cabral, M.C., Morimoto, C.H., & Zuffo, M.K. (2005). On the usability of gesture interfaces in virtual reality environments. Proceedings of the 2005 Latin American conference on Human-computer interaction. CLIH'05, October 23-26, 2005, Cuernavaca, México. <http://delivery.acm.org/10.1145/1120000/1111370/p100-cabral.pdf?key1=1111370&key2=5777822721&coll=GUIDE&dl=GUIDE&CFID=87930876&CFTOKEN=11424452>

with many leisure pastimes. Online services have made it easier to search for special interest activities and location-based services.

5.2 Future service provision: potential trends and benefits

The needs of older and disabled people in the area of leisure, such as greater social contact, high-quality accessible entertainment and low-cost services, are likely to be met by a range of services. These include: enhanced TV-like services, 'presence' and 'social presence' services (e.g. sense of social connectedness, virtual spaces for socialising and fun), developments in e-commerce and shopping, and gaming.

These benefits offered by NGS in leisure are very relevant to older and disabled people for a number of reasons. As people become older, they are more likely to experience social isolation and loneliness¹²⁰. According to Age Concern, 3.5 million older people live alone and many receive few visitors¹²¹. Mobility difficulties can exacerbate social isolation. As noted earlier, older and disabled people are more likely to spend time at home, because they are more likely to be unemployed, or they are retired. Developments in home entertainment have significant potential to enhance enjoyment of in-home leisure.

Older people on state benefits with little or no private income have to make serious considerations in their purchase decisions (priorities), and compared to people without disability, those with disabilities are around twice as likely to be living in poverty¹²². Service affordability is therefore salient to many older and disabled people.

5.2.1 More engaging entertainment

Future leisure services will capitalise on technical improvements to audio/video quality including high definition (HD) and stereoscopic (3D) displays; the focus is likely to be on providing more immersive experiences that enhance engagement and give users the sense of 'being there' and being part of the action. Gaming services are likely to similarly improve in terms of the quality of the audio and visual properties (as above), interactive possibilities (e.g. sharing information and experiences through gaming applications), and quality of service (e.g. latency, reliability and stability). These developments have potential to provide more engaging entertainment for people who have restricted mobility and spend more time relying on home entertainments to meet their leisure needs.

In the home, IPTV/on-demand video refers to television and video-style services delivered via IP (i.e., via the internet), rather than broadcast via terrestrial, cable or satellite transmissions. As broadband penetration increases, broadband speeds increase and digital video compression improves, it is expected that more television-type content will be consumed via IPTV and web delivered television. Compared with standard broadcast television, IPTV has the potential to offer greater choice of content (including live content) that can be time-shifted (e.g. catch-up TV such as BBC iPlayer), or free from scheduling (e.g. on-demand). Users can watch what they want, when they want, even on the move (mobile TV). This trend is set to continue for greater volumes of content and

¹²⁰ http://www.coag.uvic.ca/documents/research_snapshots/Social_Isolation_Loneliness.htm (accessed: 26/04/10)

¹²¹ <http://www.ageconcern.org.uk/AgeConcern/B2EA5EAEAAA84C5DB776B1FD0820ACC1.asp> (accessed: 26/04/10)

¹²² Parkcar, G. (2008). Disability Poverty in the UK. Leonard Cheshire Disability. <http://www.lcdisability.org/?lid=6386> (accessed: 24/03/10)

archived material. In the research interviews, James Micklethwait (BBC) described the BBC's strategy for online services.

"We feel that our strategy for BBC online should be to explore where the BBC can better deliver its public purposes through online and interactive media. A great example is our news website which performs a role that our news bulletins at 6, 10 and 1 o'clock just can't do: it's always there, always on. What we will see over the coming years is that the BBC will explore areas where, like news, we think the internet can do something really unique that we wouldn't be able to do as a traditional linear broadcaster." (James Micklethwait, BBC)

There are potentially huge benefits for older and disabled people who spend considerable time in the home (e.g. people with mobility impairment) relying on these types of entertainment media which offer more choice and flexible viewing to suit their needs. A number of catch-up television services are already available. Some are provided as additional broadcast channels (e.g. the '+1' digital channels), and other, more flexible, services are offered online including BBC iPlayer, ITV Player, 4OD, and Demand Five. The BBC iPlayer service is referred to throughout this section as it is one of the more high-profile catch-up television services. However, the issues raised in these contexts apply equally to other catch-up services offered by different broadcasters.

"[BBC iPlayer is] putting power into the hands of the end-user allowing people to catch up on content they missed or that they hear about after the event. Over time increasingly users are going to come into iPlayer as a place to explore and discover content they didn't know they wanted to watch." (James Micklethwait, BBC)

In terms of high quality video, both high definition (HD) and 3DTV are already here and, as illustrated in the quote below, availability of these services is intended to increase across broadcast platforms. However, spectrum limitations in terrestrial broadcasting will mean that not all content can be delivered in this way and current bandwidth limitations can affect quality of service. For instance, to watch BBC iPlayer in HD requires sufficient bandwidth without which the viewing experience is slow, awkward and with many pauses ('buffering')¹²³. Without these spectrum limitations, IPTV as a NGS will be able to better manage delivery of these high quality video services to all.

"Our users, and there's no reason why this shouldn't be true for elderly and disabled people, appreciate the better quality provided by HD. It makes a bigger screen that much richer, and improves the sound. The benefit is that it's a much more immersive viewing experience [...], similarly with 3D." (James Micklethwait, BBC)

Broadcast television is traditionally a passive (sit-back) experience. IPTV has the potential to deliver a more interactive experience. Greater consumer involvement in interactive entertainment (beyond 'press the red button'-like activity) is also on the horizon, including extensions to creating content and software applications, as illustrated in the quote below.

"We have also been thinking and experimenting in genres such as drama and entertainment, with some unique things that you

¹²³ These effects have been explored by i2 media research in related activities.

can do – for example, creating interactive experiences. We continue to experiment with this sort of innovation.” (James Micklethwait, BBC)

Another development in home entertainment, relevant to the provision of more engaging entertainment, is gaming. Currently, as noted in Section 5.1, there are a number of gaming applications already available that are accessible to people with visual and hearing impairment, enabling such users to enjoy games for leisure. NGS in gaming, as with television-like services, have the potential to provide richer and more enjoyable experiences through better-quality audio and video.

Games for leisure can be an enjoyable form of entertainment when played alone, but also have the potential to reduce social isolation by multi-player gaming where other players are located either in the same room, or elsewhere (connected through the network).

Other ongoing developments in gaming have turned towards serious games targeted at older people. For instance, many projects are exploring the benefits (in both health and entertainment value terms) to older people of 'brain/cognitive training' which serve to improve or at least maintain levels of cognitive/physical ability in a somewhat entertaining yet challenging context (e.g. Vital Mind, OASIS, Hermes, ElderGames: see Annex B).

A recent high-profile study, published in *Nature*¹²⁴, found little evidence that any benefits of 'brain training' exercises could be transferred to other tasks that were not part of the training. However, this study may be less relevant here as it did not include people aged over 60 years, for whom there is likely to be greater variability in cognitive performance¹²⁵. Furthermore, the amount of training (24 sessions lasting 10 minutes each, giving four hours in total) was considerably less than schedules recommended by other brain training programmes^{125,126}. Other research with nearly 500 people aged 65 years and over, with ten times the amount of overall cognitive training, found evidence that cognitive training can lead to generalised or transferable improvements in cognitive performance¹²⁷.

NGS in gaming could enable more choice for older and disabled users to access games to suit their preferences, and have potential for users to create games for others.

5.2.2 More life-like remote social interaction

'Chat' services (e.g. instant messenger) are being extended beyond merely text- and emoticon-based communication styles. Future remote social interaction services could include information overlays that make explicit, when communicating with others, information about oneself and others; information that you can ordinarily gauge in face-to-face contexts (e.g. the PAsION project which has been developed for use in gaming and work applications: see section 4.2.2).

¹²⁴ Owen, A. M. et al. (2010). Putting brain training to the test. *Nature* advance online publication 20 April 2010 doi:10.1038/nature0904. <http://www.nature.com/nature/journal/vnfv/ncurrent/pdf/nature09042.pdf>

¹²⁵ <http://www.nature.com/news/2010/100421/pdf/4641111a.pdf>

¹²⁶ Zelinski, E. (May, 2010). Scientific critique of BBC/Nature Brain Training Experiment. <http://www.sharpbrains.com/blog/2010/05/10/scientific-critique-of-bbc-nature-brain-training-experiment/>

¹²⁷ Smith et al. (2009). A Cognitive Training Program Designed Based on Principles of Brain Plasticity: Results from the Improvement in Memory with Plasticity-based Adaptive Cognitive Training Study. *Journal of the American Geriatrics Society*, April 2009. <http://www.anatbanimethod.com/articles/IMPACT-Study2009.pdf>

These richer experiences could enhance social presence (a sense of being there, with others) and have potential benefits in reducing older and disabled users' sense of social isolation. They may also offer particular benefits to people with social communication difficulties, such as people with autism or Asperger's syndrome (e.g. interpreting other people's non-verbal communication). Indeed, research suggests that people with autistic spectrum disorders are generally more engaged and comfortable interacting through technology than face-to-face¹²⁸.

More life-like social interaction services are also likely to build on voice over IP (VoIP) in the near future. Video enhancements to VoIP are not well supported currently unless all communicating parties have sufficient bandwidth, and there is no network congestion in the internet backhaul, which can result in 'jittery' video, out of synch with the sound. An improved service could be delivered with NGS. Rich audio/visual/text multi-user experiences can emulate more natural group interactions and can increase a sense of social connectedness, in turn reducing social isolation. In terms of leisure, this implies that geographically distant friends and family will have opportunities for more accessible shared experiences. It could also enable social group activities to be conducted remotely. This could hold particular benefits for members of the British Sign Language community, who could be enabled to hold group discussions remotely.

New services are currently being developed that use technology to support group-to-group communication. For instance, the Together Anywhere, Together Anytime project (TA2: see Annex B) combines social presence with other leisure activities that are traditionally enjoyed in co-located groups, such as playing board games or watching a live sports event on television. The Sky Player integration on the X-Box (party mode) allows the user to 'sit' with up to eight friends in a virtual living room and watch the same content. In a more converged environment, it is easy to imagine these functions and enriched services integrated with social tools being extended to other service areas, such as e-education, e-government and e-commerce (e.g. click on active parts of video for more information or a related transactional opportunities). This can turn services like e-commerce into richer, more entertaining experiences.

In virtual communities, gaming services and other communication contexts individuals could be able to create new and more defined, high quality identities (e.g. avatars) through which their physical appearance and other characteristics can be personalised into a new 'identity' within entertainment applications. This could also facilitate more accessible forms of communication, with particular potential benefit to people who are deaf or hard of hearing. For instance, automated sign interpretation via avatars in post offices could improve communication access for people who are deaf or hard of hearing in these types of context. User acceptability of avatars for BSL, however, remains a challenge, as illustrated in the quote below.

"We are developing 'avatars' [virtual humans], with the idea being that your computer translates into sign language words you speak, communicated to the deaf person via an avatar [Interviewer: How has the deaf community responded to having an avatar instead of a real person?] Very negative in parts, because one of the big things about the British Sign Language is that your facial expression says so much about an issue. [...]"

¹²⁸ Goldsmith, T.R., LeBlanc, L.A. (2004). Use of technology in interventions for children with autism. Journal of Early and Intensive Behavioural Intervention, 1 (2), 166-178.

The avatars aren't that expressive so there's a lot of work to be done." (Emma Harrison, RNID)

5.2.3 Easy to use platforms for social networking for all

It was widely acknowledged by most interviewees that because many older people are socially isolated (which in turn is associated with poorer health¹²⁹), improved social contact could benefit many people who are older or disabled.

"We research how you can use technology to reduce loneliness and help people meet other people. As you get older, a good number of your friends and family will die, so how do you make meaningful relationships with new people with common interests, and how can technology help that? I would call that social networking, staying well, and staying engaged; society valuing older people and their contribution." (Niamh Scannell, Intel Corporation)

Services designed to connect people (whether or not they know each other in the 'real world') are a key consideration for many technology developers today, and our interviews with stakeholders consistently supported this notion.

"What we find is that people want to retain contact with their local community, their family. They might not be so mobile but may still want to attend a church service, an exercise class. [...] This could be as simple as a television channel with access to that church service, maybe one-to-one call conferencing with the granddaughter, or even access to a simplified version of Facebook. Social Inclusion is our target here." (Steve Sadler, Tunstall Group)

Social networking application that exploit the capabilities of NGN should become easier to access and use for everyone in the near future, as they will be able to capitalise on good quality, and real time, voice, video and text data to meet users' access requirements or preferences.

"I think the biggest benefit [of NGS] is allowing people who aren't as able to do things outside of the home to feel connected, so you feel part of a wider world environment and communication is one of the biggest elements of this." (Simon Mycock, BT)

Social networking can offer important wellbeing benefits to people who are disconnected from others because of ill-health or disability. It offers opportunities to interact with distant friends and family (as noted above), increases opportunities for engagement and participation in local community activities and could include searching for similar others with whom to develop mutually supportive relationships (e.g. checking the wellbeing of others). For some user groups, such as people who are hard of hearing, technology can play a central role in social communication activities, as exemplified below.

"We know that younger deaf people are very much into their technology, they will use social networks a lot, they actually use it as part of the community and getting to know each other, but for people a bit older is about helping them to put their toe in the water and use some of these services." (Emma Harrison, RNID)

¹²⁹ House, J.S. (2001). Social isolation kills, but how and why? *Psychosomatic Medicine*, 63, 273-274.
<http://www.psychosomaticmedicine.org/cgi/content/full/63/2/273> (accessed 26/04/10)

These types of easy-to-use social communication methods could bypass an intermediary communicator (e.g. a BSL interpreter). This holds benefits for people wishing to communicate with others in a private context (e.g. love and friendship).

"With the telephony text relay service [...] the numbers has gone down recently, and a lot of that is because people are choosing to email more and also use webcams to communicate, but you cut out that intermediary and if you are having an intimate or romantic conversation you don't really want a third party interpreting for you, so there are a lot of benefits." (Emma Harrison, RNID)

Platforms through which some social networking applications will be available are likely to capitalise on familiar interfaces such as the television set. One of our interviewees drew on her experiences in the VIRTEx project and described what services might be accessible in the future through the television.

"So [through the television you could do] some of the obvious things like being able to talk to your relatives. The example that's really excited me is of being able to participate in real time in that exercise class that's going on up the road, or to be able to participate in real time in a church service..." (Melinda Phillips, Housing 21)

Indeed, in early January 2010, two major TV manufacturers announced that they are integrating the VoIP application, Skype, into their internet connected hi-definition TVs¹³⁰. Using web-cam and microphone accessories, users will be able to have free live video chat from their sofas. Jonathan Rosenberg, Skype's Chief Technology Strategist, anticipated that televisions in the near future will have built in wi-fi, web-cams and microphones. The quote below from one of our interviewees acknowledges the growing use of social networking and describes how some of their services might become integrated with existing social networking sites in the future.

"We recognised that the community element of the web is what it does uniquely well. [...] We don't want to be building communities when there are vibrant communities out there already. Our approach is to embrace existing communities and integrate our content into those communities through syndication, or connect those communities to our own products on our website." (James Micklethwait, BBC)

In the EC-funded project 'Networked multi-sensor system for elderly people: health care, safety and security in home environment' (Netcarity: see Annex B) the project team is developing technology ("communication terminals") to be integrated into older people's homes to promote social contact with friends, family and carers¹³¹. The aims are to encourage social interaction, help initiate conversations with others, and promote independent living at home for longer. As part of the project, a user-centred design approach is informing their development of three advanced multi-modal/multi-sensory interfaces: a touchscreen tablet PC device (as opposed to using a more difficult-to-use keyboard); camera-connected devices that can show virtual representations of objects on surfaces for users to interact with; and virtual representations of real

¹³⁰ <http://www.nytimes.com/2010/01/05/technology/internet/05hdtv.html>

¹³¹ <http://www.netcarity.org/Inclusion.10.0.html>

people (with human voices) on displays to offer guidance and support around the home.

5.2.4 Easier access to entertainment and leisure products and services

The choice of entertainment and leisure products and services is likely to increase in the future. But how will people manage the increased choice in an accessible way? Access to NGS and products could become easier because of increased availability of services across different types of product and developments in refining choice for the user.

As noted previously, there is a trend towards fixed communications and entertainment media (e.g. VoIP; email, television etc.) moving onto mobile phones (for anytime, anywhere communications) and onto television sets (familiar interface: see Nexus TVTM in the boxed example below in relation to leisure services. Note that Nexus TVTM is also described in relation to health services in Section 3.2.2).

Nexus TVTM (also see Section 3.2.2. and Annex B) capitalises on familiar devices - the television set, a set-top box, and a remote control - to offer a range of services including health, shopping, and entertainment services (e.g. Freeview) to older people, promoting richer, more enjoyable, independent living at home. It will offer an audio Electronic Programme Guide and menus for visually impaired people, downloadable audio books, and an interactive message board (for social networking). Similar to an iPhone, the Nexus TVTM supports the development of third party software applications (note: open source) opening its technology up to numerous other entertainment and leisure services.

To help users manage the increased choice of content and ensuring the services are available in an accessible form, developments in customisation and personalisation are important. Customisation of services is currently to a viewer's broadband speed and the resolution of the screen to which the content is delivered. Access to entertainment and leisure products and services in the future could become easier and more relevant to older and disabled users through technologies that match user profiles (preferences, personalisation) and context (location- and trajectory-based services¹³²).

Improvements to searching for information about local and national participative activities (via web 3.0/semantic web) could provide more personalised search results based on the user's past behaviour and preferences that are implicitly inferred or explicitly supplied by the user, or through inference about 'similar' others' preferences and habits. As one of our interviewees noted, part of the benefit of NGS is that they would be better able to manage the different entertainment and leisure needs where there is more than one user in a household.

"It's very much being able to do more of the same thing but doing it more efficiently, more productively and at the same time as doing other things. The ability for people to have multiple devices connected in the home running on the same piece of

¹³² Khokhar, S. & Nilsson, A.A. (2009). Introduction to Mobile Trajectory Based Services: A New Direction in Mobile Location Based Services. In *Wireless Algorithms, Systems, and Applications*, Lecture Notes in Computer Science, Volume 5682. Springer Berlin Heidelberg, pp. 398-407.
<http://www.springerlink.com/content/v165046221r41u2t/> (accessed: 24/03/10)

broadband effectively - someone watching a set-top box in the lounge, someone else downloading upstairs, somebody else instant messaging, somebody else on Facebook. That sort of home environment is really where [NGN/NGA] becomes a key to having that additional capability.” (Simon Mycock, BT)

Future developments in customisation are likely to lean towards personalisation in access preferences and needs across services; for example, providing subtitles, audio description and/or sign interpretation as per viewers'/users' stored needs. This type of personalised data can be stored in a user profile in the 'cloud' so that users are able to use content and services wherever they are in a form that is accessible to them.

With NGS, improvements to video quality through VoIP services will enable a more reliable and stable quality of service than is possible with uplink/downlink internet speeds available today. This has benefits for supporting accessibility software to offer more accurate lip reading and sign language (e.g. SignIfICant¹³³) and enables congruent, synchronised non-verbal information to be supported, reducing errors of interpretation. Improvements in speech-to-text software (automated text relay and captioned telephony) and availability of these types of software as a service could enable service users to choose software that best meets their needs. Personalised voice service interfaces that allow speech dynamics to be optimised for specific users are also likely in the near future.

The move to IP-based video services, along with personalisation afforded through NGA increases the opportunities for older and disabled users to create their own video content. This increases these groups' capacity for participation in society, and their ability to produce content that is relevant to their interests and needs. One of our interviewees highlighted their interest in engaging users to report on 'news'.

“It comes back to our public purposes, so we want, in the case of news, we want to engage as much as possible with the stories that matter, combining international, national and local coverage. As much as possible we'd like to encourage participation in news.” (James Micklethwait, BBC)

5.2.5 Lower cost of entry for entertainment functions

“In terms of the pricing element [...] The point has got to be [...] about encouraging competition so that the consumers get the best possible choice and communication providers will compete against each other in terms of price and quality of service.”
(Simon Mycock, BT)

The growth in software as a service (SaaS) will enable older and disabled users to access applications (e.g. communication tools such as VoIP) and content (e.g. games) at lower cost than present. For example, rather than buying software to install locally, SaaS is typically provided using micropayments (e.g. pay per use) or free (supported by advertising revenue). This offers particular benefits to these groups as many are typically on low incomes with poor prospects for income generation.

¹³³ <http://www.signvideo.co.uk/> (accessed: 24/03/10)

Other examples of low-cost entertainment that are likely to be developed further in the near future include Project Canvas¹³⁴ and Playstation Home¹³⁵. Playstation Home is a free, downloadable online community (akin to Sims/Second Life) offering large communal meeting places, or a more private 'by invitation only' 'home space' which the user can personalise by decorating. Canvas – a partnership between the BBC, ITV and BT - intends to offer subscription-free access to on-demand television services and other internet-based content (delivered via a hybrid of broadcast and broadband). Canvas is expected to be in the market before the end of 2010.

“For the significant minority of homes who cannot stream HD video, a hybrid broadcast and IP distribution approach is very effective and would allow for viewing of HD on demand...we can tell their box to record a broadcast of Doctor Who in HD using a tiny file sent over the internet and the viewers will be able to view it as if it was on demand, in HD. This is something they wouldn't otherwise be able to do over an IP network.” (James Micklethwait, BBC)

5.3 Challenges to future service provision

There are several challenges, specific to the provision of near-future leisure services, that must be overcome if the entertainment and leisure needs of older and disabled people are to be met. These include issues around regulation, managing the increased choice of entertainment content and additional costs. Other challenges that relate, though not exclusively, to leisure services are discussed in Chapter 7.

5.3.1 Controlling the accessibility of NGS for leisure

Accessibility to VoIP services is currently not regulated¹³⁶. Without industry guidance, support and standards, the general accessibility, set-up and ongoing internet-based product and service support needs of older and disabled people may not be met¹³⁷. Indeed, the Consumer Expert Group has argued that government regulation is likely to be required to address the accessibility problems of new online services¹³⁶. Without support, guidance or regulation, the digital divide could be increased with NGS (discussed in Chapter 7).

5.3.2 Managing the user experience of increased choice in NGS for leisure

Increased choice of leisure content can cause increased confusion. MyMedia is a project addressing this 'crisis of choice' challenge (see Annex B). Furthermore, the notion that television can be consumed anytime and anywhere (for instance, with catch-up television services such as iPlayer) may not even

¹³⁴ <http://www.projectcanvas.info/>

¹³⁵ <http://uk.playstation.com/games-media/games/detail/item73986/PlayStation%C2%AEHome/>

¹³⁶ Consumer Expert Group report into the use of the internet by disabled people: barriers and solutions (15 October 2009) <http://www.culture.gov.uk/images/publications/CEGreport-internet-and-disabled-access2009.pdf> (accessed: 25/11/09)

¹³⁷ Abou-Zahra, S., Brewer, J. & Arch, A. (2008). Towards bridging the accessibility needs of people with disabilities and the ageing community. Proceedings of the 2008 international cross-disciplinary conference on Web accessibility (W4A), April 21-22, 2008, Beijing, China <http://delivery.acm.org/10.1145/1370000/1368062/p83-abou-zahra.pdf?key1=1368062&key2=7958922721&coll=GUIDE&dl=GUIDE&CFID=87959524&CFTOKEN=28830536> (accessed: 26/04/10)

appeal to older generations who might hold a different expectation of how to consume television content.

"[...] there's a generation which saw television as something which filled in a particular slot, they watch television almost regardless of what was on. So this idea of choosing which particular programme you want to watch and whether you should have it via a computer [...]. It's not clear to me that lots of people are going to go down that route." (Prof. Alan Newell, University of Dundee)

Personalisation/customisation attempts to mitigate this risk of 'too much choice' and provide a more relevant experience to users. However, there are more fundamental concerns about these techniques that relate to privacy and data protection. These areas are discussed in Chapter 7.

5.3.3 Barriers to access and use NGS for leisure

Whilst the costs of many leisure services should reduce, there is always the cost of initial outlay for prerequisite equipment (e.g. an additional set-top box) which could present hurdles for older and disabled people on low incomes.

Furthermore, setting up, and feeling in control of the equipment may be beyond some users' existing skills (this area is also discussed further in Chapter 7). Ongoing product support, particularly for VoIP-style communications¹³⁸ but also for entertainment products in general (as indicated in the quote below), is often not well provided.

"Entertainment is another key part of everything [...]. How easy is it for [people over 65] [...] to use, set up your newly acquired digital TV, this internet enabled, web enabled, content delivered via your home media system, and so on?" (Steve Tyler, RNIB)

¹³⁸ <http://cde.athabasca.ca/softeval/reports/R320406.pdf> (accessed: 25/11/09)

6 Other day-to-day activities

Summary

Services considered relevant to other day-to-day activities include commerce (e.g. shopping, banking, booking travel and events), information searching (e.g. local trades people), wayfinding (navigation), government services (e.g. housing, benefits), community services/activities (e.g. neighbourhood watch), and general safety and security.

In reviewing future NGS provision in the domain of other day-to-day activities, the project identified a range of potential benefits for older and disabled people based on: context sensitivity, improved accessibility, lower cost, and easier more efficient ways of doing things.

- a. Context-sensitive services: the project identified services in research and development stages, and some already on the market, that make use of their awareness of where a user is located to present relevant information (e.g. about products/services or risks available in a user's locale, or directions towards a target). Key potential benefits of such services for older and disabled people are easier navigation, less reliance on memory, and an increased sense of security and wellbeing.
- b. More accessible products and services: the project identified ongoing developments towards more accessible interfaces for older and disabled people, personalising interfaces for users' access and communication needs (e.g. multi-modal interfaces) and budgets. Developments in the area of VoIP (e.g. the addition of video alongside audio) could also offer improved accessibility.
- c. Lower-cost products and services: with the advent of software as a service, costs have the potential to become more competitive in an NGN world, driving down prices to the benefit of the consumer. Other forms of cost saving benefits are enabled through better search strategies (e.g. price comparison sites) and through flexible payment options (e.g. pay-per-use).
- d. Services supporting an easier life: a key trend identified in our research is towards more automated services, including reminders for everyday tasks. These include home management tools and services (e.g. environmental control, such as curtain opening and closing, heating management). In addition, more engaging and realistic virtual worlds (locations and spaces) are being developed in which users can have immersive and engaging shopping experiences, and more convenient access to public services.

Potential benefits of future NGSs for older and disabled people in relation to other day-to-day activities support improvements in their quality of life, and include:

- a. improved sense of safety and security;
- b. increased efficiency and simplicity;
- c. more opportunities for participation in public life;
- d. lower-cost products and services;
- e. more accessible products and services; and
- f. improved communications with others (including social groups, and commercial and care services), through media.

In addition, such services have the capacity to support more active involvement in day-to-day life for older and disabled people.

Services considered relevant to 'other day-to-day activities' that are not covered in the preceding chapters include commerce (e.g. shopping, banking, booking travel and events), information searching (e.g. local tradespeople), wayfinding (navigation), government services (e.g. housing, benefits), community services/activities (e.g. neighbourhood watch), and general safety and security.

There are a range of services under development that could become available in the next 5 to 10 years. Again, in terms of the near future at least, many of these services are likely to be enhanced versions, or extensions of, existing products and services. For the reasons pointed out throughout this report (e.g. volume of users, high quality video data, synchronous and symmetrical services) NGS would enable many of these developments which would otherwise offer poor quality of service with the current limited network infrastructure.

Following a summary on the current provision of services relating to these day-to-day activities (Section 6.2), the different benefits that these services can bring to older and disabled people are outlined. Examples of projects in progress, and products and services likely to emerge in day-to-day activities are provided to illustrate the benefits afforded. These benefits include improved sense of safety and security, increased efficiency and simplicity, greater opportunities for participation in public life, lower cost products and services, improved accessibility, and improved communications with groups through media.

Challenges specific to services for day-to-day activities are outlined at the end of this chapter.

6.1 Current context

There are a number of ways in which people currently access and use a range of other day-to-day activities that are likely to improve over the next 5 to 10 years.

Commerce-related activities such as shopping and banking have typically involved use face-to-face interactions requiring good mobility of the user and the availability and accessibility of public or personal transport.

More recently, commerce-related experiences have moved online. Cost savings and convenience are commonly-cited incentives to use online services. Online transactional purchases can already be beneficial for people with difficulty getting out and about, and the cost savings have the potential to benefit many disabled people and state-dependent older people on low incomes.

Online shopping and banking are already commonplace, as is booking for holidays and travel. There are several examples where improved web page design is offered for on-line shopping services that better meets the needs of older and disabled people (e.g. Tesco Access website¹³⁹; Market-Eze¹⁴⁰ – run by and for older people living in sheltered accommodation).

Trends in shopping are developing towards personalisation in the sense that some websites (e.g. eBay, Amazon) offer suggestions for other goods that a user might be interested to buy, based on similarities with other people's purchase behaviour. Online user comments and feedback about products are commonly available pre-purchase.

¹³⁹ <http://www.tesco.com/access/> (accessed 2/12/09)

¹⁴⁰ <http://www.market-eze.org.uk/> (accessed: 2/12/09)

The internet contains a plethora of information. Search engines (such as Google and Bing) can identify websites that contain information relevant to 'keywords' that the user specifies. These can offer quick and easy access to anything a computer-literate person might be interested in. Furthermore, searching for information using this method can reduce costs of multiple (and often redundant) telephone calls for information, and can offer more convenient information access.

The internet is also now available on many mobile phones; 6.2 million people in the UK were reported to be using smartphones¹⁴¹ in the third quarter of 2009¹⁴². Internet-enabled phones gives users the opportunity to access information anytime and anywhere. Indeed, Essential Research reports that 15% of mobile phone users use mobile internet services at least once a week¹⁴³. However, the accessibility and usability of using the internet on mobile phones is currently limited, for instance, because of small screen sizes and awkward input to the mobile device¹⁴⁴.

Many government services are now online, supporting faster and more efficient processing of applications for government services. This provides the potential of particular benefit to older and disabled people's access to, for instance, a more streamlined benefits process.

Use of global positioning systems (GPS) is more commonly embedded in mobile technologies, helping users find their way around the physical world (e.g. in-car navigation devices). These technologies are likely to extend into various day-to-day applications which could help guide people to their intended destinations. This type of development could usefully be implemented in various day-to-day activity-related services.

Assisted living services (which overlap with health services – see Chapter 3) are still largely provided by carers through face-to-face contact. Supportive care can be offered formally or informally (e.g. preparing meals, helping to move the service user from one room to another, providing assistance with household chores, and switching lights on/off and opening/drawing curtains), supporting independent living at home. Trials are under way to explore how technology can be used to support many of these care services, and are discussed in the next section.

There is still a long way to go, however, to make some of the most basic emergency services accessible to people with disabilities. For instance, people who are deaf or hard of hearing have great difficulty accessing the '999' emergency service. A trial is currently under way¹⁴⁵ (since September 2009) with around 3,000 users, as described in the boxed example below from an RNID interviewee. The trial should end around summer 2010, and the extent of take-up in the trial is likely to dictate whether it is rolled-out more widely. One current issue with the trial, reported by the interviewee, is that users feel somewhat inconvenienced by having to register a number of personal details to access the service. If this service is implemented, people who are deaf or hard of hearing will have an improved sense of safety and security, albeit for a basic

¹⁴¹ defined by Nielsen as "mobile phones that run a high level operating system, capable of running multiple programmes or applications simultaneously, much like a computer (e.g. BlackBerry, MS Windows Mobile, Palm, MS Pocket PC, Symbian, Linux, Apple iPhone OS, Android OS)."

¹⁴² http://www.nielsen-online.com/pr/pr_091110_uk.pdf

¹⁴³ <http://www.essentialresearch.co.uk/blog/2010/04/brandheld-summary/>

¹⁴⁴ <http://www.useit.com/alertbox/mobile-usability.html>

¹⁴⁵ <http://www.ictrnid.org.uk/news14092009.html> (accessed: 29/03/10)

service to which they have been denied convenient and appropriate access. The interviewee surmised that, eventually, access to this service may extend to email/internet.

RNID and the 999 Emergency SMS project

“At the moment if you want to call the police because someone is breaking into your home, the only option really is to literally ring 999. Again if you're deaf you have to go through a text relay which lengthens the call. So now all the operators have agreed on a trial where you literally text 999 “Help I am being burgled” and they're relaying it through to the police and it's cutting down time. So there are things that industry are doing to meet the needs of vulnerable groups, but it takes a lot of negotiation and work. And there are issues about sending a text to the police anyway, because everyone has to be registered which is a complex system [...] We've been working with all the emergencies services and the mobile operators to enable deaf people to report a fire, accident, break-in and they can now text 999 - which they never could in the past - with the information about what's going on. The mobile company then contacts the police and then they send a text back to the deaf person, saying “Your call has been logged, someone is on their way.” This is quite a big step for mobile companies to do this [...] We've had a few thousand people register. There's been slight reticence among the deaf communities [...] Again it's that personal information, ‘What is my information being used for? Why do I need to register, surely it's just a service?’ But it was the only way that we could really persuade the industry to take action on this area, is that joint responsibility, ‘I'm going to register with you because I trust that you will help me in my hour of need’. So we are really hoping that more people will sign up as we go along.” (Emma Harrison, RNID)

As outlined above, many current services in this area already rely on broadband internet services. In the following section, the potential trends and benefits of future service provision in this area is outlined. Whilst NGN and NGA will overcome the current limitations of the network by supporting high volumes of users, high quality data, synchronous and symmetrical services, the benefits of NGS can only be achieved if NGS are accessible to and usable by everyone. Issues such as inaccessible website design, unfamiliar and unintuitive computer language and menu structures, and awkward-to-use interaction devices (e.g. small buttons) can all increase difficulty in access and complexity of use. This was recognised by several of our interviewees.

“Technology offers these huge sets of possibility [...] The world on one level is a very bright place where technology is concerned, there's lots of promise but I also think the complexity of it is bewildering to a huge number of people, and a growing number of people may disengage if we're not careful.” (Steve Tyler, RNIB)

6.2 Future service provision: potential trends and benefits

6.2.1 Sense of security and safety

Automated environmental communications consisting of sensors and alarms are already implemented as individual devices in some older and disabled people's homes. These technologies could support independent living. There is a clear overlap of these types of services in a day-to-day context with those provided in

a health context (outlined in Chapter 3). However, to avoid “over-medicalising” all aspects of social care that older and disabled people need, some of these technologies are also reported here as they support everyday independent living whilst having additional protective health functions. This type of categorisation was also the preference of some of our interviewees.

“[...] the designers, advertisers [...] need to have empathy with people and currently most don't. And there is a bit of the medicalisation of old people – they're just patients, they're not real people.” (Prof. Alan Newell, University of Dundee)

In terms of personal day-to-day safety and security, sensors are available to detect environment- and health-related information.

Environment-related sensors include those for detecting fire, flood (e.g. overflowing bath), gas, carbon monoxide, whether doors and windows are locked or pans are left on a hob, and to regulate room temperature. Prompt action is enabled (e.g. emergency services are automatically notified) when the sensors indicate an emergency situation.

Health-related detectors refer to monitoring devices such as for ‘vital signs’ (see Chapter 3 on health) and, more relevant to this chapter, for a user's movement or activity around the home. These latter types of detector may be used to indicate falls, strokes, loss of consciousness and other emergency health conditions.

The future trend is towards more integrated ‘packages’ of assistive technology to offer a seamless, easy-to-use security and safety service. For instance, the M-Power project¹⁴⁶ (see Annex B) is developing open source middleware¹⁴⁷ to improve service efficiency through better interoperability and integration of ICT-based support services (e.g. smart homes) for older and disabled people. The Care for Elderly Persons Suffering from Dementia project¹⁴⁸ (CCE: see Annex B) is another project exploring the development of an open, standardised and integrated assisted living platform.

Support is likely to become more tailored and personalised, providing technology where it is most needed. For instance, the Proactive Assistance for Critical Life Situations¹⁴⁹ (ProAssist4Life: see Annex B) is developing low-cost software and hardware that is adaptive in users' home environments to identify situations indicating helplessness (e.g. falls and dizzy spells and loss of consciousness). Technology will be able to ‘learn’ typical patterns of movement and behaviour^{150, 151} (e.g. how long the user spends in the bathroom) and provide ‘appropriate’ (progressive) support that does not make people overly dependent on the technology before they need it.

Such devices and systems are intended to provide a sense of safety, reassurance and reduced vulnerability, which could be particularly valued by

¹⁴⁶ <http://www.sintef.no/Projectweb/MPOWER/The-Project/> (accessed: 27/11/09)

¹⁴⁷ “middleware is the “glue” between software components or between software and the network or it is the slash in Client/Server” <http://www.middleware.org/> (accessed: 28/04/10)

¹⁴⁸ http://www.iese.fraunhofer.de/projects/med_projects/aal-lab/projekte.jsp (accessed: 27/11/09)

¹⁴⁹ http://www.iese.fraunhofer.de/projects/med_projects/aal-lab/projekte.jsp (accessed: 27/11/09)

¹⁵⁰ The EMERGE project (Emergency Monitoring and Prevention) http://www.iese.fraunhofer.de/projects/med_projects/aal-lab/projekte.jsp (accessed: 27/11/09)

¹⁵¹ Kautz, H., Fox, D., Patterson, D. & Lin, L. (2005). Understanding human behaviour from sensor data. Paper presented at The International Conference on Automated Planning and Scheduling, 5-10 June 2005, Monterey, California, USA. (<http://icaps05.uni-ulm.de/documents/invitedTalks/ICAPS05-Kautz.pdf>)

people with sensory loss. The devices also increase quality of life and promote independent living for as long as possible (reducing admissions to care homes). These types of services are particularly useful where the user is frail or has memory loss.

Location-based detection such as portable wearable GPS (e.g. Buddi system currently used in the Whole System Demonstrator Trial) can be used to detect the whereabouts of the user, particularly for those who are prone to wandering (see quote below). 'Safe boundary areas' can be defined to monitor when the user wanders outside their 'safe zone'. For some systems, carers can 'dial in' and listen to the wearer of a tracking device which may be a belt or watch (e.g. LocateMyThings¹⁵²).

"...we're developing technology that is used in the house, for example, to let people navigate and then they go outdoors and it should still work. So we are going from the home network and the internet towards a mobile environment and to do this in a smooth way that everything works together without people getting confused. And we have to take into account that this could concern people, for example, that are having navigation difficulties - perhaps some memory problems, early dementia - then it does not always work perfectly together, so we have to rethink that." (Dr. Paul Timmers, European Commission)

Many safety and security-related devices that are currently available are integrated with communication channels (e.g. telephony services and/or emergency panic buttons, pillow alerts) to enable direct access to professionals should the user so require and direct alerts to carers to provide peace of mind and reduce stress for carers and users.

Various projects are exploring how monitoring, automated, networked technologies in the home (smart homes¹⁵³) and outside the home can provide integrated assisted living to support older and disabled people with their safety and security needs (e.g. Complete Ambient Assisted Living eXperiment [CAALYX], Health Hub, Mpower, Persona [Perceptive Spaces Promoting Independent Aging]: see Annex B).

For instance, the Persona project aims to find ambient assisted living service solutions to improve the quality of life for older people and reduce their dependency on others. The challenge is to develop an easy-to-use and cost-effective platform of integrated technologies: "for social inclusion, for support in daily life activities, for early risk detection, for personal protection from health and environmental risks, for support in mobility and displacements within his neighbourhood/town, all of which make a life of freedom worth living within their families and within the society."¹⁵⁴ The integrated technologies to be developed during the project include wireless and embedded technologies and sensors (e.g. intelligent textiles, sensors that measure activity levels) and easy-to-use and intuitive (human-computer) interfaces (e.g. communication through natural language).

¹⁵² <http://www.locatemythings.com/> (accessed: 27/11/09)

¹⁵³ A smart home has been defined as "A dwelling incorporating a communications network that connects the key electrical appliances and services, and allows them to be remotely controlled, monitored or accessed." <http://www.housingcare.org/downloads/kbase/2545.pdf>

¹⁵⁴ <http://www.aal-persona.org/objectives.html>

6.2.2 Increased convenience and flexibility

Future technologies will support more convenient and flexible access to activities and services in day-to-day life. The trend is towards more automated services and reminders for everyday tasks, virtual worlds, locations and spaces in which users can have immersive, engaging shopping experiences, and more convenient access to public services.

In terms of assisted living, reminders for taking medication and re-ordering prescription medication (e.g. scanning a bar code using a TV remote control, e.g. NEXUS TVTM¹⁵⁵) could become more widely available, along with reminders about daily regimes. These services aim to improve the user's ability to manage their health conditions in daily life, increase independence and reduce reliance on carers, and supports valued routines.

"...robotics for elderly people that'll help them to get out of the bed, to walk around, remind them of things that they need to do, to help them in daily tasks. [...] we think that in 5 to 10 years some of this work will go from advanced research into real life and will actually be used by people at home, which is important because it will increase their independence but it will also reduce the load on carers, including perhaps their family." (Dr. Paul Timmers, European Commission)

Increased convenience and flexibility are benefits that could also be derived from NGS in transport-related activities. Real-time information about the outside world could improve people's ability to plan journeys. For instance, users could be notified that a regularly-used bus service is delayed, reducing unnecessary wait times, particularly for travel in bad weather conditions or evenings. The OASIS project (Open Architecture for Accessible Services Integration and Standardisation: see Annex B) will develop the OASIS system to support 12 services for independent living for older people. One of the services intends to provide transport information services designed for easy and convenient access by older people^{156,157}.

Online shopping for day-to-day goods (groceries) is already available, offering flexible and convenient access to this activity, and can reduce pressure on carers who care for a housebound person. This type of facility is also useful where transport services are infrequent and it promotes safer shopping experiences where there is no need to negotiate complex public transport systems. In the near future, these types of grocery shopping services are likely to extend to reminders to replace cupboard and fridge provisions¹⁵⁸, and automatic ordering of goods¹⁵⁹.

Improving the quality of online experiences (using presence services and virtual reality e.g. NearLondon¹⁶⁰) and enriched mobility-like experiences are ongoing

¹⁵⁵ <http://www.oceanbluesoftware.co.uk/docs/OBS-Nexus-TV-090709.pdf> (accessed 27/11/09)

¹⁵⁶ <http://www.oasis-project.eu/> (accessed: 27/11/09)

¹⁵⁷ <http://server-5.iti.gr/joomla/> (accessed: 27/11/09)

¹⁵⁸ <http://www.easylineplus.com/> (accessed: 2/12/09)

¹⁵⁹ Mayrhofer, R. (2005). Context prediction based on context histories: expected benefits, issues, and current state of the art. Cognitive Science research paper – University of Sussex CSRP

¹⁶⁰ http://news.bbc.co.uk/newsbeat/hi/technology/newsid_10000000/newsid_10003100/10003154.stm (accessed 2/12/09)

developments. For instance, products could appear more tangible in 3D¹⁶¹ giving a more accurate view of the goods before purchase.

Shopping promotions are likely to become even more relevant, personalised and location-based¹⁶². For instance, users could be notified via (mobile) alerts to special offers because their profile (personalisation) suggests they may need or want a particular product. Soft discount coupons (received on phone) could then be shown in store at purchase. These types of services may be extended to predicting or estimating user trajectories (i.e. predicting where someone is going), providing soft coupons before the user has reached their intended destinations¹⁶³.

6.2.3 Increased efficiency and simplicity

Day-to-day NGS in everyday life are expected to benefit older and disabled people by increasing efficiency and simplicity. To enable these benefits, technologies need to support automation, faster, and more accessible, richer and engaging personal interactions (e.g. text, VoIP, video, presence).

Personalisation should help to remove anticipated redundant information to increase the relevance of information in a world where information is so vast. For instance, as illustrated in the quote below, for some older people in particular, the overwhelming volume of actions possible from a single webpage or new technology can make the site or service appear overly complex, daunting and off-putting to use.

"We did some work with a company to develop a web portal for older people and it ended up as MyGuide [...] as a part of that, the designers counted how many things that you could do on the front page of Outlook Express, and it's 273. And you don't notice that because you know that you can ignore most of it. Now if you come to it new, you start at the top left hand corner and you pull down the file menu, you know, how many buttons, about 20 under that? And then there's something off the side so you never get to where you want to be. And there's very little discrimination between what's important and what isn't important." (Prof. Alan Newell, University of Dundee)

A range of tools, devices and sensors are likely to ease activity around the home (smart homes) and aim to make life simpler. Everyday tasks are likely to become automated, such as switching lights on and off (e.g. when a user gets out of bed), curtain control, automated/remote heating for comfort/energy efficiency, automated/remote door and window opening, automatic/remote appliance control, and smart toilets that automatically open and close their lid, or even toilets that talk!

"...there can be sensors that are picking up information like doors that are open, a person walking, perhaps someone is at risk of falling [...] That means there is a lot of information that is

¹⁶¹ Gyi, D., Cain, R., & Campbell, I. (2010). The value of computer-based product representations in co-designing with older users. *Journal of Engineering Design*, Volume 21, Issue 2 & 3 April 2010, pages 305 – 313.

¹⁶² Zhigeng Pan, Bing Xu, Hongwei Yang, Mingmin Zhang (2006). Content-based personalised recommendation in virtual shopping environment. *International Journal of Business Intelligence and Data Mining*, 1 (4), pp. 430-449.

¹⁶³ Khokhar, S. & Nilsson, A.A. (2009). Introduction to Mobile Trajectory Based Services: A New Direction in Mobile Location Based Service. In *Lecture Notes in Computer Science: Wireless Algorithms, Systems, and Applications*. pp 398-407.

collected and this information goes over the network to a place where it can be used, where assistance can be delivered – this could be a care centre, an alarm centre, it could also be the family.” (Dr. Paul Timmers, European Commission)

Wearable technology (smart textiles) that is integrated into clothing would be able to offer thermal regulation, among other benefits that support simple and efficient comfortable independent living. For instance, the ESRC-funded project New Dynamics of Ageing is developing design requirements in smart textiles for older people that will consider “sizing, fit, thermal regulation, moisture management and the psychological feel-good factor”¹⁶⁴.

Food, nutrition and diet could be monitored and regulated by systems that provide assistance with preparing meals based on health and taste profiles (e.g. ‘Dr J says’ from the Aware Home Research Initiative at Georgia Tech). Our RNIB interviewee talked about their work on technology-based food labelling systems.

“We are working on a [food] labelling system at the moment. [...] We try to create a business case and make our propositions attractive to the mainstream and to commercial business. We’ve created a way of being able to convert barcodes into synthetic audio speech. But also we’ve created a way of being able to profile people. With a handheld pen style device [...] you can point the pen at a packet; it will tell you immediately, so if you have diabetes, this product isn’t for you. [...] It will begin to help you be able to decipher, blind or not, how to cook it, what its sell-by date is, and all the rest of it. [...] ...it has to be done with care because is that technology taking over your life? Or do you still have some semblance of control?” (Steve Tyler, RNIB)

Other projects are exploring how everyday major domestic appliances (e.g. washing machines, dishwashers, refrigerators) can be designed to be simpler to use in assisted living contexts (see Easy Line Plus project in the boxed example below).

¹⁶⁴ <http://www.compeng.ulster.ac.uk/showResearchProject.php?projid=1317> (accessed: 27/11/09)

Controlling white goods in the home: Easy Line Plus project

The Easy Line+ project aims to “develop prototypes near to market of advanced white goods in order to support elderly persons with or without disabilities to live a longer independent life, which will compensate for their loss of physical and/or cognitive abilities.

The project foresees that integrated RFID, Neural Networks and HMI technologies will combine to build a system that can capture data of the home environment and can control any white goods appliance in the home.

The users, elderly persons, may activate by themselves any white goods appliances in the home, or allow the e-servant to do the activation. The e-servant will be a white goods control system, based on the sensor information and the habits of the user, that can programme any application with or without user co-operation. The e-servant will also be a learning system that detects the loss of abilities of the user and try to compensate for them.

An example could be a refrigerator with an RFID reader that can read the RFID labels of the products placed into it. Once this information is stored, the home system (e-servant) can tell the user which food is missing, which food is going to go out of date, and could tell them which food can be eaten in line with a known condition or disease (diabetes, gout, etc). Another example of the use of RFID/EPC code is the automatic programming of a washing machine. The washer can read the RFID label of the clothes and determine which washing programme best fits the clothes the user has put in. All these functionalities will be controlled by an extremely easy-to-use e-servant system for elderly people.” (source: http://www.easylinesplus.com/pb/wp_b1f374a8/wp_b1f374a8.html; accessed 4/3/10)

Some location-based and online information services already exist that allow users to find the nearest business or service that meets their needs and provide precise directions to any address (e.g. LookingLocal.com). This could benefit older and disabled users in avoiding unnecessarily complicated journeys to local businesses, particularly for people whose mobility is compromised. Similar technology could be used to alert the user to traffic jams and assist with wayfinding around shops. For instance,+ Media Cart trolleys indicate the location of items on a 'shopping list' held in a loyalty card which is based on previous shopping trips. Voice recognition software enables shoppers to ask for the direction to other items not on their list. These types of service may be especially useful for people living in rural areas and where it is difficult to make frequent shopping trips (e.g. where there is mobility impairment or the user relies on someone else's availability to take them shopping).

Whilst some of these technologies already exist in some form (e.g. AA Roadwatch¹⁶⁵), many projects (e.g. Ocean Blue Software's multi-service Nexus TVTM: see boxed examples in Chapters 3 and 5, and the SOPRANO project: see Annex B) that are exploring assisted living services are striving to integrate these various individual products into a complete service that appears seamless to the user. Without integration, these products and collections of individual services may be more difficult to access, manage and use for older and disabled people.

¹⁶⁵ <http://www.theaa.com/traffic-news/index.jsp>

People's ability to share information is likely to increase to ease decision-making. Reviews of services and products are becoming more easily accessible online and extend wider than within one's social circle (i.e. word of mouth, online recommendations), providing benefits for people who are housebound or have small numbers of social contacts. These benefits are likely to be enhanced with more people online, for which higher-capacity NGN is required.

"I had heard that eBay, for example, [...] were talking about employing older people. So if you want to buy something [...] they would make a consultant available, someone to talk to [...] and they had in mind a retired person who actually knew about this particular subject matter. That's again using the same technology but helping the older person to participate." (Niamh Scannell, Intel Corporation)

There are increased opportunities already to bypass complex procedures for reporting incidents or complaints about local issues such as graffiti, or street lighting replacement. Community forums are moving online for residents to discuss local issues more easily and without the need to meet, physically, in one place (e.g. fixmystreet.com).

"'Looking Local' is now operating in around about 90 local authorities on the Sky platform and on the Virgin platform, and also working with NHS Choices and Direct. So it's actually gone quite well really in terms of a programme, [...] and now we're seeing great investment in IPTV and in digital television."
(Stephen Dodson, DC10plus Network)

Information and online form completion (e.g. for benefits) is improving, with some projects focusing on accessibility for people with disabilities; making processes more simple and efficient. For instance, in Greece, the project ACCESS2e-Gov¹⁶⁶ (Access for the disabled to eGovernment services) has developed a "methodical and systematic approach for web content accessibility and usability support" with the access and use needs of people with disabilities in mind (see Annex B). In the DIADEM project¹⁶⁷ (Delivering Inclusive Access to Disabled and Elderly Members of the community: see Annex B) techniques are being used to explore older people's behaviour when using online forms. The project anticipates that this information will inform the development of adaptive and personalised computer interfaces that enable older people to more easily interact with online forms.

This type of research, that is exploring how to personalise and coach users through online form completion, can be useful in alerting users where information on the form is not consistent, or where there is a likely error or an omission, saving time. Some projects are researching how to provide simpler or different types of question structures to better support older people¹⁶⁸. Forms are likely to become more streamlined by removing redundant questions that are not relevant, based on other responses from the user. These changes to the application process could reduce delay times that are often incurred using more traditional methods (e.g. postal delays, errors in application), making online services simpler and more efficient for older and disabled people.

¹⁶⁶ <http://www.epractice.eu/en/cases/access2egov> (accessed: 2/12/09)

¹⁶⁷ <http://www.project-diadem.eu/> (accessed: 2/12/09)

¹⁶⁸ Lines et al. (2006). Online form design for older adults: Introducing web-automated personalisation. http://www-edc.eng.cam.ac.uk/~jag76/hci_workshop06/lines_et_al.pdf (accessed: 02/12/09)

"We have been doing in the past a lot of work on trying to make the web usable for people that have low vision, or people with cognitive difficulties, or perhaps also often people who find the internet difficult to use, like lots of older people. And this is now moving into real life, there are standards emerging and international cooperation in Europe." (Dr. Paul Timmers, European Commission)

6.2.4 Increased participation in public life

According to government strategy at the time of writing this report¹⁶⁹, e-government processes were planned to be the norm by 2011¹⁷⁰. The aim was to offer improved accessibility to local government information and services (some of which are already discussed above). This could benefit citizens who have difficulty with traditional methods such as using the telephone, form completion, and mobility. The strategy document acknowledges that meeting the needs of "key groups - such as older people" is likely to be complex but that the services will need to be responsive. By moving services online, information should also be more up-to-date. Online delivery also intends to enhance transparency in government operations (e.g. BBC's Democracy Live¹⁷¹). Some government websites have sections dedicated to people with disability (e.g. DirectGov¹⁷²).

Low media literacy among some older and disabled people is being tackled in many projects to enable those groups to capitalise fully on the benefits of electronic services being offered.

Numerous projects and initiatives are addressing low media literacy. These include a range of activities, coordinated by Ofcom, to meet its duty to support media literacy, and Ofcom's Digital Participation Consortium, launched in October 2009). Digital Unite¹⁷³ supports people over 50 years old with computer training, and the Senior Learning project¹⁷⁴ (see Annex B) offers an online, step-by-step practical guide to support learning how to use internet services (e.g. booking a flight, shopping, banking) for the over-65s.

As with other services described throughout this report, e-government, e-commerce and local information services may be delivered either via an internet-connected computer but or via internet-enabled set-top boxes that may provide more intuitive interfaces for digital participation in day-to-day life (e.g. T-Seniority¹⁷⁵ [see Annex B], STREAM personal TV^{176,177}).

¹⁶⁹ <http://www.cabinetoffice.gov.uk/media/141734/transgov-strategy.pdf> (accessed: 2/12/09)

¹⁷⁰ Whilst this is an ambitious target as the deadline is not far away, at the time of writing this report, the PM has reiterated his commitment to e-government services. He proposed that the second generation of e-government services will be more interactive and called 'Mygov'. To help with this process, Martha Lane Fox will be broadening her current role of the 'UK's digital champion' to assist with the set-up of a new digital public services unit in the cabinet office. <http://www.number10.gov.uk/news/speeches-and-transcripts/2010/03/speech-on-building-britains-digital-future-22897> (accessed: 28/04/10)

¹⁷¹ <http://news.bbc.co.uk/democracylive/hi/> (accessed: 2/12/09)

¹⁷² <http://www.direct.gov.uk/en/DisabledPeople/index.htm> (accessed: 2/12/09)

¹⁷³ <http://digitalunite.com/> (accessed: 28/04/10)

¹⁷⁴ <http://www.seniorlearning.eu/site/index.html> (accessed: 2/12/09)

¹⁷⁵ <http://tseniority.idieikon.com/> (accessed 2/12/09)

¹⁷⁶ http://www.idea.gov.uk/idk/core/page.do?pagelid=1http://www.streampersonaltv.co.uk/index.php?option=com_content&view=article&id=8&Itemid=7 (accessed: 2/12/09)

¹⁷⁷ http://www.accenture.com/Global/Research_and_Insights/By_Industry/Government_and_Public_Service/EvolutionPSDWeb20.htm (accessed: 2/12/09)

“One of our new services called Democracy Live uses that technology so that you can jump straight to an MP’s speech based on key words.” (James Micklethwait, BBC)

“By and large most government services that can be moved online are now available online and most of that is about consultation, e-democracy, payments, transactions, and reporting problems.” (Stephen Dodson, DC10plus Network)

A number of websites already exist to support local community activities and improve relationships between constituents, local authority and government. Examples include fixmystreet.com (for reporting, reviewing and discussing local problems like street light replacement, graffiti and potholes) and theyworkforyou.com (to promote public engagement with, and increase transparency of government activity). These types of sites, and others that will inevitably follow, are likely to have improved access in the near future for everyone to contribute to their local communities and to society in general through increased forms of communication (e.g. text, voice, audio) and by removing the barrier of mobility for people who are housebound.

6.2.5 Lower cost products and services

Internet-enabled, lower-cost products and services are already here; for instance, VoIP services can offer free calls, including international calls, as an alternative to traditional telephony services. In the future, NGS have the potential to offer greater cost benefits to people who have less disposable income than others. This could include older people who rely on state benefit and disabled people who are more likely than their non-disabled counterparts to be out of work (see Chapter 4).

In 2009, PricewaterhouseCoopers conducted research for Race Online 2012 (an initiative to reduce the number of people who are socially and digitally excluded, led by Martha Lane Fox, Digital Inclusion Champion¹⁷⁸). It reported that households that are not online could save £560 per year by using online services, and that the overall savings for the fifth of households with the lowest incomes was around £300^{179,180}. These cost-saving benefits are enabled through, for instance, paying online for utility bills and online shopping.

Many goods are often cheaper online than they would be in store (e.g. lower overheads) and shopping from home enables people to shop more competitively, widens choice, and helps consumers identify niche products. Other forms of cost saving benefits are enabled through better search strategies that allow the user to ‘shop around’ for the best price (e.g. comparison sites like GoCompare.com) and through flexible payment options (e.g. pay per use). Improved search strategies (e.g. semantic web/web 3.0) and personalisation could increase the ease and access to relevant lower cost goods and services.

Changes are continuing to the traditional retail model with online selling (e.g. Amazon, e-Bay) or exchanging (e.g. Freecycle¹⁸¹) of unwanted goods. Selling in this way has a low cost of entry for ‘would be retailers’ in that no ‘shop’ as

¹⁷⁸ <http://raceonline2012.org/> (accessed: 28/04/10)

¹⁷⁹ <http://www.ukonlinecentres.com/corporate/news-and-information/uk-online-centres-news/1395-new-research-makes-digital-inclusion-an-economic-imperative.html> (accessed: 28/04/10)

¹⁸⁰ PricewaterhouseCoopers (October 2009). Champion for digital inclusion: The economic case for digital inclusion. http://www.parliamentandinternet.org.uk/uploads/Final_report.pdf (accessed: 02/12/09)

¹⁸¹ <http://www.uk.freecycle.org/> (accessed: 28/04/10)

such is required. Furthermore, recycling goods in this way is positive for the environment, can reduce reliance on costly removal services for large bulky unwanted goods, and can raise some cash for the household. These types of service could save time and effort and minimise frustration particularly if mobility is compromised.

With the advent of software as a service, costs (e.g. for software, such as text to speech, enabling accessibility) are set to become more competitive with NGS, driving prices down to the benefit of the consumer. Affordability of services for people with disability is also a key requirement of the European Parliament:

“If you look today at many of the devices that are available for people with disabilities [...] then there is a lot of development coming from the broader network developments and the broader device developments, particularly from consumer markets, that make it possible that these devices could become a lot cheaper. [...] ...one of the requirements from the European Parliament was, as a matter of fact, to demand that the solutions would be truly affordable across Europe.” (Dr. Paul Timmers, European Commission)

6.2.6 Improved accessibility

Access for older and disabled people to day-to-day activities (e.g. e-commerce, e-government, assisted living, information searching, wayfinding) is likely to improve in general, because of a range of factors. These include technological developments (including better interoperability and improved quality of video), portability (location-independent services) and changes to the way that services are purchased (e.g. personal budgets for social care).

For instance, contextually relevant applications could detect where a person is located (e.g. a noisy environment) and adjust accessibility to a service accordingly (e.g. provide subtitles).

Improvement to the richness of the input and output of interfaces (via multi-modal interfaces as standard) is recognised as important for progress in enabling access to information and communication technologies for everyone (e.g. the European Commission's *Towards an accessible information society* report¹⁸²). Our RNID interviewee noted how simply adding subtitles, as standard, to content, improves people's sense of inclusion.

“We had a really positive experience the other day with the Treasury website [...] online videos on there are subtitled, and so for a lot of people who are hard of hearing... it's really great to have a subtitle option, because it means they can understand the content really well, and it seems to be now that the Treasury have decided that as a matter of course they will subtitle all their videos which are about taxation issues, or things that people really need to know about.” (Emma Harrison, RNID)

It is likely that in the future there will be increased availability of true multi-modal interfaces for products and services that provide information in different sensory modalities (visual, audio and touch, for instance). VoIP can already offer multi-modal communication in the form of voice, text and video. However the video quality is compromised with current average network speeds, reducing its full potential to support, for instance, use of sign language and lip reading.

¹⁸² http://ec.europa.eu/information_society/activities/einclusion/docs/access/comm_2008/staffwp.pdf

Personalisation for access and communication needs is also likely. For instance, the SNAPI project¹⁸³ is developing a system of coding user requirements so that electronic interfaces are adapted accordingly for appropriate access (via a 'smart card' which contains the user's accessibility requirements). This would enable, for instance, a person with low vision to more easily and quickly use devices such as computers, ATMs and ticket machines because the information is always presented in a format that suits their needs (e.g. particular font size or colour contrast, audio output).

Improvements to the way in which networks are interconnected are also likely to increase accessibility in the future. Software as a service would enable people with particular access requirements to purchase software anytime and anywhere (e.g. text to speech software for a one-off occasion) so that the service becomes accessible.

"If we talk about people who need to use a cash machine, if you've got someone with low vision who may need a screen reader, that screen reader could possibly be downloaded over the internet and be the latest, the most up-to-date, screen reader or the most up-to-date software that connects to their mobile phone. So again, that is connecting one network to another [...] This means there is need for a more open environment which allows for necessary services like accessibility services to come from the network – an inclusive infrastructure." (Dr. Paul Timmers, European Commission)

On purchasing services, one of our interviewees noted that the change to personal budgets for social care services, whereby users have more control over the services they choose to 'purchase', has the potential to drive a more competitive market. With new purchase systems, manufacturers of assisted living products will be under greater pressure to design them to better meet their target users' needs; they no longer will be guaranteed bulk sale of their supplies.

"[with personal budgets] individuals need to be assessed and then a certain amount of money is given to them to purchase the services they need, which may include assistive technology, and which in the future will include telecare. [...] That's creating a big change in thinking [...] on the part of manufacturers [...] and I think in the future technology will be on the shelves for people to purchase." (Prof. Gail Mountain, University of Sheffield)

6.2.7 Communicating with groups, via media

The benefit identified in our research into users' improved ability to communicate with groups through media in day-to-day activities (e.g. in local government and community) is supported by developments in NGS that increase the number of opportunities to join and create online community networks (also see Section 5.2.3).

Online community networks could enable people to provide mutual support, and exchange and share information and experiences (e.g. about local issues, e-commerce etc.). These opportunities could have the additional benefits of increasing participation in local government, reducing social isolation and improving quality of life through engaging with personally meaningful and relevant activities. Reducing isolation is a key goal of many service developers

¹⁸³ <http://www.snapi.org.uk/>

for current and future generations of older people, and this was noted by our interviewees.

"We do sincerely think that the biggest issue over the next 10 years in this country, given our ageing population, are things like isolation, loneliness, leading to depression. Dementia of course is a big issue, [...] but I genuinely believe that our biggest challenge is much more around people living at home, getting very depressed and very isolated. I think the more we can use technology to achieve results from people in that situation, the more likely we are to be able to support older people." (Melinda Phillips, Housing 21)

With NGS, the construction of online communities could be improved to provide more engaging, high quality, virtual and accessible multi-sensory spaces that people would enjoy inhabiting. For instance NearLondon (see Section 6.2.2) plans to link its virtual shopping experience with social networking websites such as Facebook so that users can meet their friends and discuss purchases using video chat, simulating shared shopping experiences with social benefits. Developments in virtual reality that provide rich and natural worlds in which to interact with others opens opportunities for a vast range of online group activities. In these types of new shared environments, people could socialise as well as participate in more serious day-to-day discussions.

6.3 Challenges to future service provision

There are several challenges, particularly relevant to the implementation of NGS in day-to-day life, that need to be addressed to ensure that the benefits to older and disabled people are met. These include the cost of equipment to access essential services (e.g. government services); negative attitudes to the migration towards online versions of traditionally face-to-face services; organisational difficulties in shifting some government services online; user acceptance of targeted and personalised advertising; and premature reliance on technologies for assisted living.

Many of these challenges are relevant when considering current-generation broadband access, although their impact may be higher in an environment in which NGS replace offline alternatives. The issues above are likely to be exacerbated by other factors such as the more general issue of poor website design for accessibility. Other challenges that relate, though not exclusively, to other day-to-day activities services are discussed in Chapter 7.

6.3.1 Costs of, and attitudes towards online access to 'essential' services

The government vision, at the time of writing this report, to shift public services online was to save hundreds of millions of pounds¹⁸⁴. However, there are over 12 million people yet to get online¹⁸⁴. Numerous initiatives to provide financial and other assistance to purchase computers and get connected to the internet are working towards the realisation of this vision.

According to the Department for Business, Innovation and Skills (BIS), people who are older or disabled are considered to be two of six priority target groups for assistance in getting online¹⁸⁴. Low-income and unemployed households are also priority groups to which some older or disabled people could be considered

¹⁸⁴ BIS (March 2010). National Plan for Digital Participation.
<http://www.culture.gov.uk/images/publications/National-Plan-Digital-Participation-Final.pdf>

to belong. Initiatives to improve access and/or provide financial support for these groups include the Home Access programme¹⁸⁵, which provides financial support to get online for low income families (but which may not be relevant to many older and disabled people) and UK Online Centres¹⁸⁶ which provide access to computers and the internet with help and advice on using them. Furthermore, the government has stated its commitment to provide £2.9million of funding to support 20,000 older people in sheltered housing to get online¹⁸⁴.

However, research by the Consumer Expert Group¹⁸⁷ and Consumer Focus¹⁸⁸ indicates that people with disabilities or on low income are also concerned about the added 'extra' costs of getting home access (e.g. extra assistive devices to enable access, peripheral devices such as printers, paper, ink, maintaining the broadband subscription).

The issue of cost as a barrier to internet adoption is complex; many people on low incomes (including those who are older or disabled) do not perceive that the benefits of accessing the internet outweigh the costs (which are not just financial)¹⁸⁸. Costs include concerns that all forms of face-to-face contact (which is valued as part of day-to-day life) will be removed as an option. And for many low income non-adopters of the internet, the money-saving benefits that are most commonly communicated are simply not considered relevant to them (e.g. no personal credit cards)¹⁸⁸.

Engaging people with online government services may also be a challenge. A study in 2008¹⁸⁹ reported that among a sample of 216 government portal users and 86 non-users, interest in e-government services was generally low. The study also suggested, however, that people valued personalisation, user-friendliness and the ability to communicate. Further research is needed to understand how to engage people.

Managing attitudes, expectations and user acceptance, particularly for NGS for day-to-day activities, is important. Users may feel more in control over whether they 'opt in' to services such as health and leisure, but for day-to-day services, this may feel like an imposition. Packaging services with those that facilitate contact with others may reduce the threat of loss of control and direct contact with others, but this area needs more investigation.

6.3.2 Practical barriers to the online provision of some government services

Whilst many government services are already online, there are still challenges for other government departments (e.g. social services) that do not translate so easily into an internet service. As noted by one of our interviewees who worked in local and community government, there are some barriers to government service staff reaching people online (e.g. social work staff are not allowed to capitalise on existing social networking sites). This would require change towards acceptance of social networking sites for reaching and engaging with

¹⁸⁵ <http://www.homeaccess.org.uk/>

¹⁸⁶ <http://www.ukonlinecentres.com/>

¹⁸⁷ Consumer Expert Group (October, 2009). Report into the use of the Internet by disabled people: barriers and solutions. <http://www.culture.gov.uk/images/publications/CEGreport-internet-and-disabled-access2009.pdf>

¹⁸⁸ Pitt, J. (March, 2010). Broadband minded? Overcoming consumers' barriers to internet access. <http://www.consumerfocus.org.uk/assets/1/files/2010/02/Broadband-Minded.pdf>

¹⁸⁹ Kolsaker, A. & Lee-Kelley, L. (2008). Citizens' Attitudes Towards eGovernment and eGovernance: a UK Study, *International Journal of Public Sector Management*, Vol. 21 (7) pp. 723 – 738

some groups targeted by social service staff. This consideration is important for effective provision of a wider range of NGS for government-related activities.

"...Social services care, youth work, community and development, housing support. Those are areas that even now you'll find that many social workers, youth workers are not allowed to access some of the potential sites – they're not allowed to have a Bebo account or Facebook account as an official site." (Stephen Dodson, DC10plus Network)

6.3.3 Accessible design of government services

Use of government websites will also be a challenge until more sites are made accessible through good universal design or through personalised interfaces. This is particularly important if alternative means of accessing government services are withdrawn.

Good research that informs website design needs to translate into reality to really improve and ensure that web pages of e-services meet web content accessibility guidelines and are not in breach of the Disability Discrimination Act. Research in 2005 for the Cabinet Office (*eAccessibility of public sector services in the European Union*) revealed that 70% of European public websites completely failed in this regard and 97% were not accessible or usable by people with disabilities¹⁹⁰. However, government websites such as DirectGov conform to UK and other web guidelines and have deployed accessibility features¹⁹¹ that benefit people with visual, hearing, and dexterity impairment.

6.3.4 User perceptions of implementation of electronically stored personal data

User perceptions and attitudes towards targeted advertising and personalisation are often mixed; the benefits of convenience are often balanced by the threat to privacy¹⁹². For instance, many people are cautious about the information that is stored about them and prefer to feel in control of their own choices. Ensuring that technology allows users to control it (in easy to use and accessible ways), rather than people feeling that the technology controls them, is important¹⁹³.

Finally, assisted living, where the quality of life for people is supported through greater use of technology, runs the risk of premature reliance on technology. Research for the AMIGO project¹⁹⁴ (Ambient Intelligence for the Networked Home Environment: see Annex B) – albeit a project not specifically targeted at older and disabled people – explored attitudes to assisted living technologies with over 50 people (15-58 years). They found that whilst users appreciated technical solutions for practical tasks (e.g. a door that recognises them, and support for adjusting lights and curtains), there was concern that automatising

¹⁹⁰ cited in <http://www.egovmonitor.com/node/6662>; and http://www.cabinetoffice.gov.uk/newsroom/news_releases/2005/051124_eaccessibility.aspx: both accessed 02/12/09

¹⁹¹ <http://www.direct.gov.uk/en/HI1/Help/Accessibility/index.htm>

¹⁹² Lee, J. K., Lehto, X. Y., & Lee, C. H. (2010). Effect of E-personalization and online security features on consumers' attitude: The case with travel websites. *Journal of Management and Marketing Research*, 4 (March) (<http://www.aabri.com/manuscripts/09347.pdf>: accessed: 30/03/10)

¹⁹³ http://www.communicationsconsumerpanel.org.uk/No%20one%20should%20miss%20out_digital%20future%20research%20report.pdf (accessed: 25/03/10)

¹⁹⁴ Röcker, C. Janse, M.D., Portolan, M. & Streitz, N. (2005). User Requirements for Intelligent Home Environments: A Scenario-Driven Approach and Empirical Cross-Cultural Study, October 2005, SOC-EUSAI 2005 (http://www.hitech-projects.com/euprojects/amigo/publications/roecker_et_al.pdf accessed: 27/11/09)

some of elements of the system may reduce everyday mental and physical exercise, rendering participants too dependent on the systems. Rather than capitalising on what people can do, it may produce over-dependent behaviour that risks reducing existing abilities that are no longer practised. Smart systems that provide appropriate support as per need and ability may reduce this risk.

7 Risks and challenges

Summary

To avoid painting an overly optimistic view of the future, it is important to highlight key risks and challenges which the project has identified as needing to be overcome for the potential benefits of future services to be realised. A theme which emerged repeatedly in the project interviews was the risk of the roll-out of NGS contributing to a bigger divide between people with and without access to online products and services, with more negative impact for those without access than currently. Many of the issues and challenges identified are general. In this chapter, these are grouped under the headings of Access, Logistics and Impact:

- a. Access: If next generation services are not accessible, usable, affordable, desirable and available to older and disabled people, then their benefits may not be realised.
- b. Logistics: Key logistical challenges relate to: (i) seamless technical integration (so there are not technical barriers to users accessing products and services), (ii) effective coordination and integration of services, and (iii) a need to move from trials and pilots of new services to implementation.
- c. Impact: A key set of risks identified in the project related to the potential for (i) increased isolation (for example, if face-to-face care is replaced by a next generation service), (ii) increased dependence (for example, because next generation services might make it too tempting for users to rely on a service for actions they would otherwise be capable of doing for themselves), and (iii) excessive reliance on electronic systems (e.g. back-up, security, quality of service for life-critical services)

Through chapters 3 to 6, the near-future (5-10 years) potential benefits to older and disabled people of NGS for health, work and education, leisure, and other day-to-day activities have been described. Each chapter concluded with a selection of challenges that were specific to each topic area.

In this chapter, a range of more generic risks and challenges to older and disabled people benefiting from NGS are detailed. The challenges are directed at various stakeholders, depending on the risk described. For instance, some risks represent a challenge for designers and researchers, to ensure that the design requirements of older and disabled for next generation products and services are met. Other risks might depend on engineers and technologists rising to those challenges, for instance, of ensuring security and reliability of the networks.

The issues outlined here were informed both by the desk research in Phase 1 and also by the interviews in Phase 2. Quotations are used extensively in this chapter to bring the issues to life through our interviewees' comments and experiences. The issues are grouped broadly into Access, Logistics and Impact.

7.1 Access

Ultimately, for older and disabled users to capitalise on the benefits afforded by NGS, 'access' has to be facilitated. There is a risk that users will not be able to benefit from NGS because of a number of factors related to 'access':

- Poor ability to access and use, and affordability;
- Low end-user engagement, acceptance and/or compliance; and
- Concerns about privacy, ethics, and data protection

Each of these factors are described and discussed below, illustrated with comments and experiences from the interviewees.

7.1.1 *Poor ability to access and use, and affordability*

The government's Universal Service Commitment¹⁹⁵ intends to ensure that by 2012 everyone can access and use the internet with a 2Mbps (Megabytes per second – a measure of bandwidth) broadband connection. As acknowledged in various reports (e.g. BIS's National Plan for Digital Participation¹⁹⁶), this assumes that: (a) there is sufficient network coverage (i.e. infrastructure across the country, including in rural areas); (b) people are sufficiently motivated to get online; (c) people are able to afford to get the necessary equipment; (d) people can get the internet installed and set up; (e) they can benefit from the services offered (i.e. they are accessible and usable); and (f) there is sufficient support for ongoing use. In 2009, 73% of the population had access to the internet (at home or elsewhere), while 27% of people were without¹⁹⁷. Of those without home access, 70% reported no intention to get online at home in the next year or so. Lack of interest was the biggest reported barrier, and around a third cited cost¹⁹⁷.

Following numerous initiatives, cited throughout this report, to support access to the internet by everyone, the digital divide¹⁹⁸ appears to be narrowing. In October 2009, Ofcom reported that groups previously identified as having lower than average take-up of the internet (e.g. older people aged 65 years or over, DE socio-economic groups) are catching up¹⁹⁹: for example, since 2007 there has been a 15% increase to 41% take-up of the internet for the over-65s.

This appears to be good news, but it is only one step towards enabling the services described throughout this report, that rely on the next generation network. The NGS rely on much higher broadband speeds (in the region of 20Mbps and above) than those currently being proposed and supported by the Universal Service Commitment. To access these NGS requires a new fibre optic network infrastructure, which is currently being rolled out (to replace the older copper network). The issues facing uptake of the first generation network

¹⁹⁵ <http://interactive.bis.gov.uk/digitalbritain/report/executive-summary/universal-service-committment/>

¹⁹⁶ <http://www.culture.gov.uk/images/publications/National-Plan-Digital-Participation-Final.pdf>

¹⁹⁷ Ofcom (May 2010). UK Adults' Media Literacy
http://www.ofcom.org.uk/advice/media_literacy/medlitpub/medlitpubrss/adultmedialitreport/adults-media-literacy.pdf

¹⁹⁸ the gap between people who have effective access to digital ICT products and services (in terms of physical accessibility, resource and skills) and those with limited or no access.

¹⁹⁹ http://www.ofcom.org.uk/advice/media_literacy/medlitpub/medlitpubrss/uk_adults_ml/adult_ml.pdf

could be replicated with the NGN, and this needs careful management by various stakeholders to avoid creating another digital divide²⁰⁰.

An increased digital divide would be an unacceptable consequence of NGS. As indicated by the research on take-up of the first generation network (see above), some groups are more likely to be at risk of exclusion than others, such as older and disabled people. This assumption was supported by comments by several of our interviewees who noted factors such as poor ability to access and use ICT-based services, and the affordability of equipment and services.

Products and services are generally not designed with older and disabled people in mind²⁰¹; older and disabled people typically require costly assistive aids to access the same technologies that non-disabled people can access. Some of our interviewees noted that extensive product functionality and designs that are considered 'stylish' by younger users are often prioritised in product development at the expense of good product usability.

"We do our own in-house research and testing and we do then give feedback to companies about their design. We have worked with some companies in the past, but the feedback is normally that people want something 'clunky' and that isn't 'en vogue' at the moment: things are meant to be sleek, things aren't meant to be clunky." (Emma Harrison, RNID)

"I think there's a huge opportunity for companies of all sorts to innovate all kinds of products and services for the 50+ market. Each month 870,000 people turn 65. Most companies seem to target young people with innovations and I think that's a missed opportunity." (Niamh Scannell, Intel Corporation)

Furthermore, as noted elsewhere, disabled people who are less likely to have financial independence (poor job prospects) and older people who are state pension-dependent are less likely to have a high disposable income to spend on costly products and services.

Many of our interviewees reported that thoughtful accessibility and ergonomics, user-centred design, ongoing support and training (e.g. basic IT skills), support with, or low costs of, equipment, and regulation and law each make an important contribution to mitigating this risk. Each of these areas relating to 'access' are discussed below.

"The tragedy is communication systems are magnificent for people who are socially isolated. Who are socially isolated? Old people. Who don't use them? Old people. And they are not sold to them in the right way - 'Oh yes you must buy a computer' with no suggestion of 'why?' So it's not sold to them in the right way [...] it's presented in a way which either does not appeal to them, or scares them." (Prof. Alan Newell, University of Dundee)

²⁰⁰ Consumer Panel (September, 2008). What is the value of next generation broadband?
http://www.communicationsconsumerpanel.org.uk/downloads/Research/NGA'sEconomic&Social%20Value_Research/NGA%20Position%20Paper/K5.pdf

²⁰¹ Freeman, J. & Lessiter, J. (2009, June). Exploring how manufacturers, suppliers and retailers address the needs of older and disabled people: what are the barriers and drivers? Research report for Ofcom's Advisory Committee on Older and Disabled people.
http://www.ofcom.org.uk/research/usability/older_disabled/research/report.pdf

7.1.1.1 Accessibility

Accessibility, or ability to access, was an overriding theme for many interviewees; many reported that accessibility should be an ongoing aim in the development of products and services and should never be ignored nor forgotten. Technology innovation holds great promise for people with disability (including older people). However, it could, equally, increase exclusion if accessibility is not considered at the outset of product and service development and throughout the lifecycle of the product or service.

“So many website are unusable by older people and there’s a lot of work which shows that [...] you need more than the W3C guidelines in order to produce systems which are accessible properly to disabled people. There’s lots of them [websites] that will speak their content, but are completely inaccessible in that form.” (Prof. Alan Newell, University of Dundee)

Encouraging product and service developers to see the benefits of accessible design is an important hurdle to be overcome for more widespread attitude change in the industry. Improving the collection and availability of market data about people who are older and disabled would support understanding of the issues in this regard²⁰².

“If you are born deaf and if you’ve grown up with it, if you grew up within a signing community you will expect sign content to be online, however it is a very, very small group. Only around 50,000 people have sign language as their first language; the vast majority of deaf or hard of hearing people will want to access content with subtitles.” (Emma Harrison, RNID)

“There are areas where manufacturers and service providers either have been forced or have recognised that accessibility is a key thing to get right.” (Steve Tyler, RNIB)

7.1.1.2 Usability

Ensuring usability, or a user's ability to use a product or service, is an important factor in minimising the digital divide. Many products and services are currently not designed with older and disabled people in mind. This is largely because where product/service testing is conducted, older and disabled people are rarely involved in the research process²⁰². User-centred design (UCD) places real people at the heart of the design process through iterative research with concept creation and prototypes. Involving older and disabled users at each step of the development process should improve the usability and success of NGS and reduce the risk of exclusion. Needs of other target markets (e.g. children) can often be well met with good UCD, for instance, toys often have large buttons, colourful, bright and textured materials.

“... if you can get user-centred design at the heart of some of what you are doing then hopefully you start to address some of these issues.” (Graham Worsley, Technology Strategy Board)

“...the widget for attention training – that was designed with older people, we had several workshops [...] It wasn't that complicated, you have to speak to them, and involve them and

²⁰² Freeman, J. & Lessiter, J. (2009, June). Exploring how manufacturers, suppliers and retailers address the needs of older and disabled people: what are the barriers and drivers? Research report for Ofcom's Advisory Committee on Older and Disabled people.

(http://www.ofcom.org.uk/research/usability/older_disabled/research/report.pdf)

try out things and go back [...]. They'll tell you straight up."
(Niamh Scannell, Intel Corporation)

Many of our interviewees reported that UCD with older and disabled people is essential to reducing the risk of an increased digital divide. As illustrated by the quotes below, the complexities of having different or multiple impairments can have profound and unanticipated effects on product/service usability.

"So if you look at older people they've got a wide variety of minor impairments, some of which interact so that if you were thinking of producing a website for a visually impaired person, you might use speech synthesis. But if you're doing it for an old person, their hearing is not as good as it was, the cognitive load of listening to synthetic speech is often higher than they can cope with, and many of them have got a antagonistic attitude to technology caused by technology being antagonistic to them."
(Prof. Alan Newell, University of Dundee)

"When you've got so many groups with so many different desires, you can come up with the perfect phone for someone who is visually impaired, but that might not work for someone who is deaf or might not work for someone who has got arthritis. And that is the thing – it should be about having a range of products to suit a range of needs." (Emma Harrison, RNID)

Similarly, capturing user feedback through research can ensure that service providers deliver the benefits that they intend. For instance, our interviewee, Melinda Phillips (Housing 21) described some unexpected results from research in the VIRTE_x (telehealth) project. Reminders that were delivered through the television set were sometimes perceived as unwanted interruptions to valued broadcast television viewing.

"One of the things that people did say is, 'I am watching Coronation Street, and it's my favourite soap programme, I don't want your prompts to be suddenly being displayed on the television; I don't want to be interrupted that way.'" (Melinda Phillips, Housing 21)

In another VIRTE_x application, blood pressure self-checks were found to increase, rather than decrease GP appointments because users became overly anxious about minor changes to this vital sign.

Our interviewees described a range of methodologies they implemented in their user testing with older and disabled people. These included behavioural monitoring (e.g. what is being downloaded), subjective user feedback and controlled scientific research that compares existing services with new ones.

"Some of our deliveries of monitoring systems in people's homes, for people living independently with heart conditions and lung conditions, the products had touch-sensitive LCD screens, where we encountered problems with arthritis, and some users having real problems in navigating around those screens. We reverted to tactile rubber buttons, and not very many of them, keeping it simple. The user interface has to be guided by the capability and the interest of the end-user."
(Steve Sadler, Tunstall Group)

"A colleague of mine has developed a system for reminiscing which is designed for use with people with fairly severe

dementia. Now, a computer being used by people with dementia seems not possible, but it is if the software has been properly designed and if it's been designed in collaboration with the users. If people with dementia can use computers, anyone can." (Prof. Alan Newell, University of Dundee)

Some research conducted by our interviewees explored the experiences of both providers and users of the service, and explored products and services in naturalistic environments (e.g. the user's own home) to ensure ecological validity of the research outputs (i.e., suitable to a real world context) and to understand of contexts of use.

"Through TRIL – that's where we work with other clinicians – with a range of doctors, nurses, physiotherapists neuroscientists and so on – we reach out to them as the experts and try to understand some of the challenges that they see from a research point of view [...] and then conduct experiments with real older people in their home setting and see how this actually plays out in real life." (Niamh Scannell, Intel Corporation)

"... we spent the first two years gathering intelligence from people with long-term conditions and with people working with them – health care practitioners, specifically - about the sorts of issues they have with technology use; and from people with long-term conditions about the issues they've got with managing their condition; what sort of technology they might feel comfortable with using. So it's a long way to get to before you get to a prototype device [...] And then moving beyond that [with the SMART 2 project] when people use the technology examining if it has benefit by looking at before and after measurements with individuals who are using the technology." (Prof. Gail Mountain, University of Sheffield)

Whilst research with users can clearly help define better products and services, many companies cite research costs as a hurdle to better meeting the needs of older and disabled people in their product/service design process²⁰³. The returns on their investment in designing for good product usability are often not well documented, but should reduce product support costs, improve brand loyalty and encourage positive word of mouth. Public service providers have a responsibility to ensure that the needs of their service users are met, and improved mechanisms to support service user research could improve the relationship between service users and providers, as indicated by the quote below.

"So I think there is the need for that more genuine dialogue amongst the population [...] more democratic engagement. And of course that's expensive. So there's more scope for conversation, but there is more of a need for genuine listening by the decision makers or the policy makers." (Stephen Dodson, DC10plus Network)

It is likely that as suppliers compete for users to buy their products, particularly within the health and wellbeing service area (e.g. with personal budgets),

²⁰³ Freeman, J. & Lessiter, J. (2009, June). Exploring how manufacturers, suppliers and retailers address the needs of older and disabled people: what are the barriers and drivers? Research report for Ofcom's Advisory Committee on Older and Disabled people.
(http://www.ofcom.org.uk/research/usability/older_disabled/research/report.pdf)

discerning consumers could have a more direct impact on suppliers' designs by choosing whether or not to buy a product. This should encourage wider implementation of both accessible and user-centred design, particularly in the telehealth domain.

The computer interface for many existing applications is associated with numerous usability problems, particularly for older people who may have only limited experience from their latter working days, if any. Some of our interviewees were less positive about the potential positive impact of next generation products and services because the interface is the computer. Computer interfaces assume at least basic familiarity with nested windows, menus and 'computer-speak'. The risk is that the NGS developers assume IT literacy, as well as motivation to learn these skills (see Section 7.1.2) in their users.

"... some e-learning is not very accessible for deaf people [...] - the language is too complicated and one of the big challenges with all of this going forward is actually making sure people use simple, understandable language." (Emma Harrison, RNID)

As some of the examples throughout this report indicate, there are alternative interfaces that are more familiar, intuitive and easier to use for older and disabled people. This includes the television set, which could be exploited in the development of many NGS. Removing the sometimes perceived 'complexity' of using the internet by harnessing the capabilities of other devices, as the example below illustrates, that seamlessly and connect (wirelessly) to the internet could reduce this risk.

"A massive challenge for the elderly is devices, because computers are not things the elderly are necessarily as comfortable with as are younger people, whereas televisions are. If the user experience of the Canvas platform can be made to be just so easy and follow the same kind of approach that we have with BBC iPlayer [...] I would expect to see the age profile of [TV] on demand in the UK change rapidly and a much higher number of elderly people consuming catch up content than happens currently." (James Micklethwait, BBC)

However, there was also some scepticism about the use of television, in particular, and other systems that are menu-based, through which to deliver new NGS. Anecdotal evidence and research have shown that older and disabled people (among others) can have difficulty using (interactive) digital television services²⁰⁴.

"... the ways those are delivered to the customer are more and more through menu-based or screen-based products right up to the obvious entertainment devices like digital TV, iPod, set top boxes, heating systems. All of these have one thing in common which is digital displays and the need to understand reasonably complex words, phrases, concepts which, if you are not in touch with, immediately cause a problem." (Steve Tyler, RNIB)

²⁰⁴ Lessiter, J., Freeman, J., Davis, R. & Dumbreck, A. (2003). Helping viewers press the right buttons: Generating intuitive labels for digital terrestrial TV remote controls. *Psychology* 1(3) pages 355-377
www.psychology.org/File/PSYCHOLOGY_JOURNAL_1_4_LESSITER.pdf

Indeed, use of the television remote control is often restricted to the most familiar buttons (e.g. channel and volume) for many users²⁰⁵.

"I would suspect that most people use about 5 keys on their remote control." (Prof. Alan Newell, University of Dundee)

"The biggest assisted device that most older people use is the remote control for their telly which is not created for someone who is older, probably having arthritis and maybe bad eyesight as well. And actually some of the basics are still wrong. [...] So I think there [are] those design issues to start off with." (Emma Harrison, RNID)

Furthermore, as highlighted by the quote below, using the television set as a portal to a variety of services could pose difficulties for multi-occupancy households where there is only one television set.

"I had this vision of a man trying to watch football, his wife waiting for Coronation Street, his son wanting to play a game and his daughter wanting to find a telephone number. The thought of everything going via the television assumes this magnificent household with one person who is completely in charge. So I don't see it really will work. I think also different generations have got different views of where technology fits into their lives." (Prof. Alan Newell, University of Dundee)

7.1.1.3 Support and training

Support and training in using ICT-based services can support improved access and usability to NGS. This is particularly important for older people (including those with disabilities) as people aged over 65 years are less likely than all UK adults to have home internet access, and for those who do have access, internet use is more likely to be limited²⁰⁶. For instance, people aged 65 and over were less likely than all UK adults to use the internet for leisure, transactions and entertainment²⁰⁶.

Of course, not everyone has difficulty with technology just because they are part of the 'older' generations. People aged over 50 are now often considered part of the 'older' generation and their familiarity and confidence with technology is likely to be very different to those aged over 80. This viewpoint was reflected in several of our discussions with interviewees.

"... people say that older people aren't yet ready to use technology in a big way; it just varies hugely. There are lots and lots of older people who use email on a very regular basis." (Melinda Phillips, Housing 21)

"I think it has reached that point where it's now got to be a granular approach. I think there's too much of that sort of generalisation based on demographics, for example 'the over 55, don't understand the new world and therefore we've got to drag them on to know how to use this particular feature'. Actually there are different needs." (Stephen Dodson, DC10plus Network)

²⁰⁵ Freeman, J., & Lessiter, J. (2007, May). Easy to use digital television receivers: remote control buttons and functions used by different types of consumer. Report for Ofcom:
www.ofcom.org.uk/research/tv/reports/dso.pdf

²⁰⁶ http://www.ofcom.org.uk/advice/media_literacy/medlitpub/medlitpubrss/older/older.pdf

Support and skills training could optimise the benefits to older and disabled people who need it, and promote, rather than restrict, a sense of control. Feeling comfortable and confident with technology, which can be encouraged with support and training, and having an ability to understand the benefits, are important for some older and disabled people to capitalise on the possibilities afforded by NGS, as illustrated in this quote by one of our interviewees.

“What you see is that today many older people and also other groups [...] that are at risk of being marginalised we see that it is kind of step one that you need to [...] make sure that they have access and that there are the basic skills to use the technology. [...] Step two would be to use that more, really, for self-development; so for people to actually increase their independence. [...] ...they need to learn, on both sides, how to use [the technology] in a beneficial way and that goes beyond knowing how to push the buttons. It's understanding how the technology integrates in your life, in your daily life, so that is the next step.” (Dr. Paul Timmers, European Commission)

To benefit from ICT skills courses, older and disabled people need to be sufficiently motivated to engage with them (see Section 7.1.2). There are many completed and ongoing projects in this regard directed at older and/or disabled people such as Ofcom's Digital Participation Consortium and Media Literacy work, the Penceil Project (How People Encounter E-Illiteracy and how they can Take Action to Overcome it)²⁰⁷ and Age Concern's IT and Biscuits²⁰⁸. These initiatives and others indicate that the challenge of support and training is receiving considerable attention to reduce the risk of digital exclusion.

7.1.1.4 Affordability

Affordability and costs are equally important factors with respect to NGA access and the digital divide. Costs are likely to be incurred by the user for the initial outlay to access the network and for the services on offer.

To access and benefit from future NGS, a pre-requisite condition is that the householder would have, at the least, a broadband connection to the home. Currently very low income households (a segment which many disabled and older people populate) are less likely to have online access at home²⁰⁹. This is currently being addressed by Government financial assistance for Home Access,²¹⁰ targeted at households with school-age children, although the issue of affordability affects those without children too. It is estimated that around 12,000 children with disabilities will be able to apply for equipment through the Home Access project, including assistive technology²¹¹.

The potential risk of exclusion because of high costs of next generation products and services was acknowledged by several of our interviews. In this context, one interviewee described how payment shared with the state (e.g. NHS funding 'collective' services) could be helpful to users.

²⁰⁷ <http://penceil.lse.ac.uk/> (accessed 02/12/09)

²⁰⁸ <http://www.ageconcern.org.uk/AgeConcern/itea-and-biscuits.asp> (accessed: 02/12/09)

²⁰⁹ Ofcom (Oct 2009). UK Adults' Media Literacy. Interim Report. http://www.ofcom.org.uk/advice/media_literacy/medlitpub/medlitpubrssi/uk_adults_ml (accessed 12/2/10)

²¹⁰ <http://www.homeaccess.org.uk/> (accessed 31/03/10)

²¹¹ 'Kids get Home Access 2' [article in] Ability: Accessible IT at work. Iss 77, Spring 2010.

"I think the Department of Health are interested in looking at the difference between what goes into personal budgets and what they see as more collective services. They're quite interested in seeing technology as being funded not necessarily through someone's personal budget but as something that's available collectively [...] Because if we simply leave it to older people and their families to access all these things on an individual basis they think might be useful, (a) they might not know about all the things that are around, and (b) it is actually much better value for money if we can think about the things globally that will support older people..." (Melinda Phillips, Housing 21)

Another interviewee raised the issue of the, as yet unknown, costs for the NG infrastructure and costs for setting up and operating NG services. He posited that the costs of *not* developing these new NG services could exceed those associated with implementing NGS.

"One of the big questions is how much is it going to cost. As vulnerable people receive other utilities as part of their benefits package then we have to seriously think that if this is a vital utility, then financial assistance may be appropriate to help lower-income households to engage." (Stephen Dodson, DC10plus Network)

Much of the discussion in the preceding chapters highlights low cost as a benefit for several reasons: partly because, in the future, software is likely to be provided as a service. Flexible methods of paying for services (e.g. pay-per-use, add-on subscriptions to existing service subscriptions) are likely propositions.

"I do think we're moving from the tens of thousands to the hundreds of thousands if we're talking about subscription to an information-support type network." (Kevin McSorley, Fold TeleCare)

To enable access by all to services, particularly those where the traditional service intends to be less widely available (e.g. government and health services) the cost of entry needs to be affordable, and there is a rationale for at least some of the costs to be met by others (e.g. NHS for telecare).

7.1.1.5 Regulation and legislation

Regulation and legislation may be required to ensure that the risk of an increased digital divide does not become a barrier for users of NGS. Some of the time, interviewees commented that ACOD, Ofcom, and others had a role to play in ensuring that all users – whatever their ability or needs – have a right to direct the way in which the services are developing, to avoid the "big Corporates" dictating what users need. As the first quote indicates, NGS should theoretically benefit people who are currently more likely to be digitally excluded. It should enable more user-generated applications and content, allowing people whose needs are not typically met, and more 'participation power' to fill what are currently seen as niche markets.

"...I think that Ofcom and the Consumer Panel and other Advisory Bodies need to say actually this is what we would like to see; we want them to start building for our needs – we have to be the consumer of what we want creating for us, not to be there to consume what's being created for us as it were and

adapt to it [...] And in that sense, that's that full cycle about enabling people to be more creative by using the technology and to be able to create new technologies which suit their needs. That you can't really do without next generation, super fast broadband; you need to create that environment for genuine innovation and creation.” (Stephen Dodson, DC10plus Network)

“We really do have, to some extent, to focus on the usability of these services and to put regulation around usability. There's a lot of focus on regulating all sorts of elements of industry; there's very little focus on regulating what it's like for the customer, what's it's like for the end-user.” (Steve Tyler, RNIB)

7.1.2 Low end-user engagement, acceptance and/or compliance

Access to NGS may be at risk if the services do not engage, are not accepted by, or complied with, by users. The successful roll-out of the services described throughout this report assumes that the services will be marketed in an appropriate and relevant manner to the user.

The risk that users fail to engage with NGS is likely to be exacerbated by factors such as low perceived need, relevance and attractiveness, and high invasiveness of the service offering. These issues are particularly relevant to older and disabled people because, as noted in Section 7.1.1, inclusion of older and disabled people for user testing or research of products and services is generally low; service providers do not always understand the full range of needs of older and disabled people and how to market the services to them. User research at the stage of concept creation can be important to ensuring that the NG product or service is what users want (user needs analysis).

Meeting needs, raising awareness and making products and services attractive and desirable will all influence the user's engagement and acceptance or compliance with the technology. These issues are discussed in the next few sections.

“[Health care practitioners worry] about the perceived invasive nature of telemonitoring technology [...] It's quite difficult to get beyond what users say overtly to their true real feelings about these forms of technology.” (Prof. Gail Mountain, University of Sheffield)

“You know, if you say to somebody [shouts] I'm gonna put a video camera in your house to see if you've fallen over', they're going to say 'no', whereas if you present it properly, and make it clear that they're in charge...” (Prof. Alan Newell, University of Dundee)

7.1.2.1 Motivation to adopt – meeting needs

Marketing NGS successfully requires an understanding of older and disabled people's needs and their motivations to behave in particular ways. Identifying applications, content and marketing messages that can be perceived as imperative to a better quality of life, and which clearly meet the needs of older and disabled users in a specific context, are important.

“...the internet's out there, but people keep saying 'why, it's not for me; it isn't that interesting' so it's still about making it

compelling enough and having a need for them to want to use it.” (Stephen Dodson, DC10plus Network)

The question of what older and disabled people need, is a contentious one in the broadest sense, as older and disabled people essentially want what everyone else wants.

“The notion that [disabled] people want different things is completely nuts, I think what people want is to be part of society and be treated as being part of society. I said that technology is a great leveller; well it is - let's utilise it.” (Steve Tyler, RNIB)

An example of how marketing a service to non-adopters is not always relevant to a target group is illustrated by recent research commissioned by Consumer Focus²¹². This research explored the question of why there is low broadband internet adoption among low-income households. Digital inclusion campaigners have been promoting the benefits of going online by citing hundreds of pounds in cost savings²¹³. Qualitative research with low-income households revealed that affordability (cost) was not the overriding factor. Participants were not engaged by the apparently relevant marketing message to save money through using services over the internet, because without a bank account or credit card, participants were unable to benefit from those cost savings. In fact, having home broadband access was perceived as low priority relative to adoption of other technology products, such as having a mobile phone and access to subscription television services.

One of our interviewees pointed out that more attention and effort could be directed at including target end-users in the concept creation and innovation stage of NG product and service development to identify user needs. User research on services tested at a later stage in development is often too late to adapt the design, as much investment has already been made. Many ongoing projects cited throughout this report have good examples of this valuable exercise of involving users in concept creation to ensure relevance to users. Several of our interviewees (some of whom were involved in those projects) commented on the importance of this process and their efforts in this regard.

“...it is essential to involve older people directly. [...] for example, in Finland, where they invited older people to develop ideas around their living space, like in an older people's recreational home [...] and they came up with many ideas themselves. Now that is relatively new, this kind of user involvement in the innovation, but it's definitely a trend.” (Dr. Paul Timmers, European Commission)

Marketing services needs to take account of how, for instance, older people tend to consume and use technology. For instance, Prof. Alan Newell commented that there can be differences across generations in the perception and use of different types of communication technologies, such as the perceived necessity of mobile phones.

Several of the interviewees in this research recognised that meeting needs with appropriate content (e.g. for Canvas, as asserted by James Micklethwait), and providing services which maintain people's engagement beyond the initial

²¹² Pitt, J. (2010). Broadband Minded: Overcoming consumer barriers to internet access. <http://www.consumerfocus.org.uk/assets/1/files/2010/02/Broadband-Minded.pdf>

²¹³ PricewaterhouseCoopers (October 2009). Champion for digital inclusion: The economic case for digital inclusion. http://www.parliamentandinternet.org.uk/uploads/Final_report.pdf (accessed: 02/12/09)

novelty of the experience (Simon Roberts, Intel), were important to driving uptake and use of new services.

There are several obvious examples of drivers, particularly for older people. The need for family connectedness is particularly relevant in today's context where there is a tendency towards family moving away from their relatives. Furthermore, there appears to be increased recognition that social interaction is associated with positive benefits to health and wellbeing.

The ability of technology to connect people at a distance suggests that social (family and friends) network applications could be effective motivators. Applications might be more successful if they build on existing interests - such as social connectedness - relevant to the target market. These types of applications were in the forefront of the interviewees' minds.

"Our approach is to start people off with the things that are going to excite them and that is always talking to grandchildren, not short emails, but being able to see them via a video camera at the same time [...] And that very often leads people into wanting to try other things." (Melinda Phillips, Housing 21)

"One of the things that goes down well with older people is these ancestral things – that's very popular. And one person I knew gained a great deal from a computer course because it was about writing her memoirs. And the output of the course was a little book with her life story in, with pictures and so on. [...] ...you weren't being sold 'you will learn about computers', you were being sold, 'you will be able to produce this book'." (Prof. Alan Newell, University of Dundee)

Understanding the characteristics and needs of older and disabled people as a unified group may not be helpful. Older and disabled people represent a diverse group of people and several of our interviewees suggested that the market and industry should consider their differences as well as their similarities. Research on older people, for instance, now often differentiates between 'younger old', 'old' and 'older old' (sometimes with differing chronological age categories) to reflect the different needs of different older generations. Needs and wants change through life and circumstance, and can be affected by whether a person has one or more disabilities.

"...there are disabled older people but the characteristics of those two groups are very different, it seems to me. And in particular, the concept of 'a disabled person' tends to be a person who has got a single disability, and who seems to be relatively well motivated to partake in society and to use technology." (Prof. Alan Newell, University of Dundee)

Some interviewees felt that NGS design and development should focus in particular on those 'younger old' groups – aged around 50-65 years – as NGS are more likely to become a reality in their lifetimes.

"But I think we also need to start talking to the next generation of older people, in the next five years [...] How do we relate to the future?" (Stephen Dodson, DC10plus Network)

With time, changes to new models of service should become acceptable and many of the attitudinal challenges should become less significant.

"It's about the adoption of IP-enabled technology. It is about the creation of connected carers and mainstreaming that as an

ordinary service model, in the same way that ten years ago we started delivering telecare and telehealth and subscriptions [...] and we're now ten years on seeing that almost as an accepted service model." (Kevin McSorley, Fold TeleCare)

"Many years ago [...] I was involved in research into community alarms [...] At that time the technology providers already had sensors so that people could be monitored moving around their houses. But it wasn't seen to be socially acceptable to do that; it wasn't raised as indeed a possibility that this technology might be used in the way it is now being used." (Prof. Gail Mountain, University of Sheffield)

Meeting user needs also involves allaying fears and anxieties about adopting and using new technologies and services. As noted elsewhere, some older and disabled people involved in trials of assisted living applications reported concern about the loss of social contact that excessive use of technology for service provision may bring. Part of meeting user needs in service development, particularly where technology replaces much of the typically human, face-to-face, contact, is not to forget the importance of a 'personal touch'.

"I think a key challenge is how to offer customers products and services in ways that customers can understand [...] I think we've lost the ability to understand what it's like from an end-user perspective." (Steve Tyler, RNIB)

Furthermore, in general people need to feel in control of the technologies they choose to have and use in their home and whilst out and about. Ensuring that NG products and services are easy to personalise and update could reduce the fear of being controlled by technology (and losing one's ability to make decisions) and promote confidence and satisfaction with using them.

"..if the text on my screen suddenly becomes bigger because it's decided that my eyesight is going wrong, I'm going to [say] 'oh my god, what have I done?' and 'can I change it back?' So personalisation has got this sort of control question in it. If you do it automatically then people lose control and that's particularly damaging when you've got people who think that what happens is irreversible." (Prof. Alan Newell, University of Dundee)

7.1.2.2 Raising public awareness of new services

Much of the discussion in Chapters 3-6 assumes that the developing and near-future NG products and services described have been developed to be accessible and usable, and have been marketed appropriately. For many of these seemingly futuristic products and services, awareness will be low and demand will not increase until public awareness is raised.

"[Another] risk is low awareness; how do you know that something would help you if you do not know it's there? I think that's where our local authorities come into the frame in a big way, information and advice services in local areas; helping people to know what is available and maybe being having things on loan and being able to try things out." (Melinda Phillips, Housing 21)

Simon Mycock (BT) drew parallels in terms of 'awareness' between NGS and current internet services, such as Facebook. He argued that internet users were

not aware when they adopted the internet that those future services, such as social networking sites, would become available; people opted in to the technology that enabled those applications. The market that emerges from the network capability often offers unanticipated but useful applications.

"I guess it's the same cycle that [...] we went through with broadband. Nobody would have [fore]seen things like Twitter or Facebook or any of the web 2.0 applications. So it's really about having the network there – and allowing the market to catch up a little bit and develop itself." (Simon Mycock, BT)

For services to be considered relevant to older and disabled people, they need to know they exist and how they are likely to benefit them. The ability to trial equipment 'before you buy' was suggested in our interviews and has been identified in other reports as a way of allowing users to make an informed decision about whether a product or service is personally useful²¹⁴. Increasing public awareness of the possibilities and benefits of the new network is a hurdle that needs to be addressed. NGS can feel a long way off when many people have still not opted in to being online at home.

"People need to see the equipment. [...] If you've got a long term condition, once you see it, once you've used it yourself – what we're told by the people doing the Whole System Demonstrator – you tend to be okay with it. But it's preconceived ideas: 'I'm not ill, I don't need a piece of kit monitoring me'. But if you make things that are more desirable..." (Graham Worsley, Technology Strategy Board)

7.1.3 Concerns about privacy, ethics and data protection

There is a risk of low end-user engagement, acceptance and/or compliance with NG products and services if concerns about privacy, ethics and data protection are not addressed; users need to trust the services and the services need to be trustworthy.

This partly involves designing and marketing services in a way that allays fears, such as loss of control (as noted in 7.1.2.1). It also involves equipping the user with (media literacy) skills to understand how to protect themselves when using NGS, ensuring that providers offer secure networks and data storage, and disseminating this information through intermediaries who are trusted by the end user.

"You need to look at what different sorts of users think about their privacy requirements and then implement something around what that research tells you because at the moment it hasn't been done." (Graham Worsley, Technology Strategy Board)

7.1.3.1 Practical security information for users to control

Issues of privacy, ethics, data protection, and other access concerns currently generate much debate in the literature around NGS, and did so among our interviewees.

²¹⁴ Freeman, J., Lessiter, J. & Ferrari, E. (2009, February). Research report: Are you really listening? The equipment needs of blind and partially sighted consumers for accessible and usable digital radio. http://www.gold.ac.uk/media/i2_RNIB_AreYouReallyListening.pdf (accessed 24/03/10)

Some interviewees noted that people often express privacy concerns, when using online services, relating to how their data are being used and whether their data are secure.

“With all your data online, how safe and secure is it? What would happen about ID theft is something that worries people a lot and it does happen.” (Emma Harrison, RNID)

If service users and staff who interact with users do not feel confident that they can trust the technology and the service providers, there is a risk that they are not likely to adopt or use the service.

“You’ve got to have trust in technology [...] When you walk into a bank you feel secure and you used to feel secure on a banking site until you learnt that there were people who set up sites which looked like banking sites. You know that little lock in the corner, what’s that for? You know, anyone could do a little lock in the corner of the screen, can’t they.” (Prof. Alan Newell, University of Dundee)

Practical information that allays people’s fears, such as information about anti-virus software and how to avoid being scammed (e.g. never responding to emails requesting confirmation of your banking details) could help in this regard. Indeed, the Communications Consumer Panel identifies ‘risk management’ as part of the framework for digital participation²¹⁵. Risk management includes helping users to understanding how to protect themselves online, being able to judge whether a service is genuine or not, and knowing one’s rights and responsibilities. Initiatives already exist to support internet users in this way (e.g. Get Safe Online²¹⁶, Webwise²¹⁷) but it is possible that NGS will bring with them new security problems such that users will need to keep up to date with security-related information as part of their ongoing protection.

7.1.3.2 Provision of secure data and networks by providers

Some of the key service benefits as well as accessibility benefits capitalise on the availability of very personal data (e.g. vital signs) including user preferences (explicitly supplied or inferred from behaviour) and the potential to ‘join up’ these different stores of information. This raises numerous challenges and risks around ensuring that the technology on which the services are based is trusted and trustworthy, and that service providers protect users’ data.

User acceptance of NGS for ‘monitoring’ is particularly important in circumstances where a user’s health or safety may be compromised if they are not monitored in the future. Older and disabled service users should feel reassured that their privacy concerns are dealt with (e.g. encrypted personal data and use of accredited data security companies, understanding who has access to their data) for users to comply with using the technology in their home.

In this health and safety service area, justified concerns about online service delivery replacing traditional methods need to be allayed. If the technological infrastructure cannot guarantee good quality of service, including data security and protection, then the service will not be an acceptable alternative to current methods and will not be adopted and used.

²¹⁵ <http://www.culture.gov.uk/images/publications/National-Plan-Digital-Participation-Final.pdf>

²¹⁶ <http://www.getsafeonline.org/>

²¹⁷ <http://www.webwise.com/how-it-works/faq.html>

Users can be put off using services when they are associated with even a hint of difficulty. In fact, as Emma Harrison (RNID) commented, organisations like banks do not always offer online services in ways which meet the needs of users who are hard of hearing.

"... we need to make sure that if we're doing more online banking that the banks know that the people are doing it this way and don't put barriers in the way. And I think that sometimes false barriers get put in the way and that frustrates people and they will walk away from the technology." (Emma Harrison, RNID)

Our interviewees who were service providers recognised the importance of presenting their service as trustworthy to users.

"...people need to believe that we're going to be looking after their interests and we are not going to let them down." (Melinda Phillips, Housing 21)

"...another area where we have a particular role to play is acting as a trusted guide [...] explaining things like technology and being mindful of elderly users." (James Micklethwait, BBC)

7.1.3.3 Engaging trusted intermediaries

Some of the interviewees emphasised the importance of targeting and engaging with people who could be considered trusted intermediaries to provide awareness-raising, and help with accessing and using NGS. Close friends and relatives are more likely than unfamiliar service providers to fill this type of role. Reaching and informing these trusted intermediaries could play an important role in facilitating adoption and use.

"...the Advisory body [Ofcom's ACOD] needs to re-emphasise that connectivity for older people is going to be more vital over the next five years, and so is the capability to know how to use this. So there needs to be a lot of emphasis around the training of trusted intermediaries, about making sure that as people become more switched on, that they actually know how to deal with it and to use it." (Stephen Dodson, DC10plus Network)

"It always is friends and family isn't it, because, the Government has tried to set up training – people have the opportunity to drop in but if you don't know anything about the internet, you're not really going to go down to the local community centre to find out about it, unless someone you care and trust has said 'Go on, let's give it a go together'. I think it's one of those lovely intergenerational opportunities." (Emma Harrison, RNID)

7.2 Logistics

In addition to 'access' challenges described above (Section 7.1), the successful implementation and adoption of NGS to achieve the potential benefits described throughout this report could be thwarted by a variety of logistical problems. The observed challenges associated with the roll-out of the first generation network services (e.g. poor availability in rural areas) could be replicated with the NGS. Indeed, as a pre-requisite for all users to benefit from NGS provision similarly, availability of the network itself needs to achieve almost full geographic coverage. Several interviewees pointed to the risk to an increased digital divide related to network coverage issues, citing issues of responsibility for the

investment and reticence from private companies to invest in the network across rural areas.

"...going beyond the 2MB for the rural communities is going to be a hard ask because the private sector companies don't see that as being a sensible investment at this stage." (Stephen Dodson, DC10plus Network)

"NGN has the potential to be great for consumers and great for society but we have to be very careful that through the economics of rolling them out, we don't fall into a world where the internet becomes a very closed network." (James Micklethwait, BBC)

Logistical problems that emerged in the research, and which may threaten the potential for benefits from NGS to be realised in the next 5-10 years, are related to a number of factors:

- Poor coordination of integrated services;
- Difficulties in technical integration;
- Slow implementation.

7.2.1 Poor coordination of integrated services

A major and difficult challenge facing service providers, which was raised by interviewees with a particular interest in health service provision, was ensuring that the services are coordinated across organisations, stakeholders, and frontline staff. Data will need to be shared across different providers in any service domain for the services to be optimised, and individual roles and responsibilities in this regard need to be clear. This is particularly relevant to the health domain - a particularly fragmented market.

"We started to think – or come to the conclusion – that the NHS or local authority market is dysfunctional because if you're making the kit you have to sell into whatever it is - 120 primary care trusts and 120 local authorities in England, each of whom has commissioners who are responsible for purchasing equipment. So if you're got to sell 20 or 30 odd bits of kit into 120 organisations the overheads of doing that stop it working so that needs to be sorted out." (Graham Worsley, Technology Strategy Board)

The consequences of not addressing this challenge could be a failure to deliver good quality services. This could lead to frustrated service users, and possible rejection of the service by users. If alternative service provision has been reduced as a consequence of the optimism that new networks will improve service delivery, users may lose all benefits associated with accessing the service in any form. Effective engagement of application and service developers with service providers at all levels, and improved clarity in legislation were two areas noted by interviewees as having potential to improve coordination in integrated NGS. These are discussed below.

7.2.1.1 Engagement of all service providers in service development

Many interviewees acknowledged the importance of involving all service providers, including frontline staff, in the development of the NGS to provide a better quality service.

Interviewees reasoned that some staff are often aware of different, important information that might be overlooked or neglected by others in more senior decision-making roles. In particular, frontline staff are likely to have better relationships with service users and so could provide valuable feedback.

Furthermore, for the NGS to be implemented effectively, all staff would need training to understand when, why and how to use the new systems. Indeed, networked services cannot completely replace face-to-face care.

"What I'd like to see is a more coordinated approach. One of the problems that we do have is that we haven't necessarily worked closely enough with the frontline staff for their understanding of the powers and the capabilities of the technology." (Stephen Dodson, DC10plus Network)

As several interviewees commented, service users benefit from an integrated, co-ordinated approach to support ranging from support provided by often untrained professionals who set up the equipment in people's homes (or a good 'out of the box' experience if the product is self-install), through to other frontline service staff who support ongoing use of NGS. This coordinated approach is likely to increase user confidence in the product or service.

"...service providers, network providers need to ensure that products, devices, services, work out of the box - that networks are up, and, you know, connections are lost and regained without any user involvement." (Simon Roberts, Intel Corporation)

"...wonderful kit that works wonderfully but actually there is no support to encourage people to use it. So again, it's there, but it's not going to be used because people haven't got anybody to help them go through the stages that give them the confidence. It's all about confidence." (Melinda Phillips, Housing 21)

However, other interviewees commented on the challenges of engaging all providers working within hierarchical organisational structures, like the NHS. It was suggested that power in these environments can be very sensitive to change; for instance, where better enabling staff in one role can pose a threat to staff working in a different role.

"We need to work with organisations, with the intercultural dynamics of health care, which is very hierarchical. [...] If you ignore that kind of dynamic you can create significant problems. [...] ...it's about the culture of the organisation." (Simon Roberts, Intel Corporation)

Most of our interviewees who raised the issue of a co-ordination challenge, did so in a health service context. However, a co-ordinated approach was suggested by other interviewees working in different contexts. In the area of leisure, content rights and distribution challenges were raised by one interviewee during a discussion about catch-up television services (iPlayer) and how to meet user needs for content that is accessible anytime.

"We're working on rights, but they remain a barrier. There are two types of that I think - the easier 'rights' to crack are the current content and recent archives. [...] When we start to look at the deep archive, it becomes extremely expensive because you need to contact all the contributors in order to clear the rights." (James Micklethwait, BBC)

7.2.1.2 Clarity of legislation

The interviewees from RNID flagged legislative issues in coordinating NGS provision. They suggested that meeting existing legal obligations governing data protection and confidentiality appear to restrict some access through technological routes. Some legislation appears to require greater clarity in the context of sharing information in NGS.

"I think a classic example is banking. You have an online bank account and you need to check something - to change a password - and you have to use the phone and call up. So for some of our users if they are profoundly deaf they might want to use a service called 'text relay', however banks won't accept a text relay call and won't accept an email. So we find people who can't properly access their bank account through no fault of their own; only that they are deaf." (Emma Harrison, RNID)

7.2.2 Difficulties in technical integration

In addition to addressing the risk of poor coordination in service provision, described above, a second logistical issue raised by some of our interviewees related to the technical difficulties in providing a seamless NGS experience to the user.

For NGS to truly offer a better and easier-to-use service than the current service provision, the collection of individual products that make up full services (e.g. vital sign monitoring devices, activity monitoring devices, accessible interfaces) need to operate in an integrated manner within the new infrastructure. For instance, signal compatibility with standard telephone systems, compatibility with assistive devices, and interface accessibility were raised as very critical issues. Dr Paul Timmers (European Commission) suggested that the EC had an important role to play in agreeing technical standards and regulatory measures to ensure that the rights of users (and those of disabled people, through the UN Convention of the Rights of Persons with Disabilities²¹⁸) are protected (see Section 7.2.2.3 below).

"Industry seeks economies of scale. We are not talking about simple solutions but bits and pieces that have to be connected: your set top box needs to be connected to your mobile phone or to a sensor. [...]... interoperability – things need to be connected and to understand each other – there's a lot of work that needs to be done there with standardisation across Europe and that will also help our internal market in Europe. In the meantime, lack of interoperability is a significant barrier." (Dr. Paul Timmers, European Commission)

Several interviewees with an interest in telehealth highlighted some of the problems associated with poor interoperability. There is currently poor compatibility between many existing analogue security and monitoring devices that are already in people's homes and the NGN. Effectively, the alarms may not work with NGN because signals may be incompatible.

"The move to BT 21CN and the trials BT has done in Cardiff have flagged that there are some devices in care homes and residential accommodation that have been there for ten to twenty years, and because of the signalling they use they will

²¹⁸ <http://ec.europa.eu/social/main.jsp?catId=431&langId=en>

not necessarily transmit over broadband networks. So you can get situations where if people are changing to broadband for a cheaper phone deal and they don't say that they have a social alarm then that alarm may then not work.” (Graham Worsley, Technology Strategy Board)

“Ironically, where we introduce NGN we introduce delays. Some people find that surprising in this brave new world but we do have to manage end-to-end network delays. The reality is that some of the older equipment that we have grown used to over the years, which is communicating a smoke alert or perhaps health data, has assumed a certain performance from the telecommunications network, and where we introduce those delays, some of the old equipment simply stops working.” (Steve Sadler, Tunstall Group)

This has potentially dangerous consequences for the user. Currently, some network providers do not guarantee that analogue products will work as intended when using their networks, and this is an important consideration for the future. Ensuring that service providers are well informed, and that users understand these risks, is imperative, as indicated in the quote below. Technically, this is a key challenge to be addressed before personal health and security services are considered as a serious alternative to current services.

“[Having more players in the network provider market and a lack of geographically planned roll out of NGN] means that our network connectivity is less predictable. Some of the new network providers are simply saying ‘do not use alarm systems; they are not necessarily compatible with our networks’. This is very unfortunate; since it has the effect of excluding vulnerable people who could benefit most from accessing new care services.” (Steve Sadler, Tunstall Group)

Three broad areas were raised as relevant to addressing the logistical challenge of technical integration: open standards, understanding how wireless broadband is distributed with a home, and generating guidelines and standards for interoperability. These are discussed in turn, below.

7.2.2.1 Creating services based on open standards

Open standards were flagged by several interviewees as central to the development of NGS to mitigate the risk of poor technical integration. According to the ITU-T²¹⁹, open standards are “standards made available to the general public and are developed (or approved) and maintained via a collaborative and consensus driven process. ‘Open Standards’ facilitate interoperability and data exchange among different products or services and are intended for widespread adoption.”

“The BBC supports openness in terms of open standards, and there’s certainly a benefit in having a small number of standards. [...] We are generally committed to standards that are pretty open and available to a broad range of platforms and devices. An example of one of the reasons why we chose the ADOBE as our supplier for iPlayer [...] was their commitment for cross platform availability. [...] We have a duty and responsibility to other right holders and for the content that we commission.

²¹⁹ <http://www.itu.int/ITU-T/othergroups/ipr-adhoc/openstandards.html>

We think about that very carefully in our choices of technology and DRM [digital rights management].” (James Micklethwait, BBC)

7.2.2.2 Quality of service for wireless LAN

Related to the challenge of providing a seamless experience to the user, the quality of service (reliability, robustness) of home WiFi networks was raised by one interviewee. The thrust of the interviewee's argument was that although high speed internet could be delivered to the home through NGN in the future, the determinant of the quality of service people will receive will be their home wireless environment.

“... whilst wireless is great from an ease-of-use perspective - so you're not putting cables all over the place - thinking very carefully about your customers and how people would use this and set this up in your own home is very important. You can say great, we know we have 40Mbps coming into the home through broadband, how do you then distribute that within your own home so you don't experience loss because of a poor internal network?” (Simon Mycock, BT)

7.2.2.3 Drafting guidelines and standards

According to some of interviewees, small step developments are under way in identifying technical issues that require guidance and standards for industry. Dr Paul Timmers suggested that the EC has a role to play in coordinating this activity and bringing the relevant stakeholders together (see Section 7.2.2). Other interviewees named other organisations such as the Telecare Services Association²²⁰ and Continua Alliance²²¹ as having important roles to play in the development of guidelines and standards for interoperability.

“In the future you need to develop IP standards which don't exist at the moment. And there's a global standards organisation called the Continua Health Alliance who will provide, if you like, certification that equipment interoperates and meets their guidelines but they don't actually write standards themselves, somebody else has to get together to write standards and make sure it all works together and all interoperates. And you're not going to get large scale global take-up of equipment and it's not going to work as a market until somebody addresses that.” (Graham Worsley, Technology Strategy Board)

So there's got to be a push towards interoperability which is why initiatives like the Continua Health Alliance are so important; they're trying to bring suppliers and service providers together to enable end-to-end continuity. That little box in your home, when it raises an alert will need talk to monitoring systems and ultimately health records at the far end. Interoperability and standards are crucial in enabling growth in this new market.” (Steve Sadler, Tunstall Group)

Other interviewees suggested that it will be a challenge to ensure that the different network requirements of different services (often supplied by small

²²⁰ <http://www.telecare.org.uk/>

²²¹ <http://www.continuaalliance.org/>

companies) are dealt with sensibly through any forthcoming guidelines and standards.

“So you can't mix and match equipment [...] so there's a short-term need to address those topics, and the Telecare Services Association is working on some of these things but it's not easy and it's hard going and you're mostly talking small companies.”
(Graham Worsley, Technology Strategy Board)

“...you have to [...] look at the attributes and the needs of the different services that are to be provided, and the providers of the equipment need to make sure that those that are critical and real time match the characteristics of the available communication networks. Those services using video and needing high bandwidth have different characteristics. We need to map the right standards to each application.” (Steve Sadler, Tunstall Group)

One interviewee highlighted that technical issues are likely to be different in different countries depending on their current network environment. He noted that the UK may be in a better position to resolve these issues than other countries such as the Netherlands. It is possible that these differences across European countries make drafting guidelines more complex, particularly if this activity is coordinated at a European level.

“[In the UK] the vast majority of cases still retain an analogue phone connection to people's homes, where NGNs may introduce transmission delays, and may also affect the transfer of tone protocols in voice-band. We can solve these issues, but this can require the replacement of older equipment. The solutions also vary by territory, given the different network implementations and differing modes of use of the system. It's not a case of one size fits all...” (Steve Sadler, Tunstall Group)

7.2.3 Slow implementation

The focus of this report was on the benefits to older and disabled people of NGS likely to become available in the next 5-10 years. Many of our interviewees suggested that this was an optimistic time line, given that the network itself has yet to be fully rolled out (see quote below), because there are technical issues that remain unsolved and and because radical new services (e.g. health) can take a very long time to test and implement. Specific issues raised by interviewees in this context are provided in sections 7.2.3.1 to 7.2.3.3 below.

“The plan is to get to summer 2012 where we've addressed 40% of the UK, and 10 million homes and businesses will have access to the fibre footprint that we're putting in. [...] We hope to hit a million homes by late spring, early summer; 2.5 million by late summer this year; 4 million by the end of this year and then phased build outs taking us to 10 million by summer 2012.”

²²² (Simon Mycock, BT)

²²² Following our interview with Simon Mycock earlier this year, in May 2010, BT announced that they were investing an additional billion pounds to extend their roll-out of superfast broadband to 66% of homes by 2015 subject to an acceptable environment for investment. (e.g. <http://www.btplc.com/news/articles/showarticle.cfm?articleid={b6241b17-f6f9-43e1-954c-d88efd2150fc}>)

7.2.3.1 Scalability of pilots to full scale implementation

Several interviewees commented on the long process of service development, particularly where the change is very radical (e.g. health service).

"It takes a long time before we can get to the population based evaluations, which of course is what is required in health service settings to demonstrate benefit." (Prof. Gail Mountain, University of Sheffield)

"Impact of technology is always overestimated. Developing takes time, for many reasons. In care settings it's a slow process; it's pretty complex." (Simon Roberts, Intel Corporation)

Whilst there are numerous ongoing trials, particularly in the health domain, the outputs to date are based on relatively small sample sizes (with the possible exception of the Whole System Demonstrator Trial). Several interviewees highlighted the challenges associated with extrapolating the research findings from existing pilots to full-scale implementation. They cited different network demands that are difficult to anticipate with small scale studies and that service providers may be reluctant to initiate change when it is difficult to scale up the cost/benefits for wider implementation. Many interviewees felt that the health service evaluation process for implementation through NGN is generally very time consuming and costly.

"If you get tens of thousands of devices interfacing with hospital back end systems, video conferencing between physicians and patients becoming the norm, clearly the demand on the network can be entirely different. [...] We are still at the point with a pretty small market. [...] Telehealth does seem to have been a market that is about to take off for a long time now, I'm in no doubt one day it will but until that happens it's difficult to have a sense of what network demand is going to exist." (Simon Roberts, Intel Corporation)

"...people are very risk averse to try things unless they're thoroughly tested and out there, because it's a major investment for government [...] So one of the problems that you get from a pilot is that you can't necessarily demonstrate that economy of scale. You can show that it works and that it has benefits for individuals, but because it's not usually got the same level of investment that other areas of business have, it's very hard to show what those returns on investment could potentially be." (Stephen Dodson, DC10plus Network)

7.2.3.2 Responsibility for investment in the infrastructure

Identifying responsibility for the overall investment in a NGN infrastructure was also raised by interviewees. As noted by James Micklethwait (BBC: see quote below), the cost can be particularly important as some existing platforms are cheaper than NGN in delivering services. For instance, in leisure service provision, broadcasting services is cheaper than delivering them through IPTV.

"We can't see it [IPTV replacing broadcasting] happening for a very long time, certainly not in 10 years. There's a number of reasons for that [...] length of contracts, linear distribution but critically, let's be honest, it's about the economics. Number one was the cost per hour served, for mass market media, there's

no question that broadcast distribution is far more cost effective than IP distribution currently. [...] We don't have the same quality of service capability on IP now and that won't happen anytime soon." (James Micklethwait, BBC)

As Simon Mycock (BT) noted, whilst BT has started the process of laying out the new infrastructure, other investors – and common funding mechanisms – may be needed to ensure comprehensive NGN coverage.

"So that's a 1.5 billion investment from BT to [reach the goal of supplying NG fibre to 10 million homes and businesses by 2012]²²². But we recognise that to expand that footprint, to continue, there needs to be other investment [...] – as we've seen with other countries that have deployed fibre – whether that's with national government, EU funding, local authority funding, other third parties coming into play." (Simon Mycock, BT)

7.2.3.3 Prioritising service areas

Whilst most of our interviewees predicted that NGS in general will be slowly implemented, a few interviewees suggested that in terms of near-future provision, some service areas may be prioritised over others.

"I think with any luck we'll begin to realise the capability for the core areas, health, education, and work, and all of that could be done more effectively, more efficiently, more cheaply." (Stephen Dodson, DC10plus Network)

However, whilst Stephen Dodson acknowledged that the health service is a core area, and indeed, research activity and investment in this domain is already high, Graham Worsley (Technology Strategy Board) suggested that health services that are paid for by the individual (on a needs basis) may be more likely to progress faster than generic health service provision. Personal budgets for health care could drive areas of the market in this regard.

"Elective care is when you go out and buy it yourself and you think, 'hang on, I'm in a group of people who might be more prone to get type two diabetes therefore I will buy some equipment that will help me to monitor myself. And that's called 'elective care'. So you've got this prescribed versus elective. Is the elective care market the one where these things are actually going to be pushed out a bit quicker?" (Graham Worsley, Technology Strategy Board)

The possibility that 'who pays' may drive adoption of particular service areas faster than others suggests that uptake of NGS in the leisure domain has the potential to be easily marketable to those who wish to opt in. As one of the least controversial service areas, existing business models of bundled subscription-based services could be envisaged to extend to access to NGS when the infrastructure becomes available.

7.3 Impact

The final set of risks and challenges identified in this research is related to the potential 'impact' of implementing NGS. These 'effects' have already been noted throughout this report, and are:

- Increased isolation;

- Increased dependence;
- Reliance on electronic systems.

7.3.1 Increased isolation

As noted throughout this report, one of the potential benefits of many of these NGS is reduced social isolation. This assumes that the technology and applications are trusted, accepted, wanted, accessible and usable. Should these pre-requisite conditions not be met, some interviewees expressed concern that people could become increasingly isolated because (a) they fail to use the services, and (b) that other methods to access the service may diminish.

Other interviewees dismissed the notion that traditional service provision would eventually no longer be available, suggesting that the savings afforded by the majority of services users using NGS could be directed towards providing support for those who could not access NGS.

"I certainly wouldn't be advocating [that face-to-face contact is removed completely] and think that would be morally reprehensible and incorrect. You know, my argument would be that this means that you can release more resources to give more information and more support to those most vulnerable members of society." (Stephen Dodson, DC10plus Network)

Another concern expressed in the interviews was that users may become reliant on mediated assistance and support to the exclusion of face-to-face contact which may or may not be of their own volition (e.g. direct contact facilitated by service providers is withdrawn).

"There should always be an option for human contact. The big thing that we find is that a lot of older people say to us, is that they get very isolated through their hearing loss - they stop going out with their friends, or going to bingo anymore, because they can't hear properly. One of our newer members said that 'thank God for the internet, because, that's all I did, day-in day-out, play on the internet' – because he can put his headphones on and the sound was better. But what he realised was that he'd stopped being part of the actual community because he was only part of a virtual community. And that's a big decision for us as a society to make: are we happy that our communities are only virtual?" (Emma Harrison, RNID)

Other factors that could further exacerbate withdrawal from real world participation (and a shift to a more 'safe' online social existence) were also contemplated in the interviews such as the growing culture of fear of leaving one's own home because of perceived dangers in society.

"If [the development and roll out of NGS is] managed well, then it's an opportunity to stimulate people, bring people out, and from most of the evidence that we've seen from projects that I've worked with older and disabled people is that, it's actually given them a new lease of life; they've met new friends, they do come out, and they do interact and find it much more enjoyable." (Stephen Dodson, DC10plus Network)

Graham Worsley also raised the possibility that rather than providing general reassurance, health monitoring devices around the home might inadvertently increase anxiety; people could become more concerned about leaving the 'safe'

home environment where everything is monitored and users can make contact with health professionals.

All of these possibilities need careful investigation and management before full roll-out is considered a feasible option, particularly for health services.

One of the interviewees, however, dismissed the potential for increased social exclusion in the health domain, noting that current service provision is so poor and social isolation so common, that any service developments to facilitate social connectedness would be an improvement.

"I think [the concern that technology may increase social isolation is] a red herring. [...] People always say that technology is going to replace people. The fact of the matter is that a lot of older people out there are desperately isolated and have got nothing anyway, so what's it going to replace? Nothing, in my opinion." (Prof. Gail Mountain, University of Sheffield)

7.3.2 Increased dependence

The desk review and interviewees' responses highlighted the risk of increased dependence on the technologies. Premature reliance on mediated assistance risks increasing dependence unnecessarily. Ensuring the correct balance of system and personal responsibilities will be important considerations (e.g. some activities may be the preferred responsibility of the user). Customisation is important in this regard.

Overall, the general view from interviewees was that products and services should enable rather than disable; enable people to meet their needs rather than providing assistance that is not necessary or required. Users should have control over products and services rather than feeling controlled or intruded upon by them. Better user-centred research methods such as UCD have the potential to reveal these types of unwanted consequences at an early stage in service development.

"[This type of technology] was supporting people, never replacing carers or people's family members [...]. I think that kind of 'support' rather than 'replacing' is, for me, the best kind of technology." (Melinda Phillips, Housing 21)

7.3.3 Reliance on electronic systems

Some interviewees discussed the potential implications of relying on an electronic network for the delivery of NGS. Challenges that arose related to network stability and reliability (e.g. power loss), quality of service, security and viruses, and data storage.

"Data protection, privacy and security which are actually different parts of the same thing and you need to get more specialist companies, organisations with a background in those issues to take on looking at these health-based things."
(Graham Worsley, Technology Strategy Board)

Reliance on electronic systems has implications for the service providers, network providers, and users. As the scenario described in the quote below illustrates, any part of the system could be susceptible to failure (e.g. power failure, problems with the wireless router, network and service providers that cease to operate) suggesting that contingency plans would need to be established.

"...if we want an alert from a smoke detector in a property, and if the only way that that information can get out of that property is via a wi-fi router in the corner of the room, then we have to manage some risks: the router itself might not be working today; the internet service provider might not be operating for whatever reason, or it might be as simple as loss of power in the home."

(Steve Sadler, Tunstall Group)

The question of whether back-up provision can deal with the different data requirements of each type of service running through the network arose in the interviews and is discussed in the section below.

7.3.3.1 Contingency service provision

Power loss in life-critical situations is an unthinkable proposition, and reliable back up mechanisms for these and other types of emergency services require careful consideration. Cloud computing service providers recommend that companies store their data across several clouds to prevent complete loss of service if technology problems arise in one data centre²²³.

One of our interviewees raised the point that managing heavy dependence on electronic systems was related to understanding the different requirements of different types of data. Steve Sadler (Tunstall Group) described in detail how data intended for use in different applications or services (e.g. the importance of real-time, accuracy and rich video content) can define how those data are managed in the network. For instance, where services do not rely on real-time data (e.g. trend monitoring of blood pressure), a delay in data transmission of a few hours is unlikely to have a major impact, as long as the data that are sent are accurate. For other applications or services (e.g. fire alert) any delay could have life-threatening consequences.

"We have to make sure that the real-time critical alerts have a way of getting to the service provider agencies when they're needed, and that we have system implementations and behaviour that are suited to the services." (Steve Sadler, Tunstall Group)

And for a video conference to be effective, the data have to be real-time, although some quality of service might be compromised if the network demand is heavy.

"...let's say we want real-time video conferencing, that is, high volumes of data, and it's got to be now for that conversation to exist in a meaningful way, but we can often accept some inaccuracy, a drop in quality." (Steve Sadler, Tunstall Group)

However, it is arguable that the impact of a drop in quality of service (e.g. video quality) will be different for different users; a deaf person may rely on good quality video to communicate using sign language. This suggests that personalisation of the systems will also play a role

What is considered an acceptable quality of service will be different for different applications, and this is likely to require careful management (from both a network perspective and users' expectations). For the network providers keen to offer the best quality of service levels in a competitive market, it will be

²²³ Simone Brunozi. The cloud as a platform for business and Government. Westminster e-forum Keynote Seminar - Cloud Computing, 10th February 2010.

necessary to manage the prioritisation of different types of data (e.g. health vs. leisure) and users' expectations of the service that they are paying for.

"... you can use techniques like deep packet inspection to tell you that that data has been marked as health data therefore it's more important [than downloading leisure content], therefore it must get across the network." (Graham Worsley, Technology Strategy Board)

Many other stakeholders will need to be involved in challenges such as understanding how to 'tag' encrypted data and how to recover encrypted data should a network provider cease to operate. Personal preferences and other customised data, e-government and business-related data can all be considered 'sensitive' and need to be protected from data loss, viruses, and piracy with secure systems. How to control access is a major challenge and new approaches are likely to be needed to address the challenge.

"Do you need to have different levels of security then applied to different types of health data? So we think that you probably do if you're transmitting this data over future networks but you need to decide the level of privacy and hence then, over and above that, the level of security you need to transmit the data. And you need people who know about these things to think about them and then implement them." (Graham Worsley, Technology Strategy Board)

"The one area which we need to be mindful of – it's about where we are moving from – we are moving from previously an analogue age for telecare industry, delivered by BT. We are now moving towards a digital network always on, maybe not as robust, and certainly with a proliferation of providers. The question is, who's the trusted advocate, who's the trusted confident for vulnerable people in this? It's an area in which there are several associated risks. So safeguards around standards are important and them being put into layman's terms for the non-expert service user is a challenge – that's where Ofcom comes into its own." (Kevin McSorley, Fold TeleCare)

8 Conclusion

8.1 Background

This report has summarised a large-scale research project conducted by i2 media research. The project was commissioned by Ofcom's Advisory Committee on Older and Disabled people (ACOD), on next generation services for older and disabled people. Next generation services (NGS) are new and improved telecommunications services that make use of the speed and capacity of next generation networks²²⁴ and are delivered to end users via next generation access²²⁵.

The project involved desk research and interviews with experts in relevant fields. Interviewees included stakeholders from industry, charity and not-for-profit (3rd sector), government, regulatory, and academic backgrounds.

The objectives of the project were to identify and report: (i) details of new and near-future NGS that have the potential to benefit older and disabled people's lives, (ii) the potential benefits from such services, and (iii) the risks and challenges to the realisation of the potential benefits to older and disabled people.

The scope of the report has, by definition, been very broad. Within scope were services that: (i) require high bandwidth (e.g. above 20 Mbps) to the user, for example, those that deliver high definition video; (ii) require high connection speeds between people (for example, video-conferencing services); (iii) are likely to require higher speed and capacity networks when multiple services and users are using the network at the same time, to ensure sufficient reliability for the services to work; and (iv) extend the functionality of existing products and services in a world of superfast broadband.

The research is of relevance to Ofcom's ACOD, given its remit to: "seek to identify issues affecting the communications sector of interest to older and disabled people, both collectively as a Committee and individually as Members, with particular reference to the sectors where they have particular knowledge or expertise; provide advice to Ofcom about general and specific issues concerning the communications sectors relating to older and disabled people; [...] provide Ofcom with advice on matters relating to its responsibilities for the promotion of media literacy affecting older and disabled people; contribute to Ofcom's annual report to ensure the work of the regulator within the communications sector on issues relating to older and disabled people is reflected."

The report is timely, given the demographic trend towards an ageing population and family dispersion, and in the context of older and disabled people wanting to live independently at home, whilst participating in, and contributing more to, society beyond their official retirement age. These factors present challenges to the ways in which services are currently delivered.

8.2 NGS offer many potential benefits

The opportunities and potential benefits to older and disabled people offered by next generation services are manifold. Future services promise a world in which

²²⁴ High speed internet networks which make use of a range of innovations to provide benefits to users.

²²⁵ High speed data connections to people's homes.

older and disabled people will achieve greater social and economic inclusion and engagement than at present.

Potential benefits to older and disabled people from future NGS were identified across the four areas of life (health and wellbeing; work and education; leisure and other day-to-day activities). These are summarised below.

8.2.1 Improved accessibility

In the future, there is likely to be more *personalised access* to information and services, meaning that people who previously faced exclusion from services because of difficulties in accessing them (e.g. mobility difficulties, inability to receive information in a format that meets their needs) could find their routes to access easier.

Alternative formats (text, video, speech) could be easier to access anywhere and anytime. This is likely to be enabled through increased availability of (accessibility) software as a service, higher capacity, faster bandwidths, improved interoperability and better online multi-modal web design (encouraged through the promotion of digital inclusion).

Personal access preferences (e.g. personally optimised colour contrast, font size, speech qualities), which are either specified by the user or inferred (learned, based on user behaviour) by the system, are more likely to be stored by the network or accessed from the network through a type of electronic identity card (e.g. smart card) compatible with a number of systems (e.g. cash machines, personal computers).

In addition, familiar consumer electronics devices, such as the television, are now evolving to become internet-connected, thereby providing a more familiar and intuitive interaction interface for people who find it difficult to use a computer.

8.2.2 Increased flexibility and convenience

NGS are also likely to facilitate improved *flexibility* and *convenience* in accessing and using services, as the services themselves are unlikely to rely to the extent they do currently on face-to-face interactions. Remote interactions with others (e.g. service providers and other service users) could be enabled and enhanced through improved technologies that can support people's sense of being physically located at another place with others (e.g. seeing and speaking to a doctor through the television set; interacting with colleagues and friends through VoIP). Virtual environments may become more common meeting places to *enhance social contact* and *reduce social isolation*.

This type of service flexibility will also mean that people's *ability to participate* in areas such as local community activities, and work and education, should improve. The higher capacity and speed of NGN will enable people to remotely access work and education related content more easily and have a sense of being in the office/classroom with their colleagues. Benefits to service users are likely to include *reduced social isolation*.

Developments towards context sensitive services have also been reviewed in the project. These have the potential to improve the provision of relevant services to users, wherever they are, with increased convenience a key benefit.

8.2.3 Increased participation and inclusion

The benefit of improved access could hold particular benefits to older and disabled people through *greater inclusion* and *opportunities to participate* in a

broad range of activities. Through NGS, with improved accessibility to more information, the activities to which the services relate (e.g. to government, commerce or health) could become more transparent, enabling service users to be *better informed* and *more independent*.

8.2.4 Improved choice from a range of richer services

NGS have the potential to support *increased choice* and *better quality* services for service users across different service domains (e.g. entertainment, shopping, health services). These potential benefits could be delivered as a result of increased network capacity, enabling service providers to more easily deliver *richer and more engaging* content (such as high definition and 3D television/video services). The additional capacity of NGN will also better support rich, real-time, two-way exchanges between all users and providers of the services, providing more convenient and efficient ways to engage with services.

Personalisation can also help to guide people to more personally relevant information in a future in which NGS have the potential to overload users with information (in effect, providing users with overwhelming choice). Personalisation should address this risk, thereby improving the *convenience* and *efficiency* of using services. For instance, intelligent online forms for claiming benefits are likely to become streamlined, removing questions from the form that are redundant to the process and presenting the questions in a manner that is more tailored to the needs of the user.

8.2.5 Lower-cost access to more relevant services

In an open NGN environment, new and existing service providers should be able to provide services at lower cost, more easily. This is likely to result in more service providers competing to deliver valued services to users. This potential increase in competition should help to both *drive down costs* and encourage service providers to deliver products and services which better meet service users' needs (as service users are likely to have more control over the services they wish to consume).

8.2.6 Improved sense of wellbeing and security

The trend towards an 'always on' network has the potential to better meet people's health and security needs. Changes in service users' health and wellbeing, and potential threats to their safety, could be monitored and significant changes detected automatically, sending alerts to relevant service providers when necessary. Early detection of emerging health problems could improve outcomes for patients. Collectively, these types of service could offer reassurance and peace of mind to service users, improving their physical health, and their involvement with managing their health and wellbeing (e.g. automatic reminders to take medication).

8.3 Challenges to realising potential benefits of NGS

The benefits outlined above cannot, however, be taken for granted because there are substantial risks, challenges and barriers to the effective implementation of NGS. Addressing these challenges is essential if the potential positive impacts of NGS on the lives of older and disabled people are to be realised.

In this regard, the following issues are of importance:

- a) Infrastructure: there is a need to ensure that adequate and reliable network infrastructure and connectivity is available to enable users to access NGS;
- b) Usability and accessibility: there is a need for internationally coordinated work to support the development of NGS and products that are accessible and easy to use for people with a wide range of abilities. Key considerations here relate to:
 - i. supporting the adoption of best practice in product and service research and development (e.g. following user-centred design principles; emphasising the importance of user involvement in concept creation);
 - ii. the regulatory and legislative environment: ensuring that it encourages the development of usable and accessible products and services; for example, encouraging that usability and accessibility are considered appropriately in the design, development and licensing of new products and services, and encouraging appropriate measures to ensure quality of service, reliability and quality of experience;
 - iii. standards for interoperability: so that personalised interfaces (meeting different user needs) can be easily integrated with new NGS and products;
- c) Cost: ensuring that potential beneficiaries are not excluded from the benefits of next generation services on the grounds of affordability. Considerations in relation to cost may include supporting competition amongst product and service providers, and making social tariffs and price caps available;
- d) Implementation: more coordinated mobilisation of and interaction between stakeholders (government, health service, social care services, regulators, service providers) is likely to be necessary to minimise the logistical risks to the realisation of the potential benefits of NGS for older and disabled people; and
- e) Digital divide: there is a potential risk that the roll-out of NGS contributes to a bigger divide between people with and without access to online products and services, with more negative impact than currently for those without access.

A key question of this research was to explore the benefits to older and disabled people of NGS likely to be available within the next 5 to 10 years. The views of our interviewees, and the literature reviewed for this work, suggest that there is a long way to go until comprehensive services are fully implemented.

However, as with existing broadband services, roll-out of NGS is likely to be gradual, with services that translate more easily onto the new network and to which users can opt in (e.g. via subscription) thereby advancing the process.

Some interviewees felt that Ofcom and ACOD, and others such as Government, could play important roles in this process of implementing NGS. Areas where they were identified to have impact included regulation, supporting efforts to improve the reliability and interoperability of the technology, and in raising awareness of the potential benefits of services, the risks to achieving those benefits, and potential solutions.

There is a pivotal role to be filled of coordinating and summarising relevant activities to ensure that communications reach both stakeholders and users.

8.4 A final note

NGS promise the potential of numerous benefits to all citizens and, in particular, to older or disabled people. If the challenges to their implementation are addressed appropriately, the opportunities for increased and easier access to services could, among many other benefits, promote more independent living and participation and help older and disabled people to lead healthier and more fulfilling lives.

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10 Glossary of terms and concepts

3D Television (3DTV)	3D Television (3DTV) is a display technology that enables viewers to experience a sense of depth similar to that we see in real life, while watching TV programmes, films or playing video games.
Activity, health and wellbeing monitoring services	Such services have the potential for application in relation to daily monitoring of existing diseases and problems, and also for early warning of a person becoming unwell.
Ambient Assisted Living (AAL) technology	AAL technology, also known as telecare, telehealth technology or (electronic) assistive technology, refers to intelligent assistance systems aimed at enhancing the lives of elderly and vulnerable people by offering them the ability to carry out routine tasks independently in their homes. Such systems are designed to be of assistance whilst ensuring that individual needs are met discretely and efficiently.
Augmented reality	Augmented reality refers to technology (e.g. mobile devices, in-windshield displays) that can overlay visual information on top of objects in the real world. The extra lines superimposed on a football field to aid television viewers watching the game at home is an example of augmented reality.
Bandwidth	The term bandwidth refers to the amount of data or information that can be transmitted over a network in a given period of time. In computer networks, bandwidth is usually expressed in either kilobits per second (kbps or kb/s), megabits per second (mbps or mb/s) or megabytes per second (Mbps or Mb/s). Eight megabits equal one Megabyte. The development of higher bandwidth networks will enable the delivery of rich, interactive and personalised multimedia services to consumers using speeds in excess of 20 Mbps.
Brain fitness program	A brain fitness program is a software program (e.g. Nintendo Brain Age) designed specifically for 'training' of certain functions of the brain, such as memory, attention, etc.
Broadband speed	Broadband speed is the rate at which data can be transmitted over a broadband connection. Broadband speed affects how quickly an internet user can look at web pages, watch films online or download images (the slower the broadband speed, the longer the download will take).
Buffering	In streaming audio or video from the internet (e.g. from YouTube), buffering refers to downloading a

certain amount of data before starting to play the music or film in order to provide a seamless and smooth audio or visual experience to the user.

Chat	The term chat, or online chat, generally refers to a real time text-based communication that occurs over the Internet between two or more persons, using instant messaging tools (e.g. MSN messenger, Yahoo!IM).
Cloud computing	Cloud computing is a technology that uses the internet and central remote servers to maintain data and applications, allowing internet users to use applications without installation and access their personal files at any computer with internet access. Yahoo email or Gmail are examples of cloud computing services.
Context sensitive services	Context sensitive services use contextual information (e.g. a user's location or preferences) to provide relevant and tailored information (e.g. about products/services or risks available in a user's locale, or directions towards a target). Key potential benefits of such services for older and disabled people are easier navigation, less reliance on memory, and an increased sense of security and wellbeing.
Digital divide	The digital divide is a term used to refer inequality of access to digital technology (e.g. internet, computers, mobile phones). Those with very limited or no access are sometimes referred to as digitally excluded.
Download	The term download refers to the process by which a file, such as a music track or a film, is transferred over the Internet from a remote location to a user's computer.
E-commerce	E-commerce refers to the selling and buying of products or services via the internet from web retailers to web customers.
Edutainment	Edutainment, or educational entertainment, is a form of entertainment (e.g. a TV programme, a video game) designed to educate as well as to entertain. A game that requires the player to answer maths related problems helping increase the user's math skills is an example of a piece of edutainment software.
E-government	E-government, also known as e-gov or online government, is the use of technology and internet, to deliver government information and services to citizens.
Email	Email, or electronic mail, refers to the transmission

of a message or information over a communications network using a computer program.

Fibre to the home

Fibre to the home is a form of fibre optic communication delivery, in which the customer has a fibre optic cable coming into the home, providing super fast broadband internet (more than 20 Mbps).

Games on demand (GoD) services

Games on demand enable video games players to buy, rent or play-for-free a wide selection of games without the need to install them on a local PC or TV.

Global positioning system (GPS)

A global positioning system (GPS) is any technology device that utilises information from satellites in order to precisely define the locations of objects, places, persons, buildings or vehicles. For example, Tom Tom is a portable GPS car device that determines the best route from your current location to a destination that you enter.

High definition television (HDTV)

High definition television is a television system that can transmit, receive and display digital television images of higher quality (with more detail) than is possible with standard definition television.

Information and communication technology (ICT)

Information and communication technology refers to the range of technologies (e.g. computers, Internet, mobile telephones) that are used for information exchange among people for different purposes.

Instant messenger (IM)

Instant messenger (IM) is a software utility that allows users connected to the Internet to send text messages and files to other IM users. MSN messengers, Yahoo IM, Google Talk and AOL AIM are among the most popular IMs.

Internet protocol (IP)

Internet protocol is a common data format used to send and receive data between two or more computers over the internet.

Interoperability

Interoperability generally refers to the ability of different devices (e.g. mobile phone and computer) to interact with one another, exchange information and operate smoothly together.

Latency

The term latency refers to a time delay in the transmission of data over the internet. A low latency network connection is one that generally experiences small delay times, while a high latency connection generally suffers from longer delays. Higher latency can result in more interruptions and waiting when using internet services.

Media access services	Media access services are services, such as audio description, subtitles and sign language, designed to meet the needs of individuals who are deaf or hard of hearing or blind or partially sighted.
Multimodal interfaces	Multimodal interfaces allow users to interact with computers using different modalities, such as speech, gesture, pen and touch screen.
Next generation access (NGA)	Next generation access (NGA) refers to broadband networks which use fibre optic connections, wireless and satellite to deliver significantly higher bandwidth than the broadband currently available via a copper phone line.
Next generation network (NGN)	Next generation networks (NGN) refers to the use of super-fast broadband to deliver multiple services (e.g. data, voice, and all sorts of media such as video) to people's homes or businesses over a single network infrastructure. Next Generation Networks are able to offer access by users to different service providers, and as such they are able to support increased mobility through the ubiquitous and consistent provision of services to users.
Next generation services (NGS)	'Next generation services' is used to refer to new and improved telecommunication services that make use of the speed and capacity of next generation networks (NGN [see above]: high speed internet networks which make use of a range of innovations to provide benefits to users) and are delivered to end users via next generation access (NGA [see above]: high speed data connections to people's homes.)
Over the top (OTT) services	An over the top (OTT) service is any kind of internet-based multimedia service which is delivered to an end device (computer, games console, TV, mobile phone) over a broadband connection.
Personalisation	Personalisation refers to the optimisation of a system's interface, or the content it delivers, according to the preferences and needs of users. These can be stored by an application or service. Examples include access preferences (e.g. that a user who is blind needs access to text-to-speech services) or content preferences (e.g. comedy programmes being presented higher up a list than other programmes because they are enjoyed by the user). Personalisation can be user-specified or learned by the system through analysing user behaviour.
Peer-to-peer (P2P)	Peer-to-peer (P2P) refers to a network architecture

where computers on a network communicate with each other directly, without passing through a central server.

Presence systems	Presence systems are technologies that enable users to feel connected to spaces or people which are remotely located. Such systems typically make use of high quality video/graphics and audio links.
Quality of service (QoS)	Quality of service (QoS) is used to describe various characteristics of network traffic (speed, latency, packet loss, jitter). Better QoS is associated with a more reliable and smooth user experience.
Semantic web	Semantic web is a component of the future web, or web 3.0, in which information is tagged with meaningful descriptors (meta-data) enabling more intuitive and relevant web searching.
Sense of presence	Sense of presence refers to users' sense of being there in a space depicted by media, for example in a film, TV show, game, or play.
Serious game	A serious game is a game designed for a primary purpose other than pure entertainment, with for example therapeutic or training goals.
Server	A server is a computer (or a program on a computer) that provide services to other machines on a network.
Set-top box	A set-top box is a device that enables a television set to receive and decode digital television broadcasts. Some set-top boxes also allow internet access through the television.
Social networking	Social networking (or online social networking) refers to a category of websites (e.g. as Facebook, Twitter) which help connect friends, business partners or other individuals over the Internet.
Social presence	Social presence refers to the extent to which a person feels he/she is physically located and connected to others in a social context, whilst interacting through technology. For example, e-mail is an interpersonal communication method that can lack social presence, whilst a video-conference using high definition or 3D displays could lead to higher social presence.
Software as a service	Software as a service refers to a software distribution model in which applications are hosted by a service provider and accessed remotely by customers through the internet. An example of such software as a service is 'games on demand', where games run on company servers whilst being played in users' living rooms.

Speech recognition software	Speech recognition software allows computers to interpret human speech and transcribe it to text.
Symmetrical services	Symmetrical services have equivalent upload and download speeds allowing internet users to send very large files and use applications such as VoIP. Conventional asymmetric broadband has slower upload than download speeds, thereby affecting the kind of applications it can run.
Synchronous communication	Synchronous communication refers to the direct communication that occurs in real time among two or more people or devices. A familiar example of synchronous communication on the Internet is live chat, whilst e-mail is an example of asynchronous communication.
Telecare	The term telecare refers to home-based devices and services which can provide support for older and disabled people to allow them to remain living in their own homes. Sensors such as smoke and fire detectors are examples of tele-care devices, which alert care staff to an emergency immediately.
Telehealth	Telehealth refers to the delivery of health-related services and information via telecommunications technologies from a remote location. Unlike tele-medicine, people who transmit and receive information through tele-health systems are not necessarily medical doctors but the patients themselves, their families, carers, nurses, and medical experts.
Telemedicine	Telemedicine refers to the use of information and communication technologies for delivering medical services (diagnosis, treatment and patient care). An example of tele-medicine system is an interactive video technology that allows the patient and a doctor to interact and develop a care plan, without having to transfer the patient to a specialised care centre.
Text relay	Text relay is a telephone service that allows deaf and hard of hearing people use a text-phone (specially adapted telephone with a keyboard) to access any services that are available on standard telephone systems. The relay user types what he or she would like to say on a text-phone, while an operator reads it aloud to the called party. The operator then types the response back to the relay user.
TV as communication interface	Several projects and activities are ongoing exploring the TV as a familiar interaction tool through people can interact with health and wellbeing services.

Ultra-high definition video (UHDV)	Ultra-high definition video (UHDV) is a prototype for a new digital video format with a resolution 16 times that of today's standard definition (SD) television. Although UHDV is the proposed replacement for existing HD television, it is not expected to be commercialised for a decade or more because the standard is still in the early stages of development and its current dimensions make it impractical for most homes.
User-centred design (UCD)	User centred design is a design philosophy based on active involvement of the user in the design process of products or services to improve the understanding of user needs and task requirements.
Video on demand (VOD) services	Video-on-demand refers to services which allow users to select and view TV programmes or films on a television, computer or other electronic device at any time, on request.
Virtual private network (VPN)	A Virtual Private Network (VPN) refers to a secure network connection that uses the internet to transmit encrypted data. VPNs facilitate home working and are thus likely to contribute to increased flexible work practices in the future. For example, a large company that needs to make its data available in different locations (e.g. employees' homes) via the Internet might first set up a VPN with an encrypted connection in order to keep the information secure.
Virtual reality	The term virtual reality refers to a computer-generated representation of an environment in which users can move around in three dimensions and interact with objects, thus giving the impression of being present.
Virtual university systems	Virtual universities are organizations that provide higher education programmes through use of Internet technology and other online media. Such universities offer educational programmes that range from full degree programmes, to certificates, diplomas and shorter courses.
Voice over internet protocol (VoIP)	Voice over internet protocol, or VoIP, refers to a way to carry calls over IP-based networks, such as the Internet. Skype is one of the most popular VoIP software applications. Like other VoIP applications, it allows free calls to be made over the internet to any other Skype user.
Web 3.0	Web 3.0 refers to the currently evolving version of the web, and which will combine elements of both Web 1.0 and Web 2.0 and introduce a more user focused, personalised, intelligent, semantic

(meaningful) and 'mobile' web experience.

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Appendix 1

List of participants in Phase 2

Interviewee	Job role(s) and affiliation(s)	Location
Stephen Dodson	National Director for the DC10plus Network and an independent advisor on inclusion and innovation	London
Emma Harrison/ Melissa Echaliier	EH: Director of External Affairs, RNID; ME: Social Research and Policy Office, RNID	London
Kevin McSorley	Director, Fold TeleCare; and partner in Virtual Extra Care Service (VIRTEEx) project	Belfast (by video-conference)
James Micklethwait	Head of Strategy, Future Media & Technology, BBC	London
Prof. Gail Mountain	Professor of Assistive Technology, University of Sheffield and Visiting Professor, Sheffield Hallam University and Associate of Lab4Living	Sheffield
Simon Mycock	Programme Manager, BT Group Strategy, Policy & Portfolio	Suffolk
Prof. Alan Newell	Professor, School of Computing, University of Dundee	Dundee
Melinda Phillips	Chief Executive, Housing 21; and partner in Virtual Extra Care Service (VIRTEEx) project	London
Dr. Simon Roberts	EMEA Ethnographic Research Manager, Digital Health Group, Intel Corporation and Principal Investigator, Ethnographic Research, Technology Research for Independent Living (TRIL) Centre	Dublin
Steve Sadler	Technical Director, Tunstall Group; and participant in the Whole System Demonstrator (WSD) project and Virtual Extra Care Service (VIRTEEx) project	Whitley, Yorkshire (by video-conference)
Niamh Scannell	European Research Director for the Digital Health Group, Intel, and Industry Director of Technology Research for Independent Living (TRIL) Centre	Dublin
Dr. Paul Timmers	Head of Unit for ICT for Inclusion in the European Commission, Directorate-General Information Society & Media	Brussels
Steve Tyler	Head of Innovation and Development, RNIB	Peterborough
Graham Worsley	Innovation Platform Leader, Assisted Living, Technology Strategy Board	London

Appendix 2

List of questions for other key stakeholders (reply by email; not interviewed)

1. What will be key services in your sector that will be delivered via next generation networks and next generation access?
2. What will they benefit people?
3. What will they benefit older and disabled people in particular?
4. What, if any, are the risks to older and disabled people from these services?
5. What steps, if any, could mitigate these risks?
6. What, if you can identify any, are the drivers to the development of NGS in your sector/company that will benefit older and disabled people?
7. What, if anything, is hindering the development of NGN/NGA services in your sector/company that will benefit older and disabled people?