Assisted living technologies for older and disabled people in 2030

A final report to Ofcom

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Acknowledgement

Executive Summary

S1   The scope of the study

How might assisted living technologies (ALTs) help older and disabled people live longer and richer lives at home over the next 20 years? We have identified five main possibilities. ALTs might enable service providers to:

- Deliver better and more cost effective social and health care into the homes of older and disabled people – enabling them to live at home longer. We refer to these as *telecare* and *telehealth* services respectively

- Deliver services which entertain, educate and stimulate social interaction so as to enrich the lives of older and disabled people who live at home (*digital participation* services)

- Provide services which encourage users to get fitter and to adopt healthier lifestyles (*wellness* services)

- Enable older and disabled people to work from home so as to participate more in the economy and in society (*teleworking* services).

We refer to this collection of services as assisted living services (ALSs).

S2   The possible development of ALSs

There are three main technology drivers for the development of ALSs:

- Moore's law will lead to cheaper equipment which offers greater processing speed and memory while consuming less power.

- Broadband communication will be available to all

- The current move to mass-market devices with software APIs, on which independent companies can then design specialist applications, will continue.

In combination these drivers have significant implications for the development of ALSs:

- They will reduce the cost of equipping a home for telecare or telehealth substantially - perhaps from £2000 to £200

- They will expand the range of ALSs which older and disabled people can use. For example use of broadband communications opens up the possibility for digital participation and teleworking services

- They could change the nature of the industry which supplies ALT equipment from one in which specialist companies deliver stand-alone systems in which software and hardware is combined, to one in which specialist companies develop applications *software* specifically for older and disabled people to run on mass-market platforms such as mobile devices.

Today *telehealth services* use a combination of sensors, hubs and remote servers to provide better and more cost efficient management of chronic conditions such as diabetes, COPD, heart failure and asthma. As the decade advances new ALT developments could improve the management of chronic

conditions, extend the range of conditions which are managed at home, and allow management while outside the home.

We expect to see a shift over the next few years, from alarm-based **telecare systems** to systems which use more continuous life style monitoring. We also expect to see the development of augmented reality services for those with cognitive disabilities and telecare services for older people when they are outside the home - through SMS reminder systems, navigation services, and services to locate dementia sufferers who wander and become lost.

As well as telecare and telehealth services to ensure physical well-being, we expect to see take-up of a range of **digital participation services** which will connect, engage, stimulate and entertain older and disabled people in their homes. Already digital participation services offer older and disabled people access to a wide range of Internet services which allow them to save money and to participate more fully in society.

Teleworking services are important to the future well-being of older and disabled people who wish to live independently at home, allowing older and disabled people to continue to contribute their skills to the economy and to society. They also enable greater job flexibility for potential informal carers who might otherwise struggle to combine a part-time job with responsibilities as a carer.

Figure S1 illustrates how these developments might in combination help a couple in their late 70s, Clare and Colin, live independent and richer lives at home 10 years from now.

FigureS1: how ALSs might help Colin and Clare

Notes: **(1)** Examples include smoke, transportation, gas, food. **(2)** Examples include infrared, bed and body sensors. **(3)** Used to access the internet and make / receive video calls. **(4)** Use to provide prompts / guidance e.g. when preparing meals.
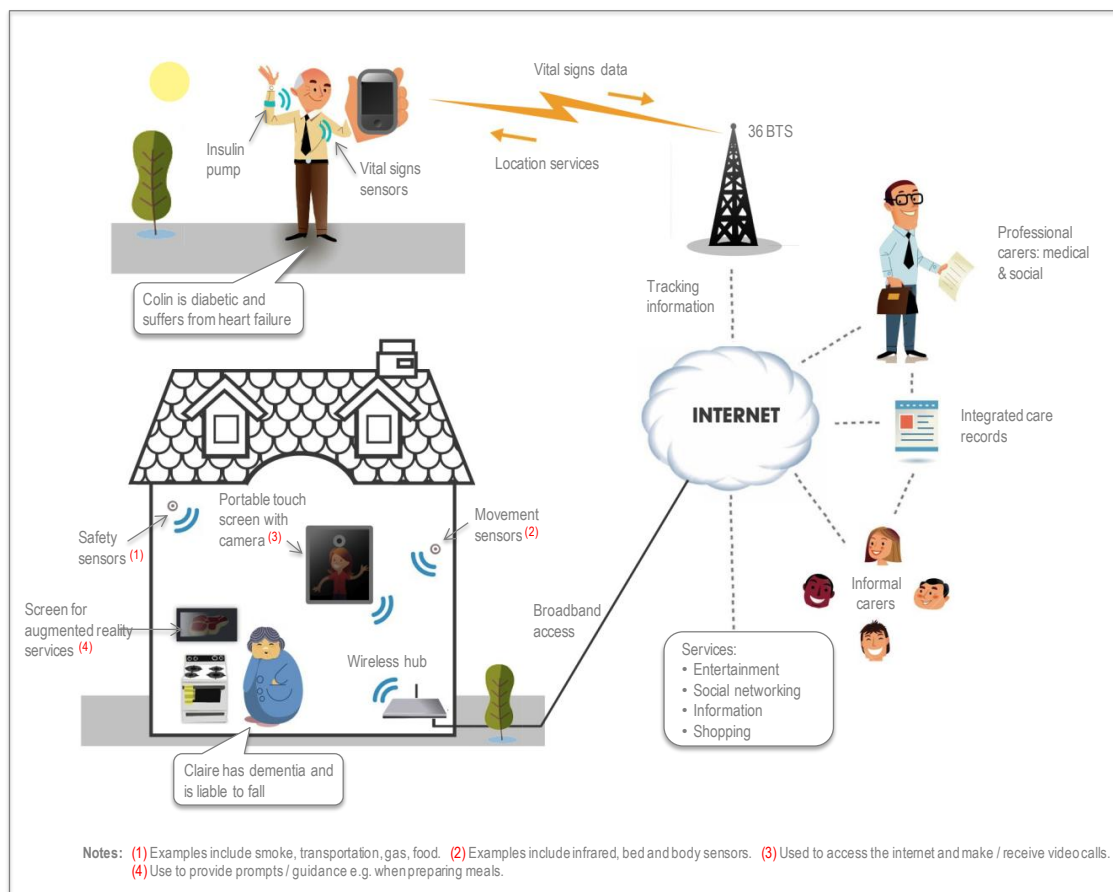
S3   The impact of demographic and economic changes

The ageing of the UK's population, in combination with restrictions on public spending, will create strong latent demand for ALSs over the next 20 years.

By 2030 life expectancy will, on current trends, increase by 4.2 years but healthy life will increase by only 2.6 years. As a result demand for *social care* will increase by 44%. The ageing of the population is likely to increase requirements for *health care* rather less. But we will also see a big increase in demand for the management of chronic conditions such as dementia, COPD, diabetes, heart problems, asthma, and depression.

It is unlikely that the state will increase its funding of *formal care* for older and disabled people so as to match the expected growth in demand[1]. As a result, the overall prospects for substantial increases in state funding for the care of older and disabled people over the next 20 years are poor. Nor will the supply of *informal care* come close to matching the expected 44% increase in demand for social care over the next 20 years.

The mismatch between the supply of, and demand for, care will generate strong pressures for take-up of telecare and telehealth services so as to use scarce resources more effectively:

- Faced with a scarcity of home care services, older and disabled people will purchase ALTs to create their own ALSs:

- Recognising that such services allow them greater flexibility and peace of mind, informal carers will demand telecare services

- Local authorities, and the care providers they commission, will use ALSs to lower unit costs; and

- Telehealth services will be used to reduce the unit costs of managing chronic conditions within the home - by reducing accident and emergency admissions, time spent in hospital, and outpatient visits to hospitals and health clinics.

In contrast demand for wellness, digital participation and teleworking services is likely to come primarily from older and disabled people themselves, driven by a desire to increase the quality and independence of their lives at home.

S4   The requirements of older and disabled people

Our research indicates that older and disabled people want to live independent lives at home or in the sheltered housing of their choice for as long as possible. They are generally positive about using ALSs. But they, and their informal carers, have concerns which need to be addressed to maximise take-up. There are a number of challenges to be met:

- How to enable service users to remain in control and not feel that ALSs are being imposed on them. Promoting ownership of solutions by older people is important to maximise and maintain take-up

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[1] Partly because of the long-term problems which UK governments face in improving public finances following the global economic crisis

- How to offer low-cost solutions which are personalised to meet the service user's needs. Related to this issue is the challenge of providing the service users with the right amount of information so that they are not overwhelmed by choice

- How to get potential service users to make an accurate assessment of their needs. Often older people will suggest that ALSs are useful for others, but that they are not yet ill enough to need them, at the same time as care professionals conclude that they need ALSs

- How to deal with concerns about privacy and confidentiality of data

- How to deal with the fear that ALSs will lead to video telephony replacing face-to-face contact with carers? This is not a groundless fear. Given the future pressure on care budgets, care providers are likely to reduce costs in this way. The introduction of digital participation services could help to compensate by increasing opportunities for social interaction by older people

- How to balance the needs of service users and their informal carers. These needs are not always aligned

- How to design and supply equipment which the user does not perceive as stigmatising them as ill and/or disabled.

S5   Digital inclusion

The digital inclusion of older and disabled people, so that they have broadband connections to the Internet, is important for the development of ALSs in general, and digital participation services in particular. There is a long way to go here. At the moment only 20% of the over 75s have Internet access at home, compared with over 80% of 45 to 64 year-olds. On historic trends it will take 33 years for 90% of this group to become Internet users.

There are currently three main barriers to the digital inclusion of older and disabled people. They do not see the *relevance and value* of Internet use; they *do not have the skills* and confidence necessary to use a PC and browser to access the Internet; and many of them *cannot afford* the equipment and/or broadband connection required

Over the next decade we can reasonably expect that market developments will significantly reduce these barriers. New devices, which are more robust and simpler to use than the traditional PCs, are now coming to market and reducing the need for ICT skills. At the same time the rollout of LTE-based mobile broadband should significantly reduce affordability problems over the next five years.

But affordability problems will remain. Mobile broadband prepay might help some older people. But for those who generate substantial video traffic through use of digital participation services, a fixed broadband connection might make more sense than mobile broadband. Making broadband connections affordable may require targeted subsidy to those on basic pensions.

The UK Government recently launched a number of initiatives to promote digital inclusion. These should help accelerate take-up by older and disabled people. But, as far as we know, there are no government funded measures to deal with the barrier of affordability of home on-line access by older and disabled people. Nor are we aware of any plans to provide government-funded helpline services to older people.

S6   Institutional factors

UK state-funded institutions now play a central role in delivering care to older and disabled people. So way they react to ALSs will fundamentally affect the extent to which these services are used over the next 20 years. There are currently a significant number of barriers to take-up of ALSs by state funded institutions. In particular:

- There are as yet no large-scale, controlled, trials to convince the caring professions of the effectiveness of ALSs. The Whole System Demonstrator trials, due to publish results in 2012, might provide this evidence

- There is almost no expertise in the use of ALSs by the caring professions. For example use of ALSs is not included in training courses

- The financial incentives for investing in, and deploying, ALSs within the NHS and local authorities are weaker than they could be

- There is a lack of integrated electronic care records which offer appropriate access to health care and social care professionals, to service users and to informal carers. Such records are important for effective ALSs and especially for the effective care of older people with both social and health care needs.

The relationship between private and state funded ALSs is also important. In the past the state has kept private and NHS medical care quite separate in most cases. A more complementary approach, in which private and public care records are shared, and privately purchased equipment is used by the state care teams, should help to maximise use of ALSs.

S7   Scenarios for 2030

Some drivers of ALS development are reasonably clear. For example we expect, under any reasonable scenario, that the latent demand for ALSs will grow strongly, that an increasing share of this demand will come from the private rather than the state sector, and that demand for digital participation services will grow strongly.

Other drivers of change over the next 20 years are uncertain, with very different outcomes possible, as shown in Table S1.

Table S1: The high impact high uncertainty drivers of change

Driver	Demand maximising outcomes by 2030	Demand minimising outcomes by 2030
1. The price performance and range of ALTs	Low prices, high interoperability, and extensive use of mass-market platforms plus specialist software Lots of new ALTs	High prices for medical ALTs, use of specialised equipment, and interoperability problems remain Relatively little development and take up of new ALTs
2. Supplier responsiveness to the requirements of older and disabled people	Global suppliers focus substantial effort on the ALS market to meet main needs and concerns of older and disabled people	State ALSs delivered using a standardised approach.
3. Digital inclusion of older people	High levels of digital inclusion of older and disabled people	Only modest increases in levels of digital inclusion of older and disabled people
4. Attitudes of older and disabled people to ALSs	Many now play an active role in managing their own well being	Most older and disabled people are a relatively passive group of service users
5. Acceptance of ALTs by the caring professions	High level of acceptance by 2015 drives increased demand	Lack of evidence on their effectiveness holds back acceptance and take-up of ALTs until the early 2020s
6. Incentives for effective state use of ALTs	State institutions restructured to enable effective coordination across social services and NHS care and to align financial incentives for investment with subsequent savings	State institutions remain unchanged
7. Complementarity of private and state ALTs	State and private supply is complementary	State institutions develop ALSs separately from private provision

Taking account of the correlations between these drivers, we have identified the four scenarios shown in Figure S2.

Figure S2: The four scenarios for ALS take up in the UK in 2030

Global market developments

Strong market interest with global supply

2. Market-led take up

1. Full scale complementary provision

Response of UK state funded care bodies

Limited acceptance

Strong acceptance

4. Sub scale provision

3. State-led take up

Limited market interest with national specialist supply
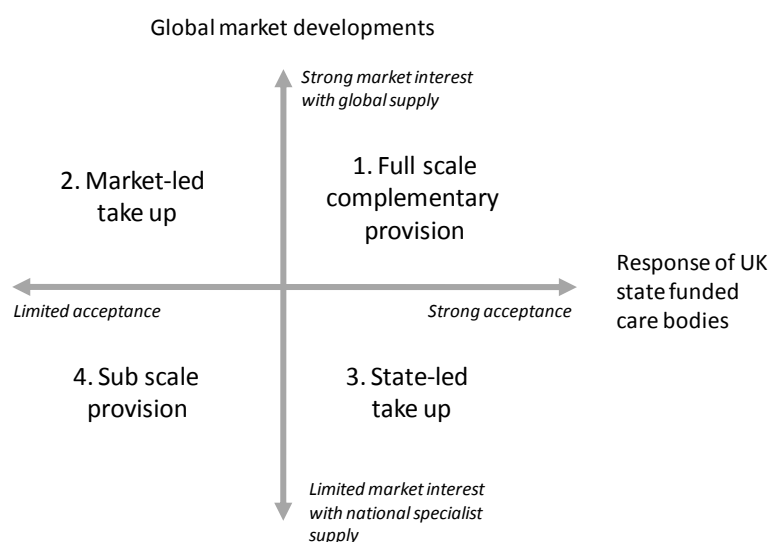
The four scenarios are constructed to be, at least in broad terms, equally probable. They are:

- **Full scale complementary provision** of ALSs. Under this scenario both market suppliers and state funded institutions recognise the importance of ALSs early in the 2010s and devote substantial effort to promoting their uptake. Private and state funded ALSs work in a complementary way using common equipment and shared health care records.

- **Market-led take-up** of ALSs. Private suppliers of equipment and services take the lead in driving take-up of ALSs for much of the next 20 years.

- **State-led take-up** of ALSs. State-funded institutions accept and promote ALSs strongly. Mass-market suppliers focus their efforts on other markets, while specialist suppliers of ALTs continue to sell their equipment and services largely through the state-funded institutions.

- **Sub scale provision** of ALSs. State-funded institutions are slow to accept and roll out ALSs, while market supply remains in the hands of specialists who sell primarily through the state-funded institutions.

Table S2 compares the four scenarios in terms of their key characteristics. It is clear that Scenario 1 is the most demanding in terms of networking and spectrum requirements. It also appears to be the most desirable from a social and economic perspective, while Scenario 4 is the least desirable.

Table S2: The four scenarios compared

Scenario	1. Full scale complementary	2. Market-led take-up	3. State-led take-up	4. Sub scale provision
Global or national markets for ALT equipment?	Global	Global	National	National
Price of ALT equipment	Low	Low	Medium	High
High level of innovation?	Yes	Yes	No	No
Supplier of digital participation services - state funded or private?	Private	Private	Private	Private
Level of use of digital participation services	Full	High	Moderate	Moderate
The scale of private supply of telehealth and telecare	Extensive	Extensive tele-care	Moderate	Moderate
Scale of state funded supply of telehealth and telecare	Extensive	Moderate	Extensive	Moderate
Relationship between state funded and private supply	Complementary	Complementary	Separate	Separate

S8   Networking and standards

What standards, network architectures and levels of network reliability are required to enable the most demanding of our four scenarios - the *Full-scale Complementary Provision* scenario - to be realised?

Interoperability of ALT equipment is important - both to realise global economies of scale in the production of equipment and to give end-users and their carers confidence that ALTs will work simply and seamlessly together. Such interoperability requires both **applications standards**, which cover the top three layers of the ISO seven layer stack, and **networking standards**, to cover the bottom

four layers. The Continua Health Alliance (CHA), which has strong industry support worldwide, is very active in developing standards for telehealth and telecare services. The focus of the CHA is on applications standards. But the CHA has also selected preferred networking standards - Bluetooth for local and body area wireless networks and USB for wired local area networks.

There is a parallel requirement for greater standardisation of the medical regulation of ALT equipment. In particular there is a need for to move from national to more global regulation if there is to be a global market for telehealth devices.

We have analysed the networking requirements of a wide range of possible ALSs. We conclude that the single general *network architecture* shown in Figure S3 will support all of them. This architecture involves the use of a mix of wired (solid line) and wireless (dotted line) transmission links, organised into body area, local area and wide area networks.

Figure S3: A general network architecture to support ALT based applications
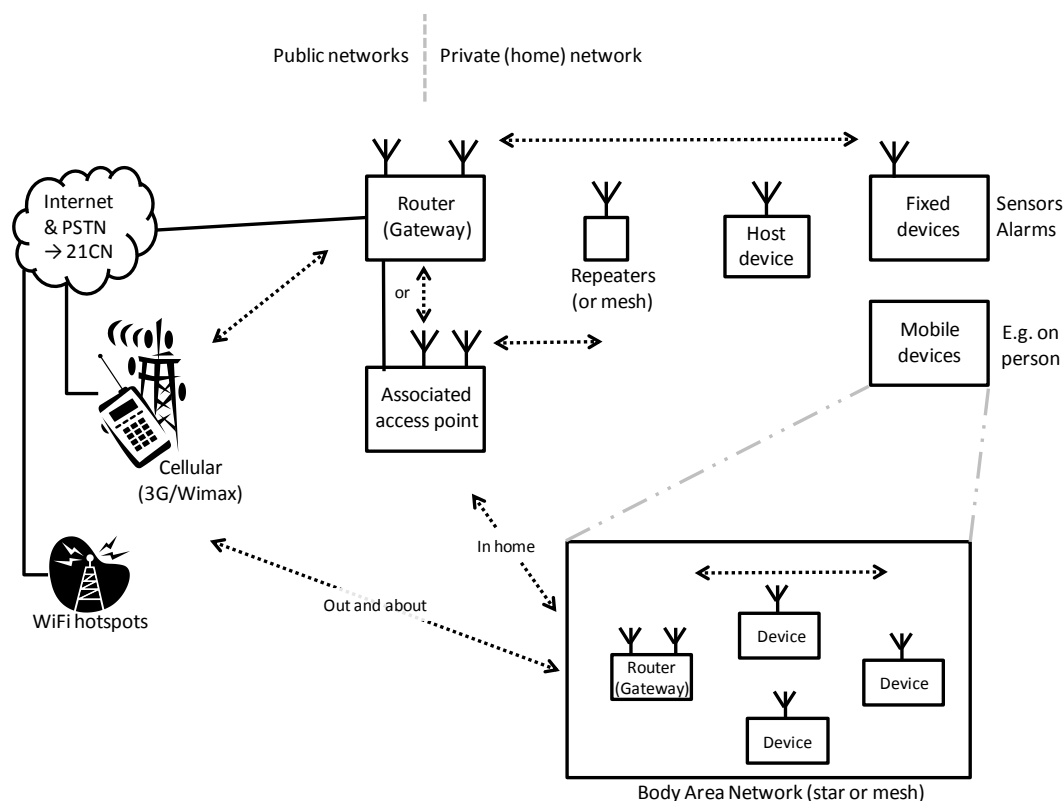
In implementing the architecture of Figure S3 there is a need to ensure that:

- The body, local and wide area networks all provide an appropriate level of service in terms of network reliability. This varies with the ALSs under consideration

- There is continuity of power for these three types of network to support safety critical applications

- There is appropriate security in the networks - both to ensure the confidentiality of the data carried and to prevent unauthorised access to gateways and servers.

Over the next 20 years the main public network platforms - both fixed and mobile - will move from circuit switched to IP networks and the reliability of these networks will need to improve significantly (to

or close to current standards for PSTN) if they are to be acceptable for telecommunications applications generally. During this transition it is unlikely that the functionality of the public IP network platforms will be influenced significantly by the networking requirements of ALT based applications. It is more reasonable to assume that the functionality of ALT-based services will be constrained by the network functionality of the public IP network platforms. To minimise these constraints ALT-based systems will need two or more wide area network paths to maximise network availability eg one fixed network connection and the ability to use any mobile network offering coverage in the area of use.

Existing spectrum allocation should be adequate for almost all ALSs including telehealth devices which simply monitor vital signs. But medical regulations will, almost certainly, demand more reliable transmission links for telehealth services which use devices that are implanted into the body and/or that administer drugs. This requirement could mean that there is a need for additional, dedicated, licence exempt spectrum for body and local area transmission links. It will however be five to ten years before such devices are in mainstream use.

S9   Measures to enable take-up of ALSs

Of the four scenarios identified above, the *Full-Scale Complementary Provision* scenario appears to be the most desirable. So we list below the measures which are required to remove barriers to its realisation. In many cases it is not yet clear which of these measures are most important or who should be responsible for them. So we have deliberately not specified responsibilities or priorities.

Addressing the needs of older and disabled people

1. Provide older and disabled people with the information they need to make an informed choice as to whether or not they will use telecare and telehealth services, and if so in what form.

2. Provide ALSs which can be personalised to the specific needs of older and disabled people.

3. Develop an ethical framework and code of practice which telehealth and telecare providers then follow on how ALSs will be implemented and how the data collected by ALSs will be used.

4. Ensure that anyone who is using telecare and/or telehealth services has access to affordable digital participation services.

5. Educate and train those involved in introducing older and disabled people to telecare services to balance the needs of service users and informal carers.

6. Raise awareness of how ALSs can help older and disabled people live independently at home through appropriate social marketing campaigns.

7. Design telehealth and telecare services which maximise the participation of older and disabled people in managing their own well-being.

Measures for availability, awareness, accessibility and affordability

1. Ensure that current government initiatives to promote digital inclusion are appropriately oriented towards older people.

2. Ensure that basic broadband is made available in rural areas as soon as possible.

3. Assess the case for demand-side subsidy, for example through a voucher scheme, to ensure that broadband services are affordable by all older and disabled people on low incomes.

4. Provide older and disabled people with appropriate training in digital literacy (so that they can use digital participation services) and with appropriate support to which they can turn when they encounter problems in using these services.

5. Use procurement processes to encourage mass-market manufacturers to provide more and better accessibility functions so that devices can be used by those with visual, aural, mobility and motor skill impairments.

6. Review advertising rules which might restrict market players from raising awareness of ALSs among older and disabled people.

Networking and standards issues

1. Develop global networking and applications layer standards to enable interoperability of ALT equipment.

2. Consider how best to get common global regulation of medical devices.

3. Align the requirements of the Medical Devices Directives and the RTTE Directive better so that they place more consistent demands on suppliers.

4. Monitor the reliability and availability of public IP networks which replace the PSTN over the next decade.

5. Minimise the constraints imposed on ALSs by any lack of reliability in public networks by ensuring that:

- ALT-based systems have two or more wide area network paths to maximise network availability
- ALT-based systems can use any priority packet services which emerge.

6. Set the medical regulations which govern telehealth services in a manner which balances the value of these services against the risks of network failure in a transparent and proportionate way.

7. Consider the need for additional dedicated licence exempt spectrum to ensure reliable transport services over body area and local area networks.

8. Set appropriate standards for continuity of power supplies for ALTs equipment.

Measures relating to state funded institutions

1. Create integrated electronic care records which offer appropriate access - to health care and social care professionals, to service users and to informal carers.

2. Review the financial incentive mechanisms currently in place in the NHS and local authority social services departments and the extent to which they encourage decision-makers, whether care commissioners or individual care professionals, to invest in and use ALSs.

3. Introduce awareness, education and training programmes in the use of telecare and telehealth services for the caring professions.

4. Consider whether there is a need to kitemark telecare and telehealth devices which are sold on the private market to indicate that they can subsequently be used in ALSs run by state funded institutions.

5. Look at the case for setting up a central, state-funded, body which purchases ALTs in bulk and provides expertise in the use of ALSs to PCTs and local authority care providers.

1   Introduction

1.1   The study's objectives

This report presents the findings of a study, commissioned by Ofcom from Plum, into how assisted living technologies (ALTs) might help older and disabled people live longer and better independent lives at home.

This is one of a series of Ofcom studies which examines the long-term requirements of key sectors for communication services within the UK. Its objectives are:

- To inform Ofcom on how ALTs might develop and be used over the next 20 years

- To develop scenarios for the use of ALT-based services by older and disabled people in 2030

- To identify barriers to the realisation of the most desirable of these scenarios and the policy implications of removing these barriers for Ofcom and others

- To assess the demands which use of ALTs might, over the next 20 years, place on the UK communications networks and on requirements for spectrum.

1.2   Definition of terms

We use the following terms throughout the report. ***Assisted living technologies*** (ALTs) refers to the sensors, devices and communication systems which, in combination, deliver ***assisted living services*** (ALSs). These services include:

- ***Telehealth services*** - delivering medical care, treatment, or monitoring services to older and disabled people at home from a remote location

- ***Telecare services*** - delivering social care/monitoring services to older and disabled people at home from a remote location. This includes preventative care but not wellness services as described below

- ***Wellness services*** – delivering services for a healthier lifestyles to older and disabled people at home from a remote location

- ***Digital participation services*** – delivering services into the home from a remote location which engage older and disabled people in terms of social, educational or entertainment activities. It is important to note that, on the advice of the Advisory Committee on Older and Disabled people (ACOD), we use this term in the limited sense defined above rather than in the broader sense used by Ofcom in its digital participation initiatives. These are described at http://www.ofcom.org.uk/digitalparticipation

- ***Teleworking services*** – in which older and disabled people work remotely from home for an employer, a voluntary organisation or themselves and need remote computing to work successfully.

We do not include ***telemedicine services,*** which involve delivering medical services and advice from one practitioner to another at a remote location, in our definition of ALSs. The development of such

services, which is proceeding in parallel with the development of ALSs in a largely independent manner, is a topic in its own right and one which is outside the scope of this study.

1.3   The focus of the study

The scope of the study is as follows. We:

- Use a broad definition of ALSs. As well as services which help *provide care at home* (telehealth and telecare services) we also consider services which help *enrich the lives* of older people (digital participation services, teleworking and wellness services). We exclude telemedicine

- Focus on the way ALSs might impact *on the UK* - while recognising that there are important *global developments* which could have a fundamental impact on UK take-up

- Look at ALTs which use *electronic and/or communications* technologies. We do not consider the use of *basic home adaptations* like stair or bath lifts, or grab rails

- Consider the use of ALSs by *older and disabled* people. But we recognise that many of the ALTs used by older people may be used by *people of all ages* in future, or might run on mass-market platforms used by people of all ages

- Examine the use of ALSs which allow people to *live in their own homes*. We include ALSs which help older and disabled people when they make trips from home but we do not, for example, consider the use of ALSs in residential homes[2].

- Consider how ALTs might help with *disabilities* which have a significant impact on older people e.g. visual, hearing, cognitive and mobility impairments. We recognise that the needs of younger disabled people are often very different from those of older disabled people and that ALSs may have a role to play in meeting these different needs. But we exclude such considerations from this study and focus on disabilities which are common amongst older people.

- Examine how demand for ALSs might arise from:

    – Older and disabled people and their informal carers

    – Private organisations wanting to make money from ALSs

    – Publicly funded bodies, such as the NHS and local authorities, wanting to deliver care more effectively.

1.4   The structure of the report

We begin by discussing how ALTs and ALSs are used today (Chapter 2). We then consider the main drivers which will shape the take-up of ALSs by older and disabled people over the next 20 years:

- In Chapter 3 we discuss how changes in technology will expand the range of ALTs and ALSs which are possible and consider the potential benefits which they might generate

- Chapter 4 looks at the demographic changes in the UK over the next 20 years and the impact they may have on demand for ALSs

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[2] In the US this is seen as a major market for ALTs

- In Chapter 5 we consider the requirements of older and disabled people for ALSs, identify attitudes which older people and their informal carers hold about ALSs and list the main challenges which these present to potential suppliers

- Chapter 6 considers the likely impact of digital inclusion measures to encourage older and disabled people to go online. The success of such measures could significantly increase the opportunities for older and disabled people to use digital participation and teleworking services

- In Chapter 7 we look at how the state-funded institutions responsible for care of older and disabled people - the NHS and local authority social services departments - might respond to and use ALSs over the next 20 years.

Chapter 8 then brings together the findings of the previous five chapters. It discusses the process we used to develop scenarios and then presents the four resulting scenarios for the use of ALSs by older and disabled people in 2030.

In Chapter 9 we consider what standards are required to enable the most desirable scenario and the networking and spectrum demands which this scenario generates. Finally Chapter 10 sets out the issues which need to be addressed, both by Ofcom and others, to enable this scenario to be realised.

1.5   The basis for our findings

The findings presented in this report are based on:

- Extensive desk research

- Interviews with over 50 stakeholders. These are listed in Annex A

- A series of scenario development workshops followed by two scenario validation workshops - one attended by policy makers and suppliers, and the other by experts who work directly with older people and their informal carers

- The guidance of Ofcom's Steering Group for the study.

2 The starting position

2.1 Introduction

In this chapter we discuss how care of older and disabled people is delivered today and the extent to which ALSs are used in delivering care. We provide a more detailed analysis of the former in Annex B.

2.2 The care of older and disabled people today

Social care

As we age our disabilities tend to increase and we are more likely to require help from others. Table 2.1 provides estimates of how many of us are disabled by age group and level of disability.

Table 2.1: The current disabled population of the UK by age

Category of disability	Adult popln 2007 (m)			
	20-64	65-84	85+	Total
Healthy	32.6	5	0.1	37.7
Mild (1 to 6 on RW scale)[3]	2.4	2.6	0.5	5.5
Moderate to severe (7+ on RW scale)	0.5	0.7	0.6	1.8
Total	35.5	8.3	1.2	45
% moderate to severe	1%	8%	50%	4%

Source: Annex B

We can see that:

- There are around 1.8 million people with moderate to severe disabilities in the UK

- 72% of these are age 65 or over

- The incidence of moderate to severe disability increases rapidly with age from around 1% of those of working age to 50% of those over 85.

75% of social care is provided by friends and family (informal carers) while the remainder is provided by a wide range of formal care providers. These are funded largely by local authority social services departments. Figure 2.1 shows the value chain for the provision of social care, while Table 2.2 shows how many older people are in receipt of the main formal care services. Note that these categories overlap. For example many who received home help also receive meals-on-wheels and/or attend day centres.

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[3] The Richayzen-Walsh scale which measures disability on a scale from zero (healthy) to 10 (severely disabled). Those requiring care from others are normally at 7+ on this scale.

Figure 2.1: The value chain for the delivery of social care[4] - 2007
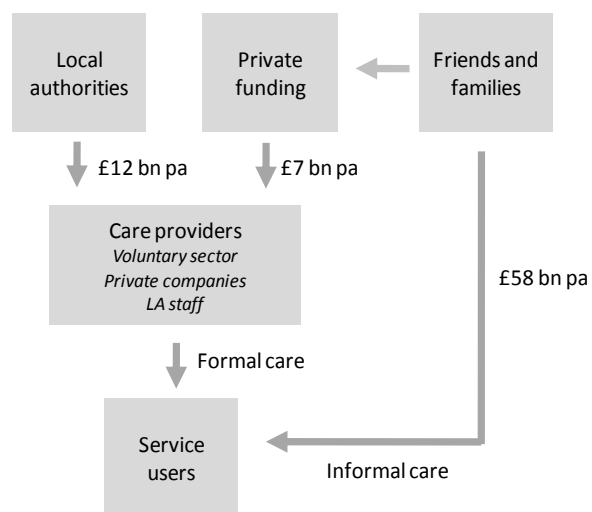
Table 2.2: Number of older and disabled people in receipt of the main social care services -2007

Measure	Number (m)
People over 65	9.5
People over 65 with mild disability (RW scale 1 to 6)	3.1
People over 65 with moderate or severe disability (RW scale 7+)	1.3
People in residential care homes	0.4
People in sheltered housing	0.7
People receiving home help	0.3
People receiving meals on wheels	0.1
People attending day care centres	0.1

Source: Annex B

Health care

There is no objective measure of demand for health care by older and disabled people. Health care is rationed - both in the UK and elsewhere - and latent demand remains largely unmeasured. But we can measure expenditure on health care. Of the £109 billion spent on health care in the UK in 2006/7, around £34 billion was spent on the over 65s[5]. Over 50% of this sum was spent on older people in their last year of life.

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[4] The £58 billion for informal care is estimated by taking time spent on care and multiplying by the average value of time

[5] *Increasing longevity and the economic value of healthy ageing and working longer*, Professor Les Mayhew, Cass Business School, February 2009

The NHS, with its 1.3 million employees, spends 87% of the UK's healthcare budget with private funding making up the other 13%. This latter proportion has fallen steadily over the past 10 years as NHS budgets have grown by 5 to 6% per annum in real terms.

In England Primary Care Trusts (PCTs) are responsible for the allocation of more than 80% of NHS spend. There are currently 152 PCTs in England - each responsible for meeting the healthcare needs of its local population - typically around 400,000 people. The PCTs:

- Are allocated a budget by the Department of Health, based on population served, but weighted for demographics and local morbidity and mortality

- Make an assessment of the care needs of the population they serve

- Contract for services to meet these needs with hospital, mental health, and specialist trusts (for secondary care) and with GPs, dentists, pharmacists and ophthalmologists (for primary care). The idea of each contract is to meet needs as cost effectively as possible

- Then monitor contracts to see if agreed service levels are met.

PCTs typically spend around 20% of their budget on primary care[6] and 80% on secondary care.

Much of the money spent on the health care of older people is spent on managing long-term chronic conditions such as diabetes, chronic obstructive pulmonary disease (COPD), cardiovascular diseases and dementia. Table 2.3 provides estimates of the number of people who suffer from some of these conditions. The numbers in Table 2.3 are not additive. In many cases an older person may suffer from two or more of the conditions at the same time.

Table 2.3: Incidence of conditions affecting older people

Condition	Estimated number of sufferers in the UK (m)
Type II diabetes	2.1
Chronic obstructive pulmonary disease (COPD)	1.6
Cardiovascular diseases	2.4
Late onset dementia	0.7

Source: Annex B

2.3   The current use of ALSs in delivering care to older people

Today ALTs are used primarily for telecare and telehealth services for older people[7]. The pattern of use differs between these two forms of care.

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6 With GPs and their drugs budgets accounting for around 75% of primary care spend.

7 In contrast the current development of digital participation and teleworking services for use by older people is in its infancy. So we discuss it, along with future developments, in Chapter 3

Telecare

Telecare services which use ALTs have been in operation for well over a decade and there are now over 1 million fall alarm systems in use in homes and sheltered housing accommodation throughout the UK. Demand for ALTs was boosted recently through government grants, such as the £80 million Prevention Technology Grant, but has slowed as local authorities await the findings of the Whole System Demonstrators trials discussed in Section 2.4.

A typical modern telecare system might consist of:

- An alarm hub which, when triggered, dials into a monitoring centre

- A series of wireless sensors which are preset to trigger alarms. They might include a pendant to summon help following a fall, smoke, carbon monoxide, and flood sensors, an extreme temperature sensor[8] and, in the bedroom, a vibrating sensor under the pillow to warn of fire (local use only) plus bedwetting and epilepsy sensors

- A series of monitors e.g. a bed occupancy sensor which sends information to the hub for retransmission to a central server

- A simple voice memo system to remind older people with short-term memory problems to take keys and turn off gas/electric before leaving the house.

Telehealth

Use of ALTs to deliver telehealth in the UK is relatively limited. Until the Whole System Demonstrators started, use was limited to a number of small-scale trials by PCTs and NHS trusts in locations such as Carlisle, Barnsley, Croydon and Southwest Staffordshire. But, according to a recent NHS presentation[9], around 30% of PCTs are now "doing something" in telehealth and a few have started to move beyond small-scale trials.

Current telehealth systems are typically designed to manage long-term conditions such as COPD, heart failure and diabetes. A system might consist of:

- A central "communication" station which incorporates a user interface with large screen, large buttons and voice control. This connects to the Internet

- Medical measurement devices which interface with the communications station, and/or heart pacemakers with inductive communications link. These devices may use wires or wireless links.

The sensors typically monitor blood pressure, glucose, weight, pulse rate and blood oxygen levels while the communications station might ask the patient intelligent questions about symptoms. In some cases there is a website from which both the patient and clinician can monitor the findings. Through these websites the patient can also join a community of patients with similar conditions and, if they choose, compare their data against the average and other patients'.

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[8] To deal with electric cookers which are left on, where the sensor registers as too hot, or to deal with hypothermia where it registers as too cold.

[9] *Consumer driven models for mobile healthcare*, George MacGinnes, NHS Technology Office, Mobile Healthcare Industry Summit, London, December 2009

The supply of ALT-based systems

The supply of ALT-based systems can be characterised as follows:

- A single supplier provides complete systems and there is little interoperability between equipment from different suppliers

- Equipment suppliers are typically small-scale, UK-based, specialists. Tunstall is easily the biggest supplier

- The PSTN is normally used to provide the communications link to a response centre

- Systems are usually alarm-based rather than providing continuous monitoring of activities

- Systems are purchased by individual PCTs or local authorities. As a result the supply chain is highly fragmented, the cost of sales is high, and production is limited. This is reflected in the price of equipment. It typically cost around £2000 per home for a comprehensive telecare system.

2.4   The Whole System Demonstrators

The Department of Health is currently funding a large-scale trial of telecare and telehealth services using ALTs. This is known as the Whole System Demonstrators (WSDs). Results are due in 2012.

There are over 6000 people participating in the trial. They live in the London Borough of Newham, in Cornwall or in Kent - three areas with very different demographic characteristics. 50% of those participating in the trial receive normal treatment while the other 50% receive ALS-based care. Participants must suffer from at least one of COPD, heart failure or diabetes to be eligible for the telehealth group, or one serious disability requiring social care to be eligible for the telecare group. It is rare that service users are high dependency users for both telecare and telehealth.

The main aim of the WSDs is to demonstrate the effectiveness of ALS-based care - both in terms of improved outcomes and lower unit costs - using a properly controlled trial. The hope is that the trial will provide the evidence which the medical profession needs to accept and use telehealth services, and which PCTs and local authorities need to justify large scale investment in ALS-based care. The WSDs are also exploring how different funding models impact incentives to take up ALS-based care.

3   Possible developments in assisted living technologies

3.1   The main technology and market drivers

In this chapter we consider how technological progress and global market trends might expand the range of ALTs and ALSs which are in mainstream use over the next 20 years. We also list the potential benefits which these services might bring. The focus is on services which are likely to be in the **mainstream** use in 2030, rather than on the **blue sky technologies** which might be possible.

We have identified three major trends which will impact use of ALSs over the next 20 years:

- Moore's law should lead to cheaper equipment which offers greater processing speed and memory while consuming less power. Our research suggests[10] that, if there are global standards in global markets, this could mean that the price for most sensors could fall to less than £10 and the price of Internet access devices and home hubs could fall to well under £100. In combination with improvements in battery technologies, this should lead to wireless sensors with a life of at least five years

- Broadband communication will be available to all. Already the government has made a universal service commitment to provide basic broadband for all by 2012. With the subsequent rollout of LTE-based mobile networks and fibre-based fixed networks we can reasonably expect broadband to be available across the UK at speeds which make high-quality, real-time, video communications a near universal possibility

- The current move to mass-market devices with software APIs, on which independent companies can then design specialist applications, will continue.

In combination these trends have significant implications for the ALSs which are possible.

First they could reduce the cost of equipping a home for telecare or telehealth substantially - perhaps from £2000 to £200. At the same time use of wireless sensors could make the task of retrofitting a home quick and simple when compared with the wired alternative.

Secondly we should see an expansion in the range of ALSs which older and disabled people use. At the moment telehealth and telecare services require only modest bandwidth, and PSTN-based communications are practicable. In future use of broadband communications opens up the possibility for additional digital participation and teleworking services, which can enrich the home lives of older and disabled people. Broadband connections could also enhance telecare and telehealth services by enabling real-time video communications and make wellness services more attractive to end users.

Thirdly we can expect the nature of the industry which supplies ALT equipment to change:

- From one in which specialist companies deliver stand-alone systems in which software and hardware is combined

- To one in which specialist companies develop applications **software** specifically for older and disabled people, which runs on mass-market platforms such as mobile devices.

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[10] See for example *Title*, Plum for Ofcom, February 2009

Such a shift has a number of advantages. It significantly reduces the cost of production[11], it makes it easier to tailor ALSs to specific needs of disabled people[12] and, by using mass-market platforms, it avoids the stigma which many old people perceive when using today's telecare and telehealth equipment[13].

3.2   Developments in telehealth

Table 3.1 lists possible developments in telehealth services over the next decade. It also lists potential benefits and gives an indication of when, under favourable conditions, each of them might come into mainstream use. As we move towards 2030 we can expect other services, currently unimagined, to join the list in Table 3.1.

Today telehealth services are focussed on providing better and more cost efficient management of common chronic conditions, using a combination of sensors, hubs and remote servers. As the decade advances this architecture is likely to remain broadly the same. But new ALT developments could improve the management of chronic conditions, extend the range of conditions which are managed at home, and allow management while outside the home. In the longer term we expect increased use of ALTs technology to enable early home diagnosis of life threatening conditions and home monitoring of vital signs to be linked to real-time drug administration. All of these developments are valuable to an older person living independently at home.

3.3   Developments in wellness services

We can also expect to see significant take-up of wellness services, driven partly by market players and partly by government policy. Use of Wii Fit is an obvious example. Other examples of how assisted living technologies can promote healthy living include:

- Use of Internet-based services to provide remote personal training to improve fitness

- Use of nutritional content scanning systems to monitor food intake and help increase compliance with diets

- Use of mobile messaging services to provide encouragement and support in smoking cessation programmes.

Perhaps the greatest challenge for people in changing to a healthier life style is maintaining the motivation required to stick to the new lifestyle. There is now evidence that a user's motivation is increased if s/he receives feedback to show progress as a result of a healthier lifestyle and can see how well s/he is doing on a wellness programme when compared with others. ALT-based wellness services are well suited to providing such feedback.

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[11] Mass-market platforms are produced on a global scale at low-cost while specialist software is developed cheaply

[12] For example people with visual, hearing, or cognitive impairments

[13] Our research suggests that the hospital-like appearance of much of today's equipment is a substantial barrier to its use by many older people

Table 3.1: Developments in telehealth

ALT development	Timeline for possible mainstream use	Potential benefits
Periodic monitoring of vital signs (weight, pulse, blood pressure, blood glucose, lung capacity) combined with automated queries of service users when monitoring data indicates a need, so as to manage chronic conditions such as heart failure, diabetes, asthma and COPD	Now	More proactive management of chronic conditions, especially for those living in rural areas Reduction in emergency admissions to hospital Earlier discharge from hospital possible Reduced needs for outpatient visits Central collection of reliable data for trials of new drugs
Use of gait monitoring of older people with mobility problems	Now	Enables prompt intervention as mobility problems worsen
Home image monitoring e.g. of potential skin cancers	Now	Introduction of diagnostic as well as disease management applications
Online cognitive behavioural therapy used extensively to treat depression and anxiety	2 years	Cost-effective treatment of depression - a major problem for all ages but especially for older people
Use of disposable wireless plasters as sensors of vital signs	3 years	More convenient and less intrusive way of collecting vital signs data
End user access to their healthcare records combined with software to interpret the data	3 years	Enables users to take active control of the management of their conditions
Use of body area networks and mobile devices to record vital signs data	3 years	Enables monitoring and management of chronic conditions outside the home
Use of real-time video links to medical staff for consultations and coaching	3 years + depends on location	Cost efficient substitute for outpatient consultations or visits from nursing staff
Vital signs data processed by artificial intelligence software at a service hub. Bias to false positives so as to minimise probability of failure to diagnose serious problems	5 years	Improves management of chronic conditions
Reliable system to ensure adherence to medication programmes e.g. telepills which signal when taken plus automated pill dispensers for complex medication programmes	5 years	More efficient management and treatment of conditions - 45% of health care costs may currently be generated by lack of adherence to prescribed medication[14]
Vital signs monitoring and drug administration devices are linked to enable real-time treatment of certain illnesses at home e.g. artificial pancreas by combining blood glucose monitor and insulin pump	5 to 10 years	More responsive and cost-effective treatment of chronic conditions
Diagnostic test kits for key medical conditions widely available for reliable self administration	5 to 10 years	Early detection of life-threatening conditions
Use of avatars in place of humans for routine consultations	10 to 15 years	Significantly reduces cost of routine consultations

3.4   Developments in telecare

Table 3.2 lists possible developments in telecare over the next decade, again with a possible timeline and potential benefits indicated. As with telehealth, many of the benefits of telecare are likely to be

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[14] According to Continua Health Alliance

greatest for those living in the more remote rural locations, where it is challenging to deliver traditional care.

We expect to see a shift over the next few years, from alarm-based telecare systems to systems which use more continuous life style monitoring as illustrated in Figure 3.1. We also expect to see:

- The development of augmented reality services to provide appropriate contextual information to those with cognitive disabilities

- Telecare services providing significant help to older people when they are outside the home - through SMS reminder systems, navigation services, and services to locate dementia sufferers who wander and become lost.

In the long term technology might help older people drive safely for longer, provide robots to help with household tasks and provide support to those with mobility problems.

Figure 3.1: Lifestyle monitoring
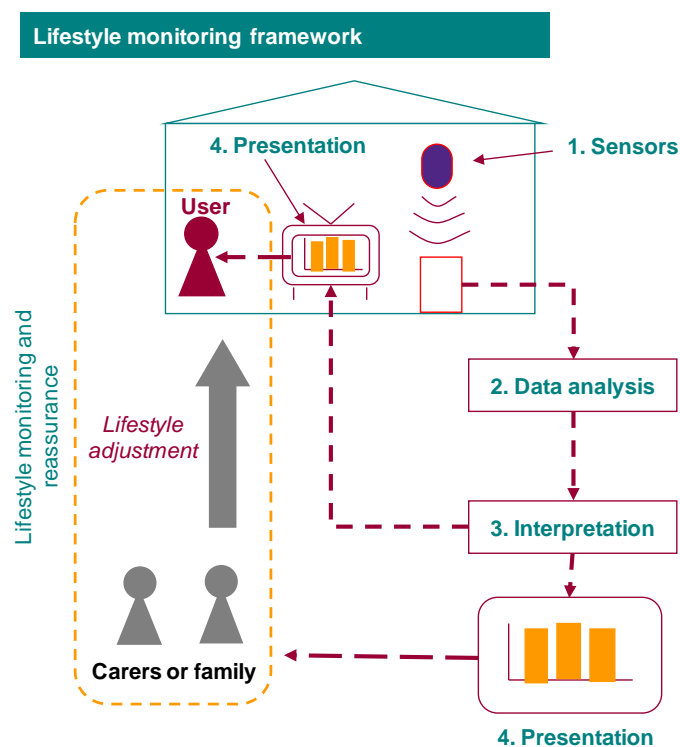
Source: Tunstall

Table 3.2: Developments in telecare

ALT development	Timeline for possible mainstream use	Potential benefits
Alarm-based monitoring of falls, fires, room temperatures, epileptic fits etc	Now	Speedy response to dangers for the user Greater peace of mind for carers
Local sensors to minimise floods, gas escapes etc	Now	A safer home environment for the user and greater peace of mind for carers
SMS-based systems which remind older people to take medicines and keep appointments	Now	Better functioning for older people with cognitive impairments
Navigation system on mobile devices allowing older people with visual or cognitive impairments to find their way around safely outside the home and, perhaps, to navigate around their local supermarket	2 years	Gives many older people more confidence to get out the house more often
Location services enabling carers to find older people with dementia who have become lost outside the home	2 years	Greater safety of older people with dementia Greater peace of mind for their carers
Continuous monitoring of the activities of an older or disabled person at home e.g. movements, eating, sleeping, and software to summarise findings so as to detect whether lifestyle adjustments are required. See Figure 3.1	3 years	Opportunity to adjust care packages more quickly and accurately to meet the needs of older people living at home as their abilities change
Augmented reality services for those with early-stage dementia e.g. reminders to lock up and turn off power/gas when leaving home Appropriate reminders to help with failing short term memory during daily activities e.g. cooking or making a phone call	Some now and some in 3 years time	Allows dementia sufferers to function effectively at home for longer
Real-time video calling with carers – both formal and informal	3 years on depending on location	Greater social contact between older person (especially if housebound) and their informal carers More cost effective consultations for formal carers
Cars provide night vision infra-red facilities to drivers	5 years	Allows older people with mild cataracts to drive safely at night
Use of robots to perform basic household tasks	5 years	Enables more older and disabled people to live independently at home for longer
Use of robots to help people with mobility problems to walk	10 years	Greater freedom for older and disabled people with mobility problems
Intelligent transport systems which help car drivers to drive more safely	10 years	Allows older people to keep driving safely for longer

3.5   Developments in digital participation services

As well as telecare and telehealth services to ensure physical well-being, we expect to see take-up of a range of digital participation services to grow. These will connect, engage, stimulate and entertain older and disabled people in their homes. For example these services might:

- ***Stimulate social interaction***. Older people already make increasing use of web-based social networking to maintain contact with friends. In future they might use social networking to interact with others who enjoy the same hobbies or interests and to arrange face-to-face meetings and

skill swaps[15]. Internet-based real-time video calling from the armchair might help strengthen contacts with distant family as illustrated in Figure 3.2. And always-on communications links with close contacts, perhaps carrying live feeds of telecare data, might provide an alternative to formal telecare monitoring services

- *Entertain*. Older people already use virtual reality games such as the Wii. In future they might enter a virtual bowling leagues through a multiplayer, gesture controlled, game which would stimulate both physical exercise and social interaction. They might use Internet-based video services to access archived TV material - for example to BBC dramas and comedy programmes from the 1970s and 1980s. If it is a struggle to travel, users might also enter virtual reality worlds to go shopping or enjoy a concert

- *Educate*. For some older people access to the World Wide Web is already an education in its own right. But others might prefer web-based learning which is integrated with social interaction to provide virtual evening classes in future.

In addition digital participation services can already offer older and disabled people access to a wide range of public and private services on the Internet – to provide information, price comparisons, shopping, banking, and a wide range of e-public services. Such access should enable users to save money, to carry out transactions from home, and to participate more fully in society. Annex C provides analysis of how digital participation services to older people have developed to date and considers possible future developments in more detail.

Figure 3.2: Video calling from the home
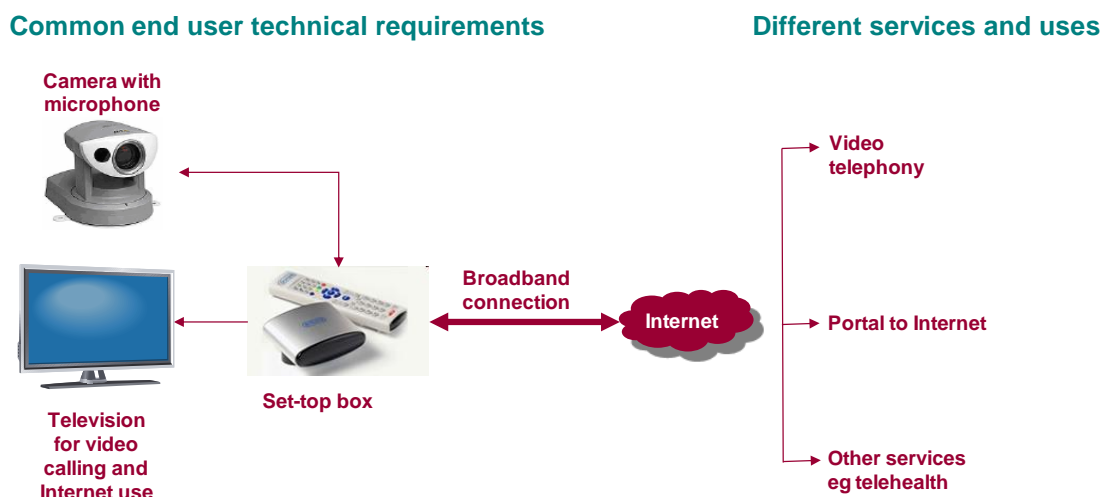
Source: Tunstall

3.6   Teleworking services

It is clear from the available data that the number of teleworkers in the UK is growing steadily - with older people making up a substantial proportion of the total. Annex D provides more detail. Stimulating

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[15] For example one older person might cook a meal for another in exchange for use of his or her carpentry skills

this trend is important to the future well-being of older and disabled people who wish to live independently at home for four reasons:

- It allows older and disabled people to continue to contribute their skills to the economy and to society. They might work for an employer, for themselves or for a voluntary organisation. Such work is valuable to older people – both as a source of self-worth and as a source of revenue.

- It enables higher workforce participation - especially from older and disabled people who otherwise find travelling to work difficult. Also higher workforce participation leads to a bigger economy which is better able to fund the care of older and disabled people

- It enables greater job flexibility for potential informal carers who might otherwise struggle to combine a part-time job with responsibilities as a carer. This should stimulate the future supply of informal carers. This is an important effect, given that 75% of social care of older and disabled people is currently undertaken by informal carers

- It stimulates mental activity by older people and there is some evidence that it helps to ward off certain forms of dementia[16].

The technologies which older and disabled people use to telework will depend upon who they are teleworking with. But it is clear that take-up will depend upon the same factors which determine the success of digital participation services - ease-of-use and affordability of devices, and availability and affordability of broadband. We discuss these issues further in Chapter 6.

3.7   The next 20 years

Bringing together the developments outlined in this chapter, Figure 3.3 illustrates how ALSs might help a couple in their late 70s, Clare and Colin, live independent and richer lives at home 10 years from now.

There are uncertainties over these developments. Over the next 20 years the rate of improvement in the price performance of the equipment and communication services used for digital participation and teleworking services should follow general market trends. The rate of improvement for equipment for telecare and telehealth services will however be constrained by:

- The extent to which equipment becomes globally interoperable and uses open platforms

- The nature of medical regulation. This is unlikely to get quicker or less rigorous. But it may become more global[17], allowing the development of global markets in telehealth equipment, and resulting in lower equipment prices.

At the same time the extent to which the newer ALSs described in this chapter come into mainstream use will depend upon the success of today's ALSs over the next few years. We factor these uncertainties into the scenarios developed in Chapter 8.

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[16] Lupton, et al. "Education, occupation and retirement age effects on the age of onset of Alzheimer's disease." International Journal of Geriatric Psychiatry. May 2009.

[17] For example through more streamlined procedures for equipment approvals, once approval has been granted in key countries

Figure3.3: how ALSs might help Colin and Clare

Vital signs data

Location services

36 BTS

Insulin pump

Vital signs sensors

Colin is diabetic and suffers from heart failure

Tracking information

Professional carers: medical & social

INTERNET

Integrated care records

Informal carers

Safety sensors (1)

Portable touch screen with camera (3)

Movement sensors (2)

Screen for augmented reality services (4)

Wireless hub

Broadband access

Services:
• Entertainment
• Social networking
• Information
• Shopping

Claire has dementia and is liable to fall

Notes: (1) Examples include smoke, transportation, gas, food. (2) Examples include infrared, bed and body sensors. (3) Used to access the internet and make / receive video calls. (4) Use to provide prompts / guidance e.g. when preparing meals.

4 The impact of demographic and economic changes

4.1 The aging population in the UK

As Table 4.1 shows, the UK's population is ageing fast. For example the population of people aged 85 or more is projected to double over the next 20 years. In this chapter we consider the impact of such changes on demand for care and ALSs while Annex E provides more detail.

Table 4.1: Changes in the age structure of the adult population[18]

Age group	Popln (m) 2007	Popln (m) 2025	% change
20-64	35.5	37.9	+7%
65-84	8.3	11.2	+35%
85+	1.2	2.4	+100%
Total adult	45.0	51.5	+14%

Recognising the problems which an ageing population brings, the UK government has launched or planned over 40 initiatives in the last two years to deal with them. Some are designed to help improve social care of older and disabled people; others to enrich their lives. Annex F provides more details. In summary the overall policy involves:

- Greater personal choice for older and disabled people over what health and social care they receive

- A more integrated approach to health and social care

- More emphasis on preventative medicine and healthy living

- Greater engagement of older people in the community and with other generations

- Digital participation for all in an e-society and an e-economy

- A greater emphasis on people taking responsibility for and control of their own well-being.

The government recognises that, within this general policy, ALSs have an important role to play.

4.2 Future demand for social care

An ageing population does not in itself impact on demand for social care. The real problem is that, as people live longer, the period of life with disability increases. Currently life expectancy increases by 77 days each year while healthy life expectancy increases by only 49 days. So in the next 20 years the life expectancy for a 20-year-old will, on current trends, increase by 4.2 years but healthy life will increase by only 2.6 years.

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[18] *Increasing longevity and the economic value of healthy ageing and working longer*, Professor Les Mayhew, Cass Business School, February 2009

When we factor these effects into our projections we estimate that the number of people with moderate to severe disabilities will grow from 1.8 million in 2007 to 2.6 million in 2025 - an increase of 44%. Excluding younger disabled people, the increase is even greater at 55%.

4.3 Future demand for healthcare by older and disabled people

Demographic changes will affect demand for healthcare service by older and disabled people in two main ways – through the ageing of the UK population and through a rise in the incidence of chronic conditions which are prevalent among older people.

The ageing of the population is likely to increase requirements for health care rather less than requirements for social care. We estimate an increase in expenditure at constant prices of only 16% over the next 20 years[19]. This modest increase reflects the fact that the biggest requirement for health care resources comes in the last year of life[20] and that deaths are projected to remain roughly constant over the next 20 years.

We are also likely to see a big increase in demand for the management of chronic conditions such as dementia[21], COPD, diabetes[22], heart problems, asthma, and mental health problems such as depression. This increase in demand will, to some extent, be offset by a decline in smoking-related diseases, as a result of a substantial reduction in smoking in the UK over the last 20 years.

Such conditions are, to a considerable degree, preventable. Recent research[23] indicates that smoking and obesity both substantially increase the chance of dementia, while obesity is strongly linked to Type II diabetes - which now accounts for more than 90% of diabetes in the UK. Preventative measures might start to reduce the morbidity of older and disabled people. However it is unclear whether the Government's measures here will be successful and, if they are, how quickly they will improve overall levels of health. Even if they are successful, it is unlikely that they will substantially reduce the morbidity of those who are currently aged 60 and will be aged 80 in 2030. So the impact of preventative measures, while clearly important for the future health of the population overall, are unlikely to reduce the projected increase in demand for care of older people significantly in the timescale considered by this study.

4.4 The likely supply of care

The state's ability to fund formal care

It is unlikely that the state will increase its funding of formal care for older and disabled people so as to match the expected growth in demand given:

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[19] Assuming that healthcare expenditure on an older person with a given age and level of disability is maintained at current levels at constant prices

[20] £30,000 per person versus £1400 per person on average for the rest of life

[21] There are around 0.7 million sufferers from late onset dementia in the UK at the moment. This group is projected to grow to 1.2 million by 2027 – a 70% increase[21]

[22] The number of people with diabetes in the UK is growing rapidly. Between 1997 and 2003 there was a 74% increase to 2.5 million people.

[23] A study published in the Journal of Neurology, Neurosurgery and Psychiatry in August 2009 shows that smokers aged between 46 and 70 have a 70% higher risk of chronic memory loss than their non smoking peers

- The long-term problems which UK governments face in improving public finances following the global economic crisis.

- Low fertility rates in the UK over the past few decades. These suppress growth in the working age population which in turn limits GDP growth

- The current high labour input to the care of older and disabled people. This means that, without substantial productivity gains within the care system, the unit costs of care are likely to grow at the same rate as, or higher than, GDP growth per capita.

- The pressures within the health system to spend a growing proportion of their budgets on new drugs and procedures. This has added 2% to 3% per annum in real terms to UK health care expenditure over the past decade[24].

As a result, the overall prospects for substantial increases in state funding for the care of older and disabled people over the next 20 years are poor.

The supply of informal care

Informal carers already provide 75% of social care to older and disabled people. As with formal care, it is unlikely that the increase in supply of informal care will match the expected 44% increase in demand for social care over the next 20 years. We will see a substantial growth in the number of older people who might act as carers. But the population of working age people, the other primary source of informal carers, is projected to grow by only 7% over the next 20 years. Even this analysis might understate the problem. Much of the 7% increase in working age people comes from immigration of workers whose parents remain overseas, and who are therefore unlikely to count in measuring the supply of informal carers of older people in the UK.

4.5   Demand for ALSs

The mismatch between the supply of, and demand for, care will generate strong pressures for take-up of telecare and telehealth services so as to use scarce resources more effectively.

Demand for *telecare* ALTs could arise in three main ways:

- Older and disabled people, faced with a scarcity of home care services, purchase ALTs to create their own ALSs

- Informal carers, recognising that such services allow them greater flexibility and peace of mind, demand telecare services

- Local authorities, and the care providers they commission, use ALSs to restructure procedures to reduce home visits and demand for residential care, without endangering the physical well-being of those being cared for at home.

There is also substantial potential for *telehealth* services to reduce the unit costs of managing long-term health conditions of older and disabled people. ALTs which offer monitoring and treatment for conditions such as diabetes, COPD, heart failure and asthma within the home should lower the unit costs of health care by reducing accident and emergency admissions, time spent in hospital, and

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[24] See Working Paper 2

outpatient visits to health clinics. This should generate demand for such ALTs, given the expected pressure on health care budgets in future.

We expect that the demand for wellness, digital participation and teleworking services is likely to come primarily from older and disabled people themselves, driven by a desire to increase the quality and independence of their lives at home.

4.6   The nature of demand for ALSs

We can expect to see a big increase in private, rather than state, funding of care over the next 20 years given:

- The constraints on increases in state funding of care.

- The greater wealth of a significant proportion of, but by no means all, older people through housing equity release schemes and generous defined benefit pension schemes[25].

We can expect this private funding to be spent in a mix of ways which includes:

- Formal private social and health care for older people.

- Informal private care – with spending both by older people and by their informal carers.

- Medical tourism - in which some older people go to places like India for cheaper private healthcare.

Spend on ALSs is likely to form a significant component of the first two of these categories. We might also see attempts to set up telehealth-based services which are located off-shore so as to avoid UK medical regulation and/or take advantage of potentially lower wage rates for medical staff in other countries.

4.7   The next 20 years

To summarise:

- We can expect to see a very substantial increase in demand for social care over the next 20 years[26], as the UK population lives longer in a state of moderate to severe disability.

- We can also expect to see substantial increases in demand for health care by older people, mainly as a result of increases in the incidence of chronic conditions such as COPD, diabetes and heart failure

- Neither state funding of formal care, nor the supply of informal carers, is likely to keep pace with this increase in demand for care

- As a result we can expect strong demand for ALTs and ALSs - both to lower the unit costs of home care and to ease the tasks of informal carers

- A growing proportion of ALSs will be funded privately rather by the state.

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[25] In the UK average income for pensioners increased by 42% in real terms between 1994 and 2007, ahead of growth in average earnings. *Old People's Day 2009: Statistical Bulletin*, ONS, Autumn 2009

[26] 44% according to Section 4.2

5   The requirements of older and disabled people

5.1   Introduction

ALSs will have to meet the needs of older and disabled people and their informal carers if take-up is to be maximised. To assess these needs we have:

- Carried out a review of the extensive literature on the subject. In all we reviewed 75 relevant publications

- Interviewed a dozen people who work directly with older people and/or their informal carers on the issues which arise when introducing ALTs

- Held a scenario validation workshop to get the responses and suggestions of a subset of these interviewees to our scenarios for use of ALTs in 2030. Box 5.1 presents selected quotes from the workshop. These illustrate many of the findings of this chapter.

A more detailed analysis is provided in Annex G.

Box 5.1: Quotes from a workshop with experts who work closely with older people

"…people were shown an "innovation house" which displayed over 40 products aimed at improving patients' independence and quality of life. There were very positive reactions, with people wanting to know where they could get these products."

"The users wanted the simplest products, with the fewest buttons and the products that, for example, looked like an alarm clock rather than a big piece of kit."

"If people have the option of a free product from the NHS that is 'hospital grey' or to buy a product from a retailer that was white – or other colour - and much more attractive, people generally prefer the shop bought item."

"People want 'tools for living' rather than 'assisted living'. Glasses [spectacles], for example, are products that fall into this category…there's lots of choice and you can even get designer ones."

"What we need is the John Lewis service where a nice man in a suit is offering products, sales and information. We would buy [ALTs] from him."

"Missing at the moment is choices and making sure people know what they can do, what their condition is and taking control. We have found that when we provide and set up telecare for people in their homes, that sometimes they don't even know what condition they have been diagnosed with"

"Users need training in the correct use of the equipment. We have found that they need to be told, for example, not to put their dog, holiday luggage and so on, onto the scales as it changes the data significantly!"

"They [carers] tend to be missed out in the product development process. They're also often the people making choices for relatives who lack capacity."

"We don't deliver services to individuals in a vacuum. You have to take the relatives into account realistically in the delivery of care, and the type of support that is put in place. The response to alarm calls, for example, is often coming from the family."

"[With ALSs] people are able to have the correct type of contact with their relative…can experience quality time together, rather than just completing tasks and chores. Social visits can come to the forefront."

"This technology leads to informed choice for the individual – they can choose to have a cigarette, knowing the consequences for themselves – they can take their own risks."

5.2   The basic needs

Our research suggests that older and disabled people want to:

- Live independent lives at home or in the sheltered housing of their choice for as long as possible.

- Enjoy life outside the home, as far as any physical impairments they may have will allow.

- Enjoy rewarding and stimulating lives and an active social life with minimum loneliness and isolation.

Many of them also want to be treated as independent decision makers, rather than as passive, dependent users of standardised care services.

Alleviating loneliness is especially important for improving the quality of life of older people. Research shows that one in three older people do not speak to a friend or family member for a week or more; one in 10 can pass a whole month without such conversation[27] . As well as reducing quality of life, such isolation impacts on the mental and physical health of older people. There appears to be a link between isolation and the onset of dementia[28]. Moreover mass take-up of telecare and telehealth services could make such isolation worse. One of the key attractions of these services to service providers is that they are more cost efficient. Given the high labour content in care services, pressures to drive down costs could lead to reduction of or elimination of visits to the homes of older and disabled people, and for many this could mean increased isolation and loneliness.

It is important to recognise that these needs and preferences vary across the population of older people as they are a heterogeneous age group, just like other age groups.

5.3   The attractions of ALSs

Our research suggests that potential users and their informal carers are generally positive about many aspects of ALSs. There are even some fiercely independent older people who reject conventional care in the form of visits from paid carers, but say they will use ALSs to maintain their independence and protect their privacy. Attractions vary with the type of ALS, and by service user and informal carer, as shown in Table 5.1. For example an informal carer is typically more concerned that the user is safe, while the user is often keen to live a full independent life at home and is willing to live with the risks.

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[27] *The perfect gift? How about an end to loneliness*, Guardian, 23rd of December 2009

[28] Wilson, et al. "Loneliness and Risk of Alzheimer Disease." Arch Gen Psychiatry. February 2007.

Table 5.1: the attractions of ALSs for users and informal carers

Assisted living service	Attraction to users	Attraction to informal carers
Telehealth and telecare	Saves time and cost e.g. fewer visits to a hospital outpatient department Makes user feel more secure at home Allows users to take greater control of their medical condition and improve their fitness Potentially provides users with the opportunity to make informed choices and have ownership of their data Feeling that they are less of a burden on informal carers Allows users to retain some independence and confidence	Provides reassurance that the user is safe - especially using telecare services Provides objective evidence on which to discuss care needs with user and formal care provider Preserves family wealth - which may otherwise go on fees for residential care Provides greater social contact with the older person by reducing time spent on caring tasks Supports the carer and increases their quality of life
Digital participation services	Enables greater social contact with friends and family A wider range of entertainment options than with passive TV viewing Opportunity to pursue hobbies and interests in a social network setting Opportunity to swap skills with other older people Increased independence e.g. shopping on-line rather than relying on others Opportunity to save money through e-shopping	Greater social contact with user
Teleworking	Facilitates working to a later retirement age Opportunity to make money Improves psychological well-being through continuing contribution to society/economy and from social relationships at work Reduces cost and physical energy required for commuting	Makes it easier to be an informal carer and to work part-time[29] Provides increased flexibility and decreased travel demands

5.4   Concerns about ALSs

Potential users may be generally positive about ALSs. But they, and their informal carers, have a number of concerns which will significantly limit take-up, if these are not addressed. Most of these concerns relate to telehealth and telecare services. For example:

• What will happen to the data collected by the various ALT sensors and who will have access to them? Privacy and confidentiality of data is the number one concern for most older and disabled people. They want to have control over their personal data. There is a particularly strong reaction from some people against video monitoring, even though they may enjoy using video links to communicate with friends and family.

• How will older and disabled people cope with the potentially large volumes of information available on the many devices and types of care? Will they have adequate financial and technical support to guide them through their decisions on what to do?

• Will use of ALSs lead to less social interaction and increased isolation?

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[29] A 1997 study in Toronto provides a number of case studies showing how the flexibility provided by teleworking lets people to continue with both their job and their care, allowing those they care for to remain home for longer. See *Telework and Taking Care: The Elderly*. Nazer and Salaff, 1997. http://www.chass.utoronto.ca/~salaff/NANCY.PDF

- Will the service and the equipment be reliable? In particular, will care providers respond quickly enough to the telecare and telehealth information sent to them? What happens if there is a technical problem with the equipment? Will there be support at every level – even for something as simple as changing a battery?

- Will ALSs make the user and his/her family feel more, rather than less, anxious? For example monitoring data might demonstrate physical or mental decline while false telecare alarms may raise anxiety levels

- Will the equipment used for ALSs stigmatise the user? Older and disabled people, like everyone else, like to appear normal to others. But many of them see the current hospital-like appearance of much of today's ALT equipment as labelling them as sick/disabled people, making their homes unattractive – both to themselves and to visitors.

- How easy will ALTs be to use? Will older people and their carers have a choice of devices and a means of personalising these devices? How accessible and usable will they be?

- How affordable are ALTs if the NHS will not pay for them? Some ALTs could deliver significant benefits to older people who have not reached the "critical level" at which ALTs are free, but who still have some health concerns.

- How can providers balance the preferences of older people and their informal carers, particularly for those who have dementia?

- Do users really need ALSs? Many older people, whose carers believe would benefit, reject ALSs on the grounds that they are not ill or incapacitated enough to need them

- Who controls the service? Most users believe strongly that they should take the final decision on whether to use an ALS, rather than having it imposed on them for their own good.

There are also concerns about digital participation services (and teleworking to some extent). Potential users are concerned about the costs of both equipment and broadband connections, fearful that they will not be able to learn the digital literacy skills required to use the service, and worried that there is no one they can turn to when things go wrong. We discuss these issues in the next chapter.

5.5   Challenges

The concerns listed above mean that there are a number of challenges that will need to be addressed in order to maximise take-up of ALSs.

Challenge 1: *how to enable service users to remain in control and not feel that ALSs are being imposed on them.* Promoting ownership of solutions by older people is important here. Our research suggests that, if older people can see what is available and are provided with clear and objective information on what is available, on the implications of implementation and use, and on the costs and benefits of different options, then they[30] can arrive at solutions which they own and with which they feel comfortable[31]. Time spent assessing an individual's needs and involving the user in the choice of

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[30] And their informal carers - since in practice decisions are often made in a family context

[31] Dementia sufferers might find it difficult to make such an informed decision. But it may be possible for sufferers, at an early stage of this condition, to draft a living will which specifies what they want to happen as the condition worsens. Before this can happen, however, there will need to be a lot of discussion and work involved in developing a new form of living will.

appropriate technologies to match those needs leads to a sense of ownership and control from the user. This, in turn, helps ensure acceptance and usage of the technologies[32].

Challenge 2: *how to provide low-cost solutions while allowing personalisation of ALSs.* There is clear evidence from our literature review and interviews that, if assistive technologies do not meet users' needs, they will not be used. The personalisation of ALTs according to a user's tastes, health situation, and their relationship with their carer will have a strong impact on whether they will be used or wanted. Yet personalisation of ALSs will raise the costs of provision. If and when services are implemented in specialist software running on mass-market platforms this challenge should become less daunting. Such service implementations allow users to choose their own service profile when the service is set up at little, if any, additional cost.

Challenge 3: *how to get potential service users to make an accurate assessment of their needs*. Often older people will suggest that ALSs are useful for others, but that they are not yet ill enough to need them, at the same time as care professionals conclude that ALSs are needed. Providing potential users with full information; enabling them to hear from an ALS user with similar disabilities or medical conditions; and showing how ALSs can help users take charge of their own well-being, are all important steps in meeting this challenge.

Challenge 4: *how to deal with concerns about privacy and confidentiality of data*. A code of ethics, which specifies how the data collected by ALSs will be used, might help give potential users confidence. Giving users a choice over who has access to the data might also help allay such fears.

Challenge 5: *how to deal with the fear that ALSs will lead to video telephony replacing face-to-face contact with carers?* This is not a groundless fear. Given the future pressure on care budgets, care providers are likely to reduce costs in this way. The introduction of digital participation services should help increase social interaction for older people. In addition, there is some evidence[33] that replacing some face-to-face contact with telephone contact is not necessarily bad, as long as the quality of the interaction is satisfactory[34].

Challenge 6: *how to balance the needs of service users and their informal carers.* These needs are not always aligned. In particular:

- The informal carer is likely to want closer monitoring than the service user. Defining what constitutes an acceptable level of risk could help resolve this tension. Giving users the ability to switch off monitors when they wish to have privacy could also promote acceptability.

- Informal carers may need to set limits on what they do, and have the opportunity to discuss with professional carers what should be done when these limits are exceeded.

Challenge 7: *how to design and supply equipment which the user does not perceive as stigmatising them as ill and/or disabled*. One obvious way forward here is to develop applications software which runs on mass-market devices, such as smart phones and tablets. Improved design of hardware will also be important.

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[32] See for example Marcia Scherer's work. *Living in the state of stuck: How assistive technology impacts the lives of people with disabilities*, 2000, 3rd ed. Brookline Books: Cambridge, MA.

[33] A study which compared experiences of patients with a variety of conditions who had either home care visits or a combination of home care visits and telecare (remote video consultations with nurses) found high levels of satisfaction (90%) with the remote video visits, which were considered both convenient and timely

[34] For example by ensuring that calls are always made by the same small subset of carers who visit the user

Challenge 8: how to raise awareness of how ALS can help older and disabled people live independently at home. One-stop information centres with a comprehensive database of information about ALT products and services, knowledgeable and friendly staff, and demonstrators to try out would help here. But this approach is unlikely to reach those isolated by disability, geography, or language. So other, more local, channels such as community centres, libraries, and health centres might be needed. Commercial marketing and the promotion of ALTs as a regular, mainstream product is one potential way of raising awareness and generating interest. Greater use of local radio and TV as it evolves will offer an important channel for information.

Challenge 9: how to ensure that older people continue to use ALSs in the long term. Trials so far suggest significant dropout rates by ALS users. This is a complex problem with no simple answers. Further study is needed - especially to see whether the provision of more interactive and interesting user experiences, in which service users take control of their own well-being, will help.

Challenge 10: how to supply the right amount of information and choice. Older people have a broad range of preferences for products, just like the general population. As a result older people risk being overwhelmed by the number of choices and/or spending too much money on overly-complicated products which they do not need. They will require the right level of support and advice to guide them through these choices.

5.6   The next 20 years

Over the next 20 years there is considerable uncertainty - both over how well suppliers will respond to the needs of older and disabled people and over the extent to which older and disabled people become more active in the management of their own well-being. So there is a very wide range of possible outcomes. By 2030 we might see outcomes in which:

- Global suppliers focus significant resources on the market for ALSs so as to meet the challenges listed above and to grow the market substantially. At the same time the majority of older and disabled people take increasing control of their own care and well-being - through the way they spend individual care budgets, take up wellness services in significant numbers, and play an active part in treatment regimes, *or in which*

- Global suppliers focus on other markets and small-scale specialists continue to supply the ALS market. They sell mainly to the state-funded institutions rather than directly to end users themselves. The state-funded institutions take a more standardised approach to delivering ALSs than market players and end user needs are not always met. In parallel the majority of older and disabled people continue to play a relatively passive role in their own care - relying largely on state institutions to provide care and treatment.

6 The impact of digital inclusion

## 6.1 The need for digital inclusion of older and disabled people

In this chapter we consider the extent to which older and disabled people might be digitally included by 2030. In other words what proportion of them will be connected using broadband communications to the Internet?

Many telecare and telehealth services can be implemented via the basic telephone line of the service user. But teleworking and most digital participation services require always-on broadband services to work effectively, while telecare and telehealth services will, in future, require broadband to enable good quality video links to carers. At the moment we are a long way from full broadband take-up by older people. One increasingly good measure of broadband take-up is the level of Internet use at home. And, according to this metric, only 20% of the over 75s have Internet access at home, compared with over 80% of 45 to 64 year-olds[35].

6.2 Progress towards digital inclusion

Without special measures in place, it could take a long time for all older and disabled people to be digitally included and to be able to enjoy digital participation services. Figure 6.1 illustrates[36]. There are currently 3.7 million over 75-year-olds in the UK who do not use the Internet. On historic trends, it will take 33 years for 90% of this category to become Internet users on current trends.

Figure 6.1

Non-Internet Users in the UK in 2009 by age group

Source: Plum Consulting, Eurostat

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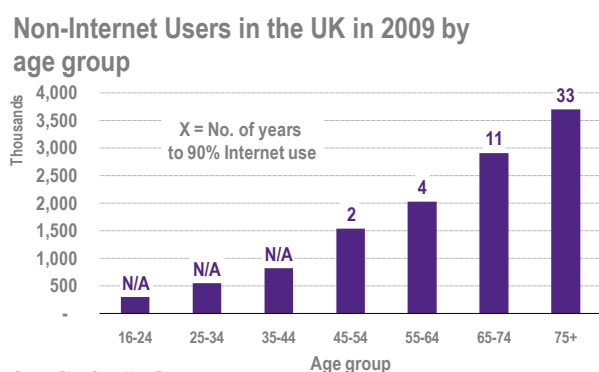
[35] *Accessing the Internet at Home*, Ofcom, June 2009

[36] We use Eurostat rather than Ofcom surveys here because the sample size of the former is significantly bigger and the estimates are likely to be more accurate

6.3   The main barriers to digital inclusion of older people

Surveys by Ofcom[37] and Eurostat[38] indicate that there are four main barriers to older people becoming Internet users:

- They do not see the *relevance and value* of Internet use. This barrier is significantly greater than the other three for older people. Our research suggests that the problem is more likely to be one of not knowing what the Internet offers rather than one of an older person taking an informed decision that Internet use is not for them. For example, according to the Ofcom survey "*Only 3% of respondents* [of all ages] *said they had never heard of the Internet"* but, among those who gave *Not relevant* as the main barrier to Internet use, "*knowledge of the Internet was low, with 95% confessing little or no knowledge of it*"

- They *do not have the skills* and confidence necessary to use a PC and browser to access the Internet

- Many of them *cannot afford* the equipment and/or broadband connection required for Internet use[39]

- Broadband connections are *not available* at an adequate minimum speed in their area. This final barrier applies to less than 10% of the UK population.

These barriers to digital inclusion are relevant to people of all ages. But our research suggests that there is another barrier to digital inclusion which is especially important to older people. Many do not have easy access to people with ICT skills to whom they can turn when they encounter problems in using a PC and/or online services. Our end user research, set out in Chapter 5, suggests the need for *helpline services* which are specifically designed to support older people with limited ICT skills. If such services are to be widely used, they would need to be available at a modest price or free of charge. This implies the need for government funding. Whether such funding will be forthcoming is uncertain. It may be more cost-effective to develop online support services specifically to guide older and disabled people with only basic online skills through common problems.

6.4   The impact of market developments

Over the next decade we can reasonably expect that market developments will significantly reduce the first three of these barriers.

After a relatively long period of stability, where connectivity was fixed and going online involved a PC using local software and a browser, we now appear to be in a period of rapid change in the way the general public can use the Internet. The following changes, which are now clearly evident but not yet widespread, may fundamentally change what it means to adopt broadband, use a "computer" and go online:

- Mobile broadband adoption, whilst still limited as a substitute for fixed broadband, is growing rapidly in a number of countries and now dominates new additions in countries such as Finland and Austria

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[37] *Accessing the Internet at Home*, Ofcom, June 2009

[38] Eurostat. Internet Usage in 2009 – Households and Individuals.
http://epp.eurostat.ec.europa.eu/portal/page/portal/information_society/data/database

[39] Increasingly Internet use requires a broadband connection to function effectively

- A proliferation of devices with Internet connectivity, including smart phones, TVs, netbooks, tablets and single purpose devices such eBook readers, are changing what it means to "go online"

- New interfaces and operating systems, including touch, provide simpler and more intuitive means of interacting with devices/services

- Cloud computing is moving software and software updates away from the user to a server on the Internet, thereby reducing the skills required to maintain software for use on a PC. Cloud computing is also lowering the processing power and memory requirements of devices

- Applications (Apps), such as those provided by Apple, Google and Nokia, are making the Internet easier to use. End users no longer need to navigate via a browser and URL but can go directly to a specific application whose function is transparent

Figure 6.2 illustrates.

Figure 6.2: The market is now delivering simpler and more robust devices to go online

- **Keyboard/mouse first**
  - => Browser => URL => Application
- **Complex**
  - Slow start
  - Learning curve, idiosyncratic problems, deterioration over time
- **Vulnerable**
  - Open OS vulnerable to viruses etc
- **Connectivity separate**
  - Separate purchase of fixed line broadband contract and set up

- **Screen first – multi-touch**
  - => Application
- **Simple (complexity concealed)**
  - Almost instant on
  - Simple and predictable, stable over time
- **More secure**
  - OS likely to prevent viruses etc
- **Connectivity included**
  - Wireless connectivity purchased & cancelled at any time from device

These market developments significantly increase the prospects for achieving high levels of broadband Internet use among older and disabled people.

Market players are currently raising *awareness of the relevance* of using the Internet amongst non-users. For example current adverts in the press stress the specific applications which smartphones offer rather than their ability to access the Internet.

In terms of the *skills required for Internet* use it may not be necessary to teach people computer skills in future, or even how to go online in order for them to benefit from online services. Some prospective Internet users might go online using an e-book while others might use a smart phone to access applications directly - rather than using a PC and browser to access the Internet

Market developments should reduce *affordability problems*. For example:

- Open source software, including Linux and Google Chrome OS[40], will lower the overall price of software, while Moore's Law will continue to drive down hardware prices

- The costs of mobile broadband per Mbyte will reduce very substantially as LTE-based networks are rolled out. Our research suggests that LTE roll out will lead to a fivefold reduction in unit costs[41]

- Given their different cost structures[42] mobile operators can offer substantially lower prices than fixed operators to older people who want low volume broadband Internet use but have a restricted budget

However, affordability problems will remain, especially for older people on basic state pensions. Mobile broadband prepay might deal with affordability problems for some older people. But for older people who generate substantial video traffic through use of digital participation services, a fixed broadband connection might make more sense. Making broadband connections affordable may therefore require targeted subsidy. For example local authorities or central government might subsidise the price of broadband connections for anyone requiring health or social care.

6.5   Other market effects

In addition to the market developments listed above, there are two other market effects which should increase broadband Internet use amongst older people over the next 20 years:

- Viral marketing effects. Word-of-mouth recommendations from others could be powerful in persuading older people to become Internet users. But analysis of historic trends (e.g. Figure 6.1) suggests that this mechanism has had little effect so far

- Cohort effects. With each year that passes, an annual cohort leaves a younger age group to join an older one. This cohort has a higher average level of Internet use than the age group it joins, and this raises the average level of Internet use in the older age group. We estimate that cohort effects might increase the level of Internet use amongst older people by one or two percentage points each year or by 20 to 40 percentage points over the next 20 years.

6.6   Digital inclusion of the disabled

There are substantial barriers to digital inclusion of disabled people because of physical handicaps - whether visual, hearing, cognitive, or motor skills impairments. The extent to which disability reduces on-line access is a substantial topic in its own right and one which is outside the scope of our study. For a description of the issues which arise see www.culture.gov.uk/reference_library/publications/6378.aspx

The impairments suffered by older people impact on their ability to use both devices and services. There is now a number of market developments designed to minimise these barriers.

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[40] Anticipated in 2010

[41] *Entertainment in the UK in 2028*, Plum for Ofcom, February 2009,

http://www.ofcom.org.uk/research/technology/research/sectorstudies/entertainment/entertain2028.pdf

[42] The costs of fixed broadband are dominated by the fixed costs of installing and maintaining the line to the user's home. The costs of mobile broadband are dominated by the traffic volumes generated by the end user. So it is possible to offer a low volume user a cost based price which is significantly lower with mobile than with fixed broadband

Barriers to use of **access devices** by those with disabilities are reducing. In particular the addition of Braille readers, sign language, touch screens and voice recognition features to mass market devices and software is improving access for those with visual, hearing, physical and motor skill impairments; and for those with poor literacy[43] [44] [45]. Some of the stakeholders we interviewed believe that, in the long run, it should be possible to use software which automatically configures a device to compensate for such impairments following a few simple interactions with the end user to assess possible impairments.

The development of accessibility aids embedded into **mainstream Internet services** is at an early stage of development. The World Wide Web Consortium (W3C) has launched and a European Commission-funded Web Accessibility Initiative (WAI) project known as WAI-AGE. The aim is to create international standards for accessibility by older people which cover items such as text size, colour contrasts and audio interfaces. But the level of implementation of web accessibility is not yet satisfactory although there are exceptions. For example in April 2009 Baidu[46], the Chinese search engine, launched the *Baidu Elderly Search* site which uses large font sizes and provides links from the home page to sites of interest to elderly people (e.g. classical Chinese poetry).

6.7   Government-funded measures to promote digital inclusion

Recognising the current low level of digital inclusion of older people, the UK Government is funding a number of measures to promote it. Specifically:

- The Government has set aside £200 million to implement the universal service commitment recommended by the Digital Britain report[47]. This should ensure that **98% of the UK population has access to broadband** at download speeds of 2 Mbps or more by 2012. Such a measure should help with the supply of entertainment services for older people. But higher upload speeds will also be increasingly important if older people are to use real time video calling for care consultations and for high-quality social interaction with friends and family.

- The Government funds UK Online, which provides a network of online centres in community centres, libraries, training centres and other public buildings, where people can go to use the Internet and receive basic tuition. **Access to and use of the Internet outside the home** gives non-users a good way to assess its value and their ability to use it, before they commit to a broadband subscription and the purchase of a PC. In a recent UK survey[48] for example, over seven in 10 (72%) of those who intend to get the Internet at home over the next six months are already Internet users outside the home

- There is a wide range of measures to provide older people with the **digital literacy skills** needed to use a PC and browser. Many of these are now designed to take account of the fear of failure which many older people feel when they contemplate a computer skills course. To quote from Ofcom's consumer panel research on the subject of ICT skills training *"many of the older people*

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[43] The Apple Snow Leopard OS which includes support for those with visual impairment including brai le support. http://www.apple.com/macosx/universal-access/

[44] *YouTube videos which will include automatic captioning.* http://news.bbc.co.uk/1/hi/technology/8369941.stm

[45] iPhone "voice over" gesture based screen reader and 3rd party applications including sign-language. http://www.apple.com/accessibility/iphone/vision.html

[46] http://123.baidu.com/

[47] http://www.culture.gov.uk/images/publications/digitalbritain-finalreport-jun09.pdf

[48] *Accessing the Internet at Home*, Ofcom, June 2009

on [ICT] courses were afraid - afraid of the unknown, of breaking the computer, or of appearing foolish in the eyes of younger tutors and fellow learners." Research shows that informal learning i.e. from family and friends – and preferably one-to-one – is generally favoured by older people. Where formal training is sought, they prefer this to be in the company of peers and to be delivered by an older person or an empathetic younger person

- The Government plans to provide up to £12 million for a consortium of UK organisations, lead by Ofcom, to launch a campaign to promote awareness of the **relevance of the Internet**,. With over 60 members from across Government, industry and Civil Society, the aim of the Consortium is to encourage people to change their attitudes and behaviour towards digital communication technologies by providing information, motivation and support. The initiative is in two main parts. Members such as the BBC, BT and Virgin Media will use their brands, literature, audiovisual material and advertising inventory to launch a social marketing campaign. In parallel the consortium will use targeted outreach methods, developed from the TV digital switchover programme, to raise awareness through external networks of local organisations such as the Women's Institute and Age Concern

- The charity Digital Unite has put considerable effort over the last 10 years into **promoting the relevance of the Internet** to older people. For example it runs an annual *Silver Surfers Day* which has introduced a significant number of older people to the Internet. But the charity's efforts are focused where it can get funding - on sheltered housing and community care centres.

As far as we know, there are no government-funded measures to deal with the barrier of affordability of home online access by older and disabled people. Nor are we aware of any plans to provide government-funded helpline services to older people[49].

6.8   The next 20 years

Digital inclusion is an important prerequisite for the use of digital participation and teleworking services. So achieving digital inclusion is important if older people are to enjoy independent lives at home. But it is unclear how close we will get to 100% digital inclusion of older people over the next 20 years:

- Historic trends are not especially encouraging, as Figure 6.1 illustrates. At the same time the current cost of getting an older person online are considerable - well over £1000 for a three-year period, if we combine equipment, broadband subscription, training and support costs.

- On the other hand market developments should, over the next decade, substantially reduce these costs, while government measures could raise the digital inclusion of older people substantially.

We reflect this uncertainty in the scenarios of Chapter 8.

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[49]   There are however a number of intergenerational initiatives, such as the DWP's Intergenerational Demonstrator Project, which are designed to bring school children and older people together, and in which getting older people to use the Internet is one of the central activities

7   Institutional factors

7.1   The importance of state-funded care delivery

In the UK a very significant proportion of the formal care of older and disabled people is directly funded by the state:

- Over 60% of formal social care[50] is commissioned by the social services departments of local authorities

- Nearly 90% of health care is provided by the NHS, which is funded directly by central government rather than through insurance schemes.

This is unusual in the developed world and could impact take-up of ALSs in the UK. There are powerful direct incentives to invest in ALSs in countries with insurance-based health care systems so as to lower unit costs. Such incentives are much weaker in the UK system.

Given the central role of UK state-funded institutions in delivering care to older and disabled people, the way they use and promote ALSs will fundamentally affect the extent to which these services are used.

7.2   The current position of state-funded institutions

There are significant differences between the attitudes of local authorities to telecare and the NHS to telehealth. Local authorities have funded use of ALTs for some time, and alarm-based telecare systems are available in many parts of the UK. In contrast, use of telehealth services has, until recently, been limited to relatively small-scale trials. There is a culture of evidence-based medicine which requires successful controlled trials before treatment is made available on a nationwide basis. Such evidence for the effectiveness of telehealth services has so far been lacking. One of the prime aims of the current Whole System Demonstrators is to provide this evidence so as:

- To convince doctors that ALSs are cost-effective and improve outcomes when managing chronic conditions

- To provide the financial evidence which both the NHS and local authorities need from major investments in ALSs.

It is not yet clear what the Whole System Demonstrators will show when the independent evaluations start to emerge in 2012. Some stakeholders are optimistic. Others are convinced that the evaluations will prove inconclusive and that further large-scale trials will be required, using fresh technologies and/or procedures.

7.3   Other barriers to take up by state-funded institutions

Through the stakeholder interviews we have identified a number of other potential barriers, besides the lack of medical and financial evidence, to take-up of ALS by state-funded institutions. In particular:

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[50]   Note however that 75% of social care is provided by informal carers

- The financial incentives for local authorities to invest in ALSs are weaker than they could be. In many cases the introduction of telecare services by **local authorities** helps to reduce costs for **the NHS**. However there are no clear mechanisms for passing these savings back to the local authorities

- There are financial problems in raising the capital expenditure needed for investment in ALSs from budgets which are already under considerable pressure. This is especially true while the price of equipment remains high – partly as a result of fragmented procurement by independent PCTs and local authorities

- Caring professions have almost no experience in the use of ALSs. For example use of ALSs is not included in training courses and this position is not likely to change for several years

- The financial incentives for GPs and health visitors are designed to reward home visits and other activities, rather than to improve outcomes through the use of telehealth services

- There are concerns that GPs and other medical staff might be overwhelmed by the volume of data that telehealth services generate. There are also issues as to whether ignoring such data might be considered as negligence

- There is a lack of integrated electronic care records which offer appropriate access to health care and social care professionals, to service users and to informal carers. Such records are important for effective ALSs and especially for the effective care of older people with both social and health care needs.

Within the UK, England, Wales, Scotland and Northern Ireland organise care services in different ways. In Northern Ireland for example there is more integration of health and social care than in England. This might lower some of the barriers listed above and lead to different rates of take-up of ALSs by state bodies in the four nations of the UK.

7.4   The role of the private sector

Given the barriers to take-up by the state sector and the predicted increase in private funding of care over the next 20 years, we may well see the private sector lead in the deployment of ALSs. This might start with:

- Deployment of wellness services, where there is limited medical regulation, strong promotion by UK government, and a growing interest from consumers. A *stop smoking* service is a good example

- Take-up of telecare services by informal carers, who want to make their responsibility for an older or disabled person easier to manage

- Purchase of the equipment and communication services needed for digital participation services by older people keen to make their lives at home more enjoyable.

We are much less likely to see the private sector buying ALTs for telehealth services. Here there is a need to involve doctors and other health professionals in the service and to use medically approved equipment. So the NHS is the obvious supplier of telehealth services.

The relationship between private and state-funded ALSs is also important. In the past the state has kept private and NHS medical care quite separate in most cases. However a more complementary

approach might help to maximise use of ALSs. For example an older person, or his informal carer, might purchase ALT equipment privately and set up his own care records. Then, as needs grow, this person might require state care. The transition might be most effective if private and public care records are shared, and if privately purchased equipment continues to be used by the state care teams.

7.5   The next 20 years

Overall there is considerable uncertainty as to how UK state-funded bodies will implement ALSs over the next 20 years. On the one hand we might see:

- Excellent results from the Whole System Demonstrators

- Rapid acceptance of ALSs by the caring professions and especially by clinicians

- Changes in existing organisational structures and incentives which make ALSs more effective and attractive to decision makers within the care system and

- Substantial investment in ALSs as a consequence.

Alternatively we might see ambiguous results from the Whole System Demonstrators, little change in traditional structures or incentives, and only modest take-up of ALSs by the state sector.

There is also uncertainty over how the relationship between state bodies and the private sector will evolve. Here:

- The state might complement the private sector in the supply of ALTs and services which use them. This might involve the sharing of private and public healthcare records and equipment.

or

- The state might develop its own ALT-based services quite separately from private services and equipment.

8 Scenarios for 2030

8.1 The scenario development process

We followed a six step process to develop the scenarios for use of ALSs in 2030, using techniques developed by Shell in the 1970s and used extensively by a wide variety of organisations since. The process is as follows:

Step 1: *decide what the scenarios are for*. We have concluded that the primary function of the scenarios is to help Ofcom identify the potential policy issues which might develop as and when ALS take-up grows. But the scenarios provide valuable outputs in their own right which should be useful to policymakers outside Ofcom. So the scenarios were also developed with this secondary purpose in mind.

Step 2: *identify the high impact drivers of change in the use of ALTs by older and disabled people over the next 20 years.*

Step 3: *classify the high impact drivers*. There are two categories of interest to us:

- Those drivers where there is a high degree of uncertainty about their long-term impact. These are the **high impact, high uncertainty drivers**. This uncertainty needs to be reflected in the scenarios.

- Those where there is a reasonable degree of certainty about outcomes. These **high impact, low uncertainty** drivers of change are common across the scenarios.

Step 4: *group the high impact, high uncertainty drivers together* where they are strongly correlated with each other. The aim is to identify just two dimensions for the scenario space, as shown in Figure 8.1.

Figure 8.1: A two-dimensional scenario space
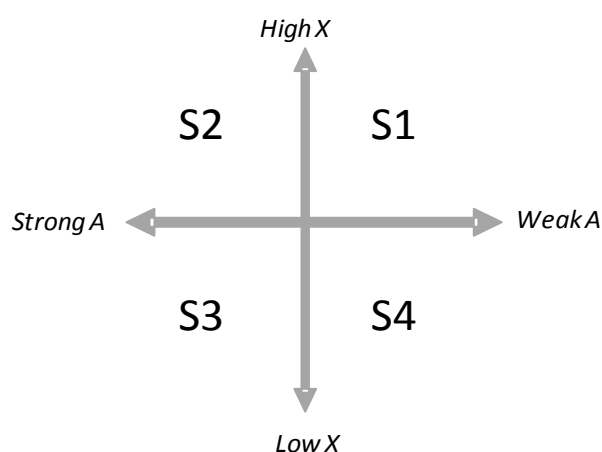
Step 5: *identify and name the scenarios*. Each of the quadrants of Figure 8.1 could provide us with a scenario. Each scenario should have a name which captures its essential features.

Step 6: develop each scenario. The process so far has provided a set of named scenarios, each of which is specified in terms of outcomes for each of the high uncertainty drivers. In this final step we specify, for each named scenario, how ALSs are used by disabled and older people in 2030 and how this use has developed over the last 20 years. We provide a plausible backstory for each scenario.

8.2   The main drivers of change

Based on the analysis set out in Chapters 3 to 7, we have identified seven high impact, ***high uncertainty*** drivers. We list these in Table 8.1 and indicate the range of outcomes which we consider likely for each driver over the next 20 years.

Table 8.1: The high impact high uncertainty drivers of change

Driver	Demand maximising outcomes by 2030	Demand minimising outcomes by 2030
1. The price performance and range of ALTs	Low prices, high interoperability, and extensive use of mass-market platforms plus specialist software Lots of new ALTs	High prices for medical ALTs, use of specialised equipment, and interoperability problems remain Relatively little development and take up of new ALTs
2. Supplier responsiveness to the requirements of older and disabled people	Global suppliers focus substantial effort on the ALS market to meet main needs and concerns of older and disabled people	State ALSs delivered using a standardised approach.
3. Digital inclusion of older people	High levels of digital inclusion of older and disabled people	Only modest increases in levels of digital inclusion of older and disabled people
4. Attitudes of older and disabled people to ALSs	Many now play an active role in managing their own well being	Most older and disabled people are a relatively passive group of service users
5. Acceptance of ALTs by the caring professions	High level of acceptance by 2015 drives increased demand	Lack of evidence on their effectiveness holds back acceptance and take-up of ALTs until the early 2020s
6. Incentives for effective state use of ALTs	State institutions restructured to enable effective coordination across social services and NHS care and to align financial incentives for investment with subsequent savings	State institutions remain unchanged
7. Complementarity of private and state ALTs	State and private supply is complementary	State institutions develop ALSs separately from private provision

In addition we have identified a number of high impact, ***low uncertainty*** drivers of change. Common to across all of our scenarios, they are as follows:

- By 2030 the pressure for cost-effective delivery of care to older and disabled people has increased substantially as demand for care has grown while the supply of informal care and funding of formal state care has struggled to match increased demand. As a result, there is strong latent demand for ALSs which can potentially lower the unit costs of providing care to older and disabled people and make life easier for informal carers.

- There is a significant increase in the proportion of funding of health and social care of older people coming from the private sector by 2030.

- The move to ALSs has cut the cost of providing older and disabled people with care, primarily by reducing labour costs. But this greater cost efficiency has also meant that older people have become more isolated from physical contact with others.

- This trend, in turn, has fuelled demand for digital participation services which engage, entertain, stimulate and enable the social lives of older people. In parallel the devices and services used for digital participation services have become much more robust and are easier for older people to use.
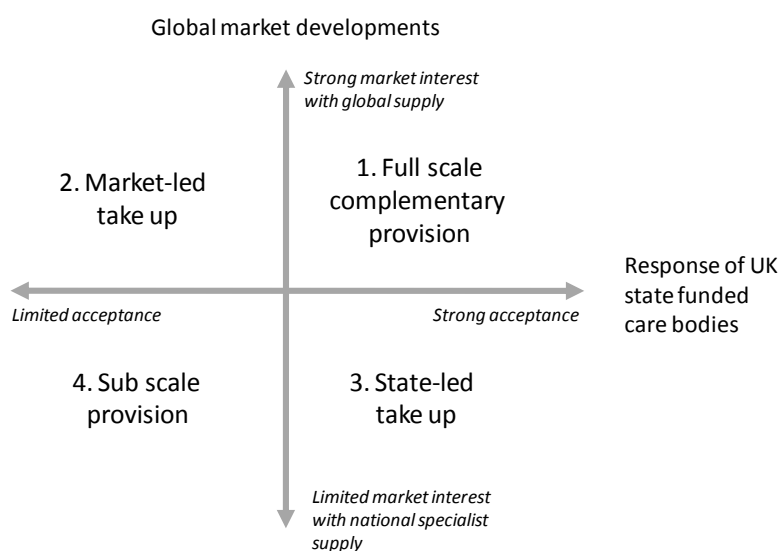
8.3   The four scenarios

The drivers of Table 8.1 can be grouped in two main categories[51]:

- Drivers 1, 2 and 3 reflect global technology and market developments which impact on the take-up of ALSs

- Drivers 5, 6 and 7 reflect the way in which the UK state institutions responsible for the care of older and disabled people react to developments in ALSs.

This classification has a desirable property. While drivers within each group are correlated, the super driver represented by the first group is largely independent of the super driver represented by the second. Plotting these two super drivers on orthogonal axes leads to the scenario dimensions and names shown in Figure 8.2.

Figure 8.2: The four scenarios for ALS take up in the UK in 2030

Based on Figure 8.2 there are four scenarios for detailed development:

- ***Full scale complementary provision*** of ALSs. Under this scenario both market suppliers and state-funded institutions recognise the importance of ALSs early in the 2010s and devote

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[51] Driver 4 does not fit into either of these two groups easily. But we have integrated it into the four scenarios of Figure 8.2

substantial effort to promoting their uptake. Private and state-funded ALSs work in a complementary way using common equipment and shared health care records.

- *Market-led take-up* of ALSs. Private suppliers of equipment and services take the lead in driving take-up of ALSs for much of the next 20 years.

- *State-led take-up* of ALSs. State-funded institutions accept and promote ALSs strongly. Mass-market suppliers focus their efforts on other markets, while specialist suppliers of ALTs continue to sell their equipment and services largely through the state-funded institutions.

- *Sub scale provision* of ALSs. State-funded institutions are slow to accept and roll out ALSs, while market supply remains in the hands of specialists who sell primarily through the state-funded institutions.

We describe the scenarios in detail in the remainder of this chapter.

8.4   *Full scale complementary provision* **in 2030**

Use of ALSs

Older and disabled people now make extensive use of ALSs - both in their own homes and on trips away from home. There is substantial supply by both the private sector and state-funded institutions. Between the two sectors, there is a wide range of device and service options which allow end users and their carers to select the options best suited to them. The devices have been adapted to address accessibility and usability concerns and generally require minimal training for use.

Those with serious medical conditions, such as COPD, heart failure and diabetes, are able to use telehealth services to monitor their condition at home without needing to make frequent and often arduous trips to health clinics. Continuous monitoring allows doctors to detect problems quickly and accurately and to take remedial actions early - often preventing the need to stay in a hospital or allowing earlier discharge.

Those who are frail or who suffer from cognitive or physical impairments use a wide range of telecare services. These involve monitoring of their activities and home environments, using artificial intelligence software to interpret the monitored data, and intervening when something goes wrong. As a result they are able to remain at home longer, rather than needing to live in residential care homes. Video monitoring is used in emergencies but not on a routine basis. Older people have rejected such services as unacceptable intrusions on their privacy. However, they are happy to use telecare and telehealth services because they recognise that these services:

- Enable them to remain in their own home where they feel comfortable.

- Give their informal carers greater peace of mind.

Many older people now play a central role in monitoring their own medical conditions and well-being. They have access to their own care records and can use software to interpret the data and tell them how they are doing - both over time and in comparison to others with similar conditions. Many of them use ALSs to ensure they take their medicines on time and to maintain as much physical fitness as possible.

Nearly all of them now make extensive use of digital participation services of one form or another. These provide a more stimulating and social experience than the passive television viewing which played such a central role in the lives of most older people back in 2010. For example:

- Some use these services to help them organise their social lives outside the home. Digital participation services are especially popular within local communities as a way of organising skill swaps in which older people supply one skill in return for another. Such exchanges allow older people to continue to contribute to their communities while promoting social interaction

- Others, who have limited mobility, rely on digital participation services to maintain their social lives - through video calls with friends and family, and through social networking sites where they share interests, memories and photos with others in a similar situation.

- Some are deeply involved in educational programmes delivered online and others have become serious and competitive online games players. (With their consent, outputs from their performance in playing these games also form a valuable input to telecare and telehealth services).

- All appreciate the much wider range of entertainment services which broadband Internet now offers when compared with broadcast television.

These digital participation services require broadband, which is now widely used by older people for Internet access. Digital inclusion initiatives have demonstrated the relevance of broadband Internet and given older people the skills and confidence to use it. But some older and disabled people can't afford such connections so the government now subsidises anyone in need of telehealth and/or telecare services through a voucher scheme, which pays for their broadband connection. Some older people also take advantage of these tools to telework or to volunteer from home, particularly if they have limited mobility and/or wealth.

The use of telecare services has helped to increase the *availability of informal carers*. The functionality which these services now offer, where alarms are sent immediately to their mobile devices, has increased the peace of mind of informal carers and given them much greater flexibility in how they provide care. This means that the role is a less daunting one and more people are inclined to accept it. The *quality of life of informal carers* has also been improved by the increased take-up and use of ALTs. They now have more time for social visits with the older person and for themselves. Many now telework, which provides the flexibility they need to care for the older person while maintaining an income. Carers are helped by separate support provided when the user signs up for any telecare or telehealth service. This support includes financial advice, guidance in selecting the appropriate ALTs, training in using ALTs, and technical support for any equipment failure.

ALT equipment is now cheap, unobtrusive and easy to install, using wireless links to a home hub. The overall cost of equipping a home for the average user is under £200 and sensors last five years before batteries need to be replaced. Telehealth sensors are worn or implanted and linked to a mobile device wirelessly using a body area network. The mobile device can then transmit to a home hub or, if the user is outside the home, over a cellular mobile network.

The supply of ALSs

ALSs now constitute a very substantial global market – for equipment suppliers, for software developers and for service providers.

Medical regulators around the world have gradually developed a set of accelerated approval processes for telehealth devices, while equipment suppliers have developed open standards which allow ALT equipment from different suppliers to interoperate. This has generated global markets for ALT equipment with substantial economies of scale. In conjunction with improvements in the price performance of electronic components, which have followed Moore's Law, ALT sensors are now very cheap – with entry level prices at well under £10 each.

Recognising this potential, global suppliers have encouraged use of their mass-market devices in the provision of ALSs. As well as marketing to end users to raise awareness of the potential of ALSs, they have provided interfaces to their devices which allow specialist suppliers to connect sensors and develop specific applications software for ALSs. So the market for ALT equipment has moved, from one dominated by national specialist suppliers of hardware, to one in which global suppliers provide devices and sensors while specialist companies provide the software needed to support a wide range of ALSs.

A substantial growth in private funding of care has encouraged the development of competitive private supply of ALSs. This has encouraged innovation in, and the development of a wide range of ALT equipment, and older and disabled people now have a wide choice of services from providers who meet a high proportion of their needs.

The role of state-funded institutions

The NHS and local authority social services departments now play a major role, alongside the private sector, in providing telecare and telehealth services to older and disabled people. In contrast, digital participation and teleworking services are almost entirely provided by the private sector.

State-funded institutions began to offer telehealth and telecare services nationwide following the success of the Whole System Demonstrators in 2012. Following these controlled trials, the medical profession recognised the value of telehealth services in terms of both better clinical outcomes and greater cost efficiency. This recognition led to a number of developments:

- Training in the use of telecare and telehealth technologies was incorporated into health and social care training in 2015.

- State financing for home care of older people was restructured to create greater incentives for investment in ALSs - by directing the savings from ALSs to those who invested in them.

- Common equipment standards were introduced. These enable the same equipment to be used by NHS, social services and privately funded care teams.

- Common care records were developed for access and use by both service users and service providers - whether from NHS, social services or private care teams.

- Care coordinators, responsible for assessing and coordinating care of older people with a complex mix of medical and social care needs, rapidly became more important.

As a result of these changes, the private and state sectors now work in a complementary way to deliver telecare and telehealth services to older and disabled people. The state sector provides adequate services. But some people buy direct from the market for greater choice. Others, whose health has not deteriorated enough to qualify for state provision, have found ALSs useful and also go directly to the market.

8.5   *Market-Led Take-up* **of ALSs in 2030**

A strong global market for ALSs

The global market for ALSs is now very substantial. Market conditions are similar to those of the *Full Complementary Provision* scenario in which:

- A move to global medical regulation has created a global market for health equipment, major economies of scale, and lower equipment prices.

- Open standards have led to interoperability of ALT equipment and strong competition between suppliers.

- Global device manufacturers have strong interest in ALSs, as they are keen to expand the markets for their products and prepared to devote significant marketing spend to stimulate this market.

- There is a move from national markets for ALT equipment, dominated by specialist hardware-oriented suppliers, to a global market for hardware[52] and a separate market for specialist software to run on this hardware. Such software provides ALS applications which are tailored to the diverse needs of older and disabled people at relatively low cost.

In the UK these developments have led to a flourishing private market for ALT equipment and services. But the role of the state has been limited.

The limited role of state-financed institutions

The NHS and local authority social services departments have, until recently, taken a cautious approach to the deployment of ALSs. There is a combination of reasons for this:

- The Whole System Demonstrators produced ambiguous results when findings were published in 2012. As a result many care and medical professionals remained resistant to using ALSs, and training in their use was virtually non-existent.

- Over the past 20 years, state-funded carers have been under enormous pressure to meet rising demand for care under limited budgets. As a consequence, it has been difficult to find either the capital expenditure or the expertise for an effective nationwide rollout of ALSs.

- The separation of local authorities and NHS budgets for the care of older people remained until very recently. So, while local authorities' investments in telecare led to significant savings overall, much of these savings were enjoyed by the PCT rather than by those who made the investment. This misalignment of investment incentives reduced local authorities' investment in ALSs.

- There were three well-publicised cases where the avoidable deaths of older people at home were linked to their use of ALSs. This led policymakers to adopt an even more cautious approach to state use of these services.

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[52] Devices, hubs, sensors

This policy of cautious deployment changed in 2021 because of:

- Growing public pressure for state-funded ALSs. Many potential service users and their families could see the benefits of ALSs in the private sector and wanted the same services available with state funding.

- The success of ALSs in other parts of the developed world.

- The findings of fresh controlled trials of ALSs, made using new equipment and procedures. This showed a substantial improvement in outcomes at lower costs.

Now, in 2030, the state care sector has just completed a comprehensive nationwide rollout of ALSs. But it still has some way to go to catch up with provision in other developed countries.

Use of ALSs

As a result of the state-financed institutions' more limited role in their delivery, older and disabled people make more restricted use of ALSs under this scenario than under the *Full Complementary Provision* scenario. Specifically:

- Almost all older and disabled people make extensive use of digital participation services for their entertainment and education, and to enrich their social lives. Following the success of digital inclusion initiatives in the early 2010s, nearly all of them now use broadband Internet connections for this purpose.

- Most use privately-supplied telecare services. Cheap ALTs have made it possible for almost all informal carers to install this equipment in the homes of those for whom they care. There is also a flourishing market, stimulated by the growing proportion of privately-financed care, of private telecare services based on ALT equipment. These are available to wealthier older people and their families - but not to those with limited incomes

- Many older and disabled people use wellness services as part of a general move by the population to take more control over their own health and well-being. Such services are both affordable for most individuals and free from strict medical regulation.

- Until recently, only wealthy older people used telehealth services. The market for such services was restricted by the fact that service users had to pay, not just for the ALT equipment, but also for the medical care delivered using ALTs.

- To overcome this problem, some older people used offshore telehealth services in which ALT-generated information was sent to telehealth centres in India for interpretation and intervention. UK medical authorities recently banned such services as unsafe and inefficient[53].

Now, following the change of policy towards ALSs by the state care sector in 2021, we have seen rapid take-up of telehealth services by older and disabled people in all income groups.

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[53] On the grounds that it is difficult for a telehealth diagnosis from India to be treated, other than in the UK.

8.6   *State-Led take-up* **of ALSs in 2030**

A limited, national, market for ALSs

Under this scenario the global market for ALSs has developed to a more limited extent than in the two previous scenarios. Three main factors have limited market developments:

- Medical regulation has remained national in character. This means that markets for telehealth equipment and services are national rather than global, economies of scale are lower and prices are higher

- Interoperability problems have proved more difficult to resolve than expected - partly because of conflicts between major suppliers and partly because of unanticipated technical difficulties.

- Global device suppliers have focused on mass-market platforms for younger people and have not attempted to grow the ALS market

- Private service providers, such as the medical insurance companies, found that the payback periods on investments in ALTs were too long for their shareholders. The state took a longer term view.

At the same time, extensive state provision of ALSs, as set out below, has limited the size of the market for privately supplied services and created a small number of powerful state buyers of ALSs and ALTs. This, together with requirements by state-funded institutes for controlled trials before deploying new ALSs, has limited the pace of innovation. As a result, there has been only modest additional deployment of new ALTs over the past 20 years. One of the only significant developments has been that alarm-based telehealth and telecare applications have been replaced by systems which involve more continuous monitoring.

Most suppliers of ALSs remain national specialists who sell most of their equipment and services via the state-funded institutions. The private market for ALSs suffers from the fact that state-funded telehealth and telecare services only use equipment which meets certain strict standards. This excludes much of the cheaper ALT equipment sold on the commercial market.

The price of ALT equipment has declined steadily over the past 20 years, but the national nature of the markets and their more modest scale, when compared with other scenarios, mean that the average price for equipping a home is still over £500.

The central role of state-funded institutions

The NHS and local authority social services departments embraced the idea of telecare and telehealth services following the success of the Whole System Demonstrators in 2012. This led to the acceptance of ALSs by the caring professions, the rapid introduction of training, and other measures to promote take-up of ALSs within the state care sector. ALSs are now widely used for the care of older people in their own homes.

Use of ALSs

Older and disabled people make extensive use of telecare and telehealth services. Most use services provided by the state, while only relatively wealthy older people use privately-provided services. Unfortunately digital participation services are still some way from universal. Digital inclusion initiatives in the 2010s were only partially successful - eventually raising the proportion of over 65s with broadband Internet from 30% to 75%. This leaves 25% of older people - mostly those on the lowest incomes and with the poorest education - unconnected.

This group of older people has suffered increased loneliness as a result of the move to ALSs. They receive telecare and telehealth services which ensure excellent physical care. But these services offer substantially less face-to-face contact with carers than the services they replace. This means that this group of older people are often more isolated. At the same time they do not have access to the digital participation services which would alleviate their loneliness.

8.7   *Sub-scale provision* **of ALSs in 2030**

The supply of ALSs

Under this scenario the provision of ALTs and ALSs is limited. A combination of medical regulation, interoperability problems and supplier assessments that technology markets for the over 65s are limited[54], have led to:

- A national, rather than global, market for ALSs, supplied by relatively small-scale, specialist, firms
- Relatively high equipment prices and limited innovation.

In addition, the state-funded institutions and the caring professions have been slow to adopt ALSs, as described in the *Market-led take-up* scenario.

The use of ALSs

This restricted supply means that older and disabled people make only limited use of ALTs and ALSs. At the same time providers using traditional forms of formal care have found it impossible to keep pace with rising demand, while the number of informal carers is inadequate to meet demand. As a result, older and disabled people have seen a significant reduction in the standard of care they receive when compared with that available at the turn of the Millennium.

8.8   **Comparison of the four scenarios**

Table 8.2 compares the four scenarios on a number of key measures.

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[54]   ,As discussed in Section 7.1

Table 8.2: The four scenarios compared

Scenario	1. Full scale complementary	2. Market-led take-up	3. State-led take-up	4. Sub scale provision
Global or national markets for ALT equipment?	Global	Global	National	National
Price of ALT equipment	Low	Low	Medium	High
High level of innovation?	Yes	Yes	No	No
Supplier of digital participation services -- state funded or private?	Private	Private	Private	Private
Level of use of digital participation services	Full	High	Moderate	Moderate
The scale of private supply of tele-health and telecare	Extensive	Extensive tele-care	Moderate	Moderate
Scale of state-funded supply of tele-health and telecare	Extensive	Moderate	Extensive	Moderate
Relationship between state-funded and private supply	Complementary	Complementary	Separate	Separate

It is clear that Scenario 1 is the most demanding in terms of networking and spectrum requirements. It also appears to be the most desirable from a social and economic perspective, while Scenario 4 is the least desirable.

9 Standards and networking

9.1 Introduction

In this penultimate chapter we consider the technological developments which are required to enable the most demanding of our four scenarios - the *Full-scale Complementary Provision* scenario - to be realised. We consider:

- The prospects for the development of global standards which will enable interoperability of ALT equipment from different suppliers. Such interoperability is important – both to realise global economies of scale in the production of equipment and to give end users and their carers confidence that ALTs will work simply and seamlessly together

- The impact of medical regulation on the market for ALT equipment. In an ideal world, a single authority which approved ALT equipment for global use would promote the greatest economies of scale and the fastest pace of innovation. But this is not a realistic possibility

- The demands which ALSs place on the networks required to carry information between sensors, gateways and remote servers. Some applications are safety critical and put special demands on the networks which carry them

- Whether there is likely to be a requirement for additional spectrum for use by ALTs.

9.2 The development of global standards

In order for ALTs to interoperate, there are requirements regarding both *applications standards*, which cover the top three layers of the ISO seven layer stack, and *networking standards*, to cover the bottom four layers.

In terms of applications standards, important candidates include:

- IEEE11073

- Health Layer 7 (HL7)

- DICOM & PICS. These are image protocols for high resolution pictures which are mainly used for telemedicine.

In terms of networking standards, there is a wide range of candidates for both wired and wireless transport services. These are listed in Table 9.1.

The Continua Health Alliance (CHA)[55] is now working to select standards with specific profiles which offer minimal processing, memory and power consumption footprints and which will allow the development of commercially attractive ALTs for telecare and telehealth. The focus of the CHA is on applications standards. But the CHA has also selected preferred networking standards - Bluetooth for local and body area wireless networks and USB for wired local area networks.

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[55] A standards development body with over 200 members worldwide. Many are major consumer electronics and network equipment suppliers. Others are specialist care equipment suppliers

CHA members, who make up a high proportion of the world's potential ALTs suppliers, hope in this way to develop practicable and robust standards which will enable global plug and play interoperability between equipment over the next few years. See Annex H for more details.

Table 9.1: Possible networking standards for ALS

Network type	Wired standard	Wireless standard
Body Area Networks (BAN)[56]	Used between on-body devices and their controller (proprietary?)	ZigBee, Low Power Bluetooth and potentially others mentioned under the LAN category if they can be adapted sufficiently to minimise power consumption to an acceptable level
Local Area Networks (LAN)	Ethernet cabling, HomePlug/Powerline, USB	DECT, Wi-Fi (2.4 GHz / 5 GHz) - 802.11 family, ZigBee (802.15.4), Bluetooth (802.15.1) – new higher rate "Wi-Fi" at 60 GHz (currently three variants), Z-Wave, EnOcean, Wavenis
Metropolitan / Wide Area Networks (MAN/WAN)	POTS, Broadband (ADSL, cable etc)	Cellular (2G to 4G)

9.3   The impact of medical regulation

Medical regulation of telehealth ALTs is required to ensure that they are safe for their users. See Annex I for more details. In Europe, the process for implementing such regulation is specified in two Medical Device Directives:

- The Medical Devices Directive 93/42/EEC (MDD). This covers general medical devices such as first aid bandages, X-ray machines, and ECG machines.

- The Active Implantable Medical Devices Directive 90/385/EEC (AIMDD). This covers devices which are active and implantable in a patient. e.g. a heart pacemaker, bladder stimulator etc

These directives define four main classes of device:

- Class I: Non-invasive medical devices.

- Class IIa: Surgically invasive devices intended for transient or short term use.

- Class IIb: Implantable devices and long-term surgically invasive devices

- Class III: Devices which contain a drug delivery or action element

The majority of telehealth ALTs, used to monitor chronic conditions, fall into Class I. Others may be subject to stricter regulation. So a pacemaker with built-in mobile communications will fall into Class II, while an artificial pancreas, which both monitors blood sugar levels and administers insulin, will fall into Class III.

Medical regulation has three impacts on the take-up of ALTs:

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[56] In this context sometimes called Body Area Networks (BAN) or Human Area Networks (HAN). Acronym confusion reigns as Continua uses PAN to signify a Peripheral Area Network which is the same in terms of meaning but others use HAN to signify Home Area Network (HAN) which is more like a LAN and therefore not the same thing.

- National medical regulation, which varies significantly from country to country, and which requires onerous testing in each country, raises the cost of supply, reduces the pace of innovation and reduces economies of scale in production. We should not expect the rigour of medical regulation to be relaxed. But it might be possible to develop common standards of regulation and to accelerate the approval processes in most countries once approval has been generated in key jurisdictions

- There are inconsistencies between the medical device directives and the EU's RTTE Directive[57].. A number of stakeholders told us that these inconsistencies raise the costs and increase the time required to receive approval for ALT equipment.

- Medical regulation might specify minimum networking requirements, in terms of reliability and freedom from interference. These could have a significant impact on the commercial viability of ALTs. Such specifications will vary with the application. For example:

  - A blood pressure monitor is not a critical device so any convenient physical and transport layer standard, such as Bluetooth, would be suitable

  - A morphine syringe pump or heart pacemaker requires more predictable and controlled communications and hence might require defined, interference-free, radio spectrum with a suitable set of transport layer standards.

We consider this last impact in more detail below.

9.4　Networking requirements - an overall architecture

We have analysed the networking requirements of the ALTs and ALSs identified in Chapter 3. See Annex K for details. We conclude that the single general network architecture shown in Figure 9.1 would support all of them.

The following features of Figure 9.1 are worth noting:

- Wired connections are represented by solid lines[58], and wireless connections are represented in a general sense by dotted arrows.

- The left hand side of the diagram represents both wired and wireless public networks, and both local area (WiFi hotspots) and wide area.

- The upper right hand side of the diagram represents a home network with a gateway supporting a number of devices both fixed and mobile.

- The lower right hand side of the diagram represents the case where the mobile device is a person who in turn is carrying a body area network.

- The body area network will need to interface to both the home network and public networks.

- The fixed devices in the home network could be hard wired but this is not shown in the diagram.

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[57]　Radio and Telecommunications Terminal Equipment Directive 95/5/EC

[58] This has also been used for public network backhaul even though microwave links are used but this aspect is outside the scope of this study.

- The home network is based on a wireless gateway (i.e. router and wireless access point combination) with one or more associated wireless access points supporting wireless connections to devices around the home. These connections may run directly from device to gateway or through host devices, repeaters or associated access points, or via a mesh network.

- Access points might be needed if different wireless technologies are used within the home. These can either be separate from the home gateway (and connected by wire or wireless to the home gateway) or be integrated in the home gateway.

- The body area network is a smaller (in area) version of the home network in terms of architecture (i.e. devices are connected wirelessly to a gateway which then has an interface to another network). This gateway architecture has the advantage that the body area network, for example, should be able to interface to networks in other locations (e.g. GP's surgery, hospital, ambulance).

Figure 9.1: A general network architecture to support ALT based applications
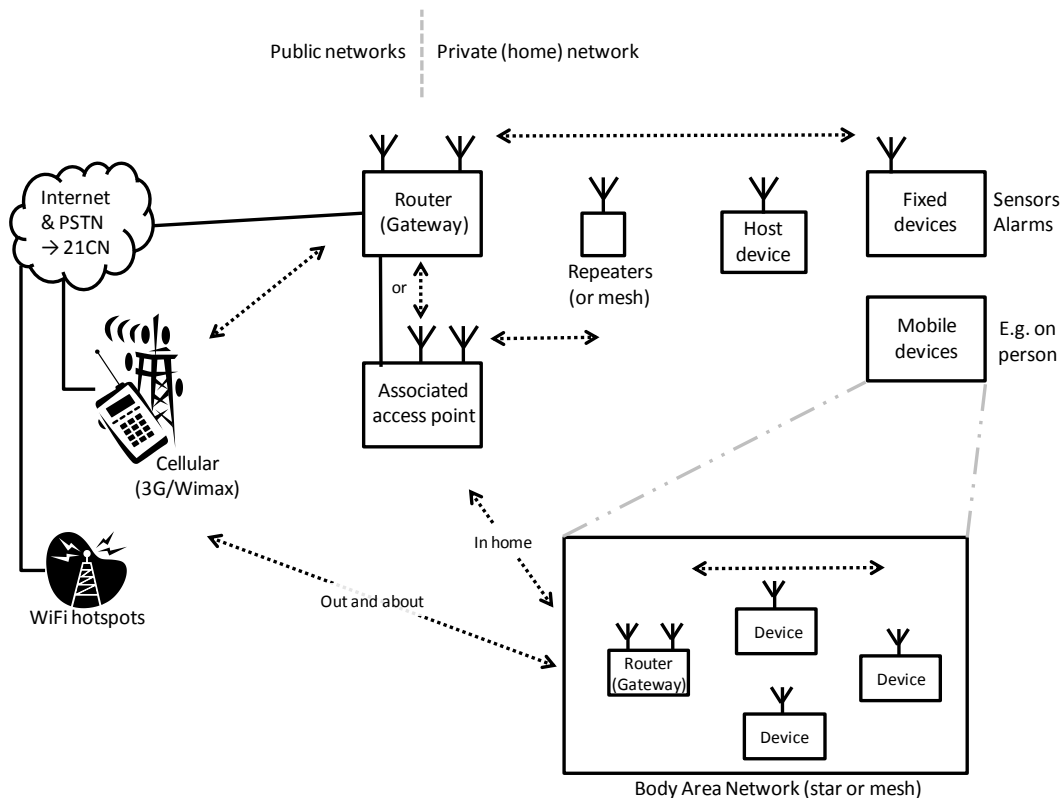
Some stakeholders have suggested that industry should try to develop integrated home hubs which combine the functions of the router and access points for smart metering, entertainment, smart home and the various ALSs. Our view is that:

- The costs of coordinating such integration and the consequent delays in developing appropriate equipment are likely to be very substantial

- It is better to let market players develop separate hubs which are optimised for each of these applications separately, but which can all connect to a single router for wide area networking

- In the long term, when the various home hub applications are all well established, it might then make sense for suppliers to produce integrated hubs.

9.5   Networking requirements - implementation considerations

In implementing the architecture of Figure 9.1 there is a need to ensure that:

- The body, local and wide area networks all provide an appropriate level of service in terms of bandwidth and network reliability. This varies with the ALT application under consideration

- There is continuity of power for these three types of network to support safety critical applications

- There is appropriate security in the networks - both to ensure the confidentiality of the data carried and to prevent unauthorised access to gateways and servers.

We consider each of these requirements below and provide more detailed analysis in Annex J.

Service levels for body area networks

Body area networks, which are likely to use wireless rather than wired links[59], regularly transfer small amounts of data generated by sensors on the body. In the short term such equipment is likely to be classified as a Class I device and low power standards, such as Bluetooth and ZigBee, which operate in non-specific licence-exempt bands at 2.4 GHz and 868 MHz, are suitable. In the longer term, as medical care moves from the hospital to the home, we can expect that the body area networks will start to support devices that are not simply sensors on the body, but include implantable/surgically invasive devices and/or drug delivery devices. Such devices have a higher medical device class categorisation and require more robust communications links to comply with medical regulations.

This probably means a requirement for dedicated spectrum. It is not yet clear whether the existing spectrum allocations at 401 to 406 MHz will be sufficient or whether a new band will be required. The FCC is currently looking at the possibility of setting aside additional dedicated spectrum in the 2 GHz and/or 5 GHz bands.

If required, it is unlikely that such spectrum will be needed in the near term, since its primary application, to support Class II and Class III medical devices in the home, is still some way off. If and when such spectrum is required, it will be important to harmonise frequencies with spectrum allocations elsewhere in the world, so as to create global markets for the devices concerned. This suggests the need to follow FCC initiatives on the possible allocation of additional spectrum for telehealth application in the US closely.

Service levels for home local area networks

Local area networks may use a mix of wired and wireless technology. Except for new builds, wireless networks are more likely to be used for reasons of aesthetics and of minimising installation costs.

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[59] There are other possible body area transmission links. For example one supplier has developed a **human area network** technology which, it claims, allows duplex communications over the body at speeds of up to 10 Mbps using the electrical fields which exist on the surface of the human body (http://www.redtacton.com/en/index.html). But this transmission works only while a person holds a transceiver. As such it may not be especially suitable for vital signs monitoring

Whereas the communications links associated with a body area network will only need to support the regular transfer of small amounts of data, the demands of ALTs on the home network will be much greater. The home network will not only have to carry data from the gateway of a body area network and the relatively low amounts of data from sensors around the home, but it will also have to support video in various flavours, especially for digital participation services. The most demanding of the video applications will be real-time video interaction with friends, relatives, carers or clinicians at remote sites.

For many ALT-based applications including high bandwidth video applications, mainstream services, such as those which use WiFi, should offer adequate network reliability and bandwidth. But in the case of safety critical telehealth applications there may be a requirement for the allocation of specific new spectrum bands. Without such dedicated spectrum the medical regulatory authorities may determine that wireless based equipment supporting critical applications do not provide the predictable and controlled environment needed by the higher classes of medical device.

There are precedents for allocating dedicated spectrum for such purposes:

- In the EU, licence-exempt spectrum (near 170 and 870 MHz) for the sole use of social alarms has been set aside for this purpose for many years. While this allocation does not relate to medical devices as classified by European Directives, it does show a recognition that certain critical ALT-based applications also need more reliable communications links than those offered by shared licence-exempt spectrum.

- In the US, the FCC has made special provision for the Wireless Medical Telemetry Service (WMTS)[60]. However, these are only available for use in *clinical establishments* and not for use in *the home*.

Again the need for such spectrum is some way off and, if it is needed, international harmonisation will be important.

Service levels for wide area networks

For the wide area part of their transport, ALSs will rely on public fixed and mobile networks. The functionality required to support ALTs in the home and on the person when out and about will in general be provided by these networks as a matter of course during their continuing development. At the same time we note that most of the networking demands of telehealth, telecare and digital participation services are no more onerous than the demands of other sectors. We therefore conclude that, in terms of the *sizing* of public networks, ALTs will not be a major driver of additional demand.

The *reliability* of public networks for ALSs is however an important issue. For the critical applications, current best efforts public broadband networks (whether fixed or mobile) do not offer sufficiently high standards of performance.

Over the next 20 years, the main public network platforms - both fixed and mobile - will move from circuit switched to IP networks and the reliability/availability of these networks will need to improve significantly (to or close to current standards for POTS) if they are to be acceptable for telecommunications applications generally. The precise reliability/availability of public IP networks in the long term is as yet ill-defined.

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[60] Which uses the bands 608 to 614 MHz, 1395 to 1400 MHz and 1427 to 1432 MHz

It is unlikely that the functionality of the public IP network platforms will be influenced significantly by the networking requirements of ALT-based applications. It is more reasonable to assume that the functionality of ALT-based services will be constrained by the network functionality of the public IP network platforms and that ALT-based systems will be designed to minimise these constraints.

For example constraints might be minimised by ensuring that:

- The medical regulations governing ALSs are set in a way which balances the value of ALT-based systems against the risks of network failure in a transparent and proportionate way

- ALT-based systems have two or more wide area network paths to maximise network availability, e.g. one fixed network connection and the ability to use any mobile network offering coverage in the area of use

- ALT-based systems can use any priority packet services which emerge

- ALT-based systems can operate for periods of time in local mode without endangering life (e.g. when monitoring vital signs and administering drugs)

Note should be taken of the FCC's current investigation into broadband supporting the healthcare ecosystem which includes the home.

Legacy systems such as telecare alarms often use tone/frequency based modems to transmit information over the PSTN. To operate successfully, such modems require a continuous audio path with stable characteristics such as those of a circuit switched network. Packet-based networks will also support voice channels and these channels will be optimised for voice[61]. The characteristics of such networks, in combination with the techniques used to make them suitable for voice telephony, cause significant problems for tone/frequency based modems. The modems might even stop working as they reject other non-voice sounds or present an unclean on/off path when modem signals start and stop. So, as packet-based networks start to predominate:

- There is a population of legacy devices that will have to be replaced.

- New devices should take account of the characteristics of packet based systems if new devices are not to suffer the same fate.

Continuity of power

Many of the transport services which will be used for ALSs will rely on mains and/or battery power. For some applications failure of the power supply is not important; for others it could be critical. In the past, end users have often relied on the self-powered PSTN - which has its own backup sources of power. This will not be an option in 20 years time. So it will be important to set appropriate standards for continuity of power supply for ALT equipment. These standards will need to provide users of ALSs with the appropriate levels of reliability to the application without raising equipment costs unnecessarily.

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[61] In terms of buffering, silence suppression and quality of service in order to ameliorate network characteristics such as delay, delay variation (jitter) and packet loss

Security

Security is also important - especially when using wireless networks. There is a requirement to ensure **data security** to address user concerns about confidentiality of care data and **network security** to protect networks from unauthorised access. There are adequate technical solutions available to provide such security. But there are also concerns that the limited level of expertise available to individual ALS users and their care providers will lead to poor implementation and security breaches. Set against this concern we must ask what an unauthorised person with access to patient data would gain. In the US, there are strong incentives for medical insurance companies to acquire healthcare data for financial purposes so that they can adjust insurance premiums accordingly. There is also regulation to constrain access to such data - the Healthcare Information Portability and Accountability Act or HIPAA. In the UK, where private health care is limited to 10% of the market, incentives are much weaker. As a result the need for security may be less demanding. We can also reasonably rely on global suppliers of ALT-equipment, for whom the US is an important market, to have developed products which incorporate adequate levels of security.

10 Enabling take-up of assisted living services

10.1 Introduction

In this final chapter we list measures which might be taken to remove barriers to realising the most demanding and desirable of our four scenarios - the *Full-Scale Complementary Provision* scenario.

It is possible that ALSs will prove to be of only limited value over the next 20 years and that the measures set out in this chapter are redundant. But this is unlikely. All our analysis, and all the many stakeholders to whom we talked, agree that demand for ALSs is likely to grow substantially over this period.

We have grouped the measures under four main headings:

- Measures which address the needs of older and disabled people

- Issues of availability, awareness, accessibility and affordability

- Networking and standards issues

- Issues relating to state funded institutions

In many cases it is not yet clear which of these measures are most important or who should be responsible for them. So we have deliberately not specified responsibilities or priorities.

10.2 Addressing the needs of older and disabled people

Measure 1.1: provide older and disabled people with the information they need to make an informed choice as to whether or not they will use telecare and telehealth services, and if so in what form and to what extent. Such information is required if older and disabled people are to have genuine choice, a sense of ownership and control over ALSs, and a real sense of the benefits they can bring. This should minimise the probability that they will reject such services on the basis of unfounded fears, concerns and prejudices. The need for unbiased advice, which takes account of the individual needs of potential users, suggests that **independent advisors** might play a valuable role in ensuring effective take-up of ALSs.

Measures 1.2: provide ALSs which can be personalised to the specific needs of older and disabled people. For this to be possible at costs which make them viable, software implementation of ALSs on mass-market hardware may be required. Such a development has an added advantage. Users are unlikely to see such equipment as stigmatising them as ill and/or disabled. But realisation of such a development requires standards and changes to medical regulation which are covered later in this chapter.

Measure 1.3: develop an ethical framework and code of practice which telehealth and telecare providers then follow on how ALSs will be implemented and how the data collected by ALSs will be used. Such a code should give potential users confidence that their privacy will be respected.

Measure 1.4: ensure that anyone who is using telecare and/or telehealth services has access to digital participation services. This might mean subsidy of equipment, broadband connections, and appropriate training for use of digital participation services. It is likely that the introduction of telecare and telehealth services will lead to fewer home visits and could increase the risk of isolation. Access to

digital participation services is one important way to compensate for such effects and to introduce new opportunities for enhanced social interaction.

Measure 1.5: educate and train those involved in introducing older and disabled people to telecare services to balance the needs of service users and informal carers. These needs are sometimes in conflict. In particular it may be useful to define what constitutes *acceptable levels of risk* to help resolve tensions between users and their informal carers. There is a wealth of knowledge and experience among professional practitioners engaged in supporting people with learning difficulties which could transfer appropriately in a number of respects – especially in relation to the concept of acceptable risk.

Measure 1.6: raise awareness of how ALSs can help older and disabled people live independently at home through appropriate social marketing campaigns. Such approaches might involve one-stop information centres and/or other, more local, channels such as community centres, libraries, and doctors surgeries to reach those isolated by disability, geography, or language. Interactive theatre, discussions with enthusiastic users, case studies (e.g. supported by video) of effective and successful use, are proven ways of promoting awareness of the opportunities offered by ICTs. Stakeholder organisations, such as Age Concern, could have an important role to play here.

Measure 1.7: design telehealth and telecare services which maximise the participation of older and disabled people in managing their own well-being. Such services are likely to minimise the dropout rate.

10.3   Measures for availability, awareness, accessibility and affordability

Measure 2.1: ensure that current government initiatives to promote digital inclusion are appropriately oriented towards older people. In particular it is important to raise awareness of the relevance of the Internet to older people[62], given that:

- Older people are the largest group which is currently digitally excluded

- On current trends it will take far longer to raise the digital inclusion of older people to 90% than for any other substantial group in the UK population

- Digital inclusion creates opportunities for access to digital participation services which could substantially enrich the home lives of many older people.

Measure 2.2: ensure that basic broadband is made available in rural areas as soon as possible. The government's Universal Service Commitment should result in 98% population coverage at broadband download speeds of 2Mbps or more by 2012. But the remaining 2% is also important. Many older people live in remote rural areas where care services are limited because of this remoteness. ALSs have the potential to significantly improve care in these rural areas, but broadband connections will be of growing importance to support these services.

Measure 2.3: assess the case for demand-side subsidies, for example through a voucher scheme, to ensure that broadband services are affordable for all older and disabled people on low incomes. Initially such a scheme might be restricted to those requiring telecare and telehealth services. But, if demand for digital participation services is strong, it may be appropriate to extend these subsidies to

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[62] For example through Ofcom's current social marketing campaign

all older and disabled people on low incomes. Subsidies might be required for both fixed broadband (e.g. to enable video services in the home) and for mobile broadband (e.g. to enable telecare and telehealth services on the move).

Measure 2.4: provide older and disabled people with appropriate training in digital literacy so that they can access digital participation services. Traditional high cost digital literacy training in the use of PCs and browsers may not be appropriate in future. New approaches, which take advantage of the recent market developments set out in Section 6.4, may be more cost-effective in the long run.

Measure 2.5: provide older and disabled people with appropriate support to which they can turn when they encounter problems in using ALSs (and especially digital participation services). The best form of this support might vary. For some service users it might be a telephone helpline designed specifically for older people. In other cases it might be more cost-effective to train carers to provide basic support, especially as the nature of digital participation services changes and access becomes simpler and more intuitive. Manufacturers, software developers, local authorities, third sector organisations, etc. all have a role to play in providing support.

Measure 2.6: encourage mass-market manufacturers to provide more and better accessibility functions so that devices can be used by those with visual, aural, mobility and motor skill impairments. Market mechanisms have led to substantial progress in this area over the last few years. But public bodies might use their procurement power to encourage further progress. For example, they might indicate that accessibility functionality on devices will be a factor in making procurement decisions. It is important not to be too prescriptive here. To do so might inhibit innovation by suppliers and raise the cost of mass-market devices to public bodies.

Measures 2.7: review advertising rules[63] which might restrict market players from raising awareness of ALSs among older and disabled people. Such awareness is important in creating market demand for ALSs and the current rules were put in place without considering their impact on ALS advertisements. A review might lead to a relaxation of rules in some areas. But it might also lead to tighter regulation in others. For example there may be a need to restrict advertising and promotion of Internet-based ALSs located in lower cost countries such as India, where ALTs will not be bound by the same regulation as in the UK.

10.4   Networking and standards issues

Measure 3.1: develop global networking and applications layer standards to enable interoperability of ALT equipment. Such standards are required if we are to see the development of global markets, with global economies of scale and low prices for equipment. The Continua Health Alliance is the industry body which has taken the lead in such activities and appears to have widespread support.

Measure 3.2: consider how best to get common global regulation of medical devices. Such regulation is important to protect the well-being of those who use telehealth services. But it should be possible to align regulation more across major markets and to seek accelerated approval of a device already approved in leading jurisdictions. Such moves would help with the development of global markets for telehealth equipment.

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[63] Such as those contained in the EU's Audio-Visual Media Services (AVMS) Directive

Measure 3.3: remove the inconsistencies within the EU between the requirements of the Medical Devices Directives and the RTTE Directive. Such inconsistencies currently hamper the pace of innovation in, and raise the costs of producing, medical devices for EU markets.

Measure 3.4: monitor the reliability and availability of public IP networks which replace the PSTN over the next decade. It is unlikely that the functionality of the public IP network platforms will be influenced significantly by the networking requirements of ALT based applications. It is more reasonable to assume that the functionality of ALSs will be constrained by the network functionality of the public IP network platforms and that ALT-based systems will be designed to minimise these constraints.

Measure 3.5: set the medical regulations which govern telehealth services in a manner which balances the value of these services against the risks of network failure in a transparent and proportionate way. The key here may be to set the right standard of acceptable risk. One obvious benchmark is to ask whether a telehealth service reduces risk when compared with traditional forms of health care, rather than to demand network reliability standards which, while offering very low risks to users, make an ALS impossible to provide because it requires levels of network reliability which public networks cannot meet.

Measure 3.6: take steps to minimise the constraints identified in Measure 2.4 in other ways - perhaps by ensuring that:

- ALT-based systems have two or more wide area network paths to maximise network availability e.g. one fixed network connection and the ability to use any mobile network offering coverage in the area of use

- ALT-based systems can use any priority packet services which emerge

- ALT-based systems can operate for periods of time in local mode without endangering life (e.g. when monitoring vital signs and administering drugs)

Measure 3.7: consider the need for additional dedicated licence-exempt spectrum to ensure reliable transport services over body area and local area networks. It is unlikely that such spectrum will be needed in the near term, since its primary application, to support Class II and Class III medical devices, is still some way off. If and when such spectrum is required, then it will be important to harmonise frequencies with spectrum allocations elsewhere in the world, so as to create global markets for the devices concerned. This suggests the need to follow FCC initiatives on the possible allocation of additional spectrum for telehealth application in the US closely.

Measure 3.8: set appropriate standards for continuity of power supplies for ALTs equipment. These standards will need to provide users of ALSs with reliability which is appropriate to the application without raising equipment costs unnecessarily.

10.5   Measures relating to state funded institutions

Measures 4.1: create integrated electronic care records which offer appropriate access - to health care and social care professionals, to service users and to informal carers. Such records are important for effective ALSs and especially for the effective care of older people with both social and health care needs. These records need not be the same as people's existing healthcare records, although it will be important to have a unique identifier to cross reference to these records easily and reliably. Instead such records might provide a daily record of care from the time at which an older or disabled person started to receive formal care.

Measure 4.2: review the financial incentive mechanisms currently in place in the NHS and local authority social services departments and the extent to which they encourage decision-makers, whether care commissioners or individual care professionals, to invest in and use ALSs. Many stakeholders believe such incentives need to be changed, perhaps by shifting from rewards for undertaking specific activities to rewards for good outcomes.

Measure 4.3: introduce awareness, education and training programmes in the use of telecare and telehealth services for the caring professions. Such preparation is important if more carers are to make widespread use of ALSs and to use them effectively and ethically.

Measure 4.4: consider whether there is a need to kitemark telecare and telehealth devices which are sold on the private market to indicate that they can subsequently be used in ALSs run by state funded institutions. Such a mechanism should enable more cost-effective use of ALT equipment in the long term.

Measure 4.5: look at the case for setting up a central, state-funded, body which purchases ALTs in bulk and provides expertise in the use of ALSs to PCTs and local authority care providers. At the moment the purchase of ALTs is done in a fragmented way by individual PCTs and local authorities. Central purchase should lead to a significant reduction in unit prices and encourage bigger suppliers to enter the market.

List of annexes

The following annexes to the study report are provided in a separate volume.

A   Stakeholder interviews

B   Current use of assisted living technologies

C   Digital participation services

D   Teleworking

E   The impacts of demographic change

F   UK government initiatives to deal with an ageing population

G   The needs of older and disabled people

H   Application standards for ALTs

I   Medical regulation of ALTs

J   Network reliability requirements for ALTs

K   Networking architecture requirements of ALTs