North Wales Regional Collaborative Approach To Telecare

Feasibility Study

Work Package 6

The Impact of IP-Based Communications on Telecare Service Users and Providers

Telecare Think Tank

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Disclaimer

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1. Executive Summary

This report provides information and recommendations on two questions of key importance to the development of an innovative telecare and telehealth service in North Wales;

1. Does the emerging market in new IP-based monitoring centre technology better meet the aspirations for innovative solutions to re-enable and empower people through maximizing the use of continually-evolving assistive technology?
2. What is the viability of using broadband communications to provide innovative services for telecare/telehealth service users in North Wales?

The report considers these questions in two parts, highlighting 21 key points and providing 11 recommendations for further action.

The report will be of value to those opinion-formers and decision-makers in the alliance of authorities, social and healthcare sectors who are developing strategic plans for the future development of an integrated telecare/telehealth service in North Wales.

With some caveats stated, the overall outcome of this report is to encourage broad support for the adoption of Internet-based technologies, not only for the telecare/telehealth monitoring centres, but also for the delivery of these services over broadband into vulnerable peoples' homes.

21 key points are listed, along with 11 recommendations as to how to proceed towards meeting the clients' vision.

2. Setting the Scene

2.1 Client Vision

"By March 2008, telecare/telehealth will have been embraced as a new and flexible approach to meeting the health and social needs of vulnerable adults (in North Wales). Innovative solutions will re-able and empower people through maximising the creative use of continually-evolving assistive technology."[1]

[1] *From "Draft Telecare / Telehealth strategy for Denbighshire", V8 revised 27/10/06*

2.2 The Questions addressed in this document

This document addresses two important topics that will have to be faced when making strategic decisions on the path to achieving the vision. The questions addressed in this document are;

In **Part I**:

> *Does the emerging market in new IP-based monitoring centre technology better meet the aspirations expressed in the clients' vision, and, in the knowledge of the current benefits and disadvantages of this technology, what recommendations can be made to proceed to procurement?*

In **Part II**:

> *What is the viability of using broadband communications in North Wales to provide innovative services for telecare/telehealth users, and what confidence level can be suggested to proceed?*

3. PART I - Telecare Monitoring Centres

3.1 Introduction

Telecare services help enable vulnerable people to live independently in their own home or in a supported living scheme through the provision of technologies and systems which assist in the effective delivery of care and support in the home. The main elements of a telecare *monitoring* system are shown in Figure 1.

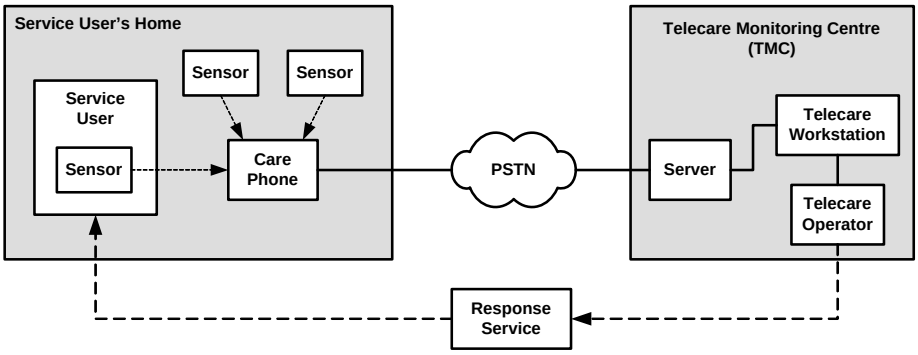

Figure 1. The main elements of a telecare monitoring system.

First generation telecare *monitoring* equipment in the home consists of sensors that monitor the well-being of the service user by keeping track of their status, activities and the suitability of their local environment, raising an alarm to the local care phone automatically if a hazardous event (or a sequence of events) occurs. The equipment in the home may then initiate a local response to an event (e.g. automatically lighting the way to the bathroom if a service user gets up during the night frequently to visit the toilet) or it may raise an alarm call through

to the Telecare Monitoring Centre (TMC) (e.g. if the service user falls and is wearing a fall detector). When an alarm call is made to the TMC by the care phone in the service user's home, an operator will assess the situation by considering the reason for the call (displayed automatically by the monitoring centre equipment) and by interacting with the service user (if possible) using a two-way voice channel to provide reassurance and to ascertain whether assistance is required. The operator follows an agreed response protocol for the set of circumstances identified (including the time of day and day of the week) so that the most appropriate response may be arranged. This often involves communicating the identified need to an informal carer, care-professional, healthcare worker or the emergency services. In the future, the TMC may also act as a data-store for data-intensive monitoring services such as lifestyle and physiological monitoring as well as tele-triage type services.

It can readily be seen that the TMC is the critical part of rendering support or assistance to vulnerable people in need at home. The TMC has to be available and staffed at all times, night and day, and must operate with close to 100% reliability in handling events which may be of an increasingly life-critical nature as the dependency of service users moves towards the critical and substantive levels of need and risk. This makes it not only "mission-critical", but also an expensive component of the telecare/telehealth[2] service.

The TMC is the hub of the communications network upon which the effectiveness of the service depends, but it also has a core function to access data about the vulnerable person (part of the incident evaluation process upon which an appropriate response is based) and to retain data on the start of the event, records of times and outcomes, and analyses of performance. The TMC computer system will also manage call-routing, recording, data-handling and display – for example automatic pop-up screens on receipt of a caller-ID, or a "click-to-contact" a selected care service. Current TMCs that use this methodology are commonplace, robust and effective. They are built on reliable and secure (but slow and relatively old) telephony-based communications sitting alongside computer data and call-management systems, and essentially provide all the **current** functionality required.

However, if the North Wales region wants to "embrace a new and flexible approach" and "maximise the creative use of continually evolving assistive technology", then the strategic view will be seriously disrupted by the emergence

[2] *The term 'telecare' will be used henceforth in this report to mean both traditional telecare services and medical telecare (or telehealth) services.*

of, and rapid growth in, a new way of operating TMCs based on IP technology. IP stands for Internet Protocol, indicating that internet technology is used to provide a single unified approach to working with voice and data communications. This convergence has been made possible through the ability to carry voice traffic over the internet, called Voice over IP, or VoIP.

In VoIP, voice signals are digitised and then sent as addressed packets of information across the public internet (or a closed, private internet-like network), to be unbundled and decoded at the destination. High-speed internet connections have made VoIP accessible to people that have a broadband service, and currently some 10% of internet users in the UK exploit VoIP to make phone calls at zero cost, or for a nominal sum. Having broadband wireless hubs in a home or small office has encouraged the use of a plethora of dual-function devices that can either make calls via the internet or via the public telephone network. Call-charges are almost eliminated because the telcos[3] networks are effectively bypassed by the internet, although of course the user must pay for the internet connection.

Part II of this document will consider the impact of broadband (the common terminology for the fast IP-based communications network provided by BT, Cable Companies and Satellite Providers) at the domestic end of a telecare service. Part I will continue to consider the impact of IP technology in general – and the use of VoIP in particular – on the future of a TMC.

3.2 Growth in IP-based Call Centres

The majority of Call Centres, Corporate Networks, and small PBXs will be IP-based by 2010. 47% of all Call Centres in North America will use VoIP by the end of 2007[1]. The UK is lagging slightly behind, with 10% of all new Call Centres in the UK (mid 2005 figure) using a complete IP solution, whilst 47% of all Call Centres run VoIP alongside the more traditional phone technology[2]. The early-adopter phase is over, the technology is maturing in development, and mass-market penetration is occurring.

It is the correct time to carefully consider the implications of this new technology on the North Wales Telecare Strategy. The TMC will be at the core of current and future telecare operations and probably be the largest capital and ongoing cost item. It will be more difficult (though vendors say easy to do) to retro-fit an IP-

[3] *A 'telco' is an abbreviation of 'telecommunications company', i.e. a company that provides telecommunications services such as telephony and data communications (e.g. British Telecom).*

based system onto an existing system, so therefore a new-build scenario is the best starting-point for implementation of an IP-based system.

3.3 Potential benefits of IP-based TMCs

3.3.1 Infrastructure Costs

The most often-quoted savings are on the infrastructure costs of an all-IP network. This is largely based on the savings brought about by having a single cable- or wireless-based network at a physical monitoring centre premises, and this is often where a "greenfield" site is seen as a lower-cost option[4]. Caution must be exercised here, because a positive gloss is often put on infrastructure costs by the vendors of such networks. Worked examples on smaller PBX installations show that the up-front costs are essentially similar for a standard hybrid telephony/data network and an all-IP network, and these results are expected to scale to the provision of mid-sized TMCs[3].

KP 1	**The up-front costs of an IP-based infrastructure are likely to be similar to traditional TMC costs, but adding VoIP to an existing non-IP-based system may be more expensive.**

3.3.2 Running Costs

There is no doubt that the main advantage of an IP-based TMC is in the much reduced cost of voice calls made from the centre, between centre staff (who may be distributed geographically), and with the other partners and agencies involved in the telecare system. Generally-speaking, calls to other VoIP users are free wherever they are on the planet, and to other telephony-based devices there is only a small connection charge, typically about only 10% of the cost of a normal phone call. A broadband internet connection is required, but that is shared by all voice and data communications. A service provider that supports VoIP is also essential.

As calculated in Appendix 1, the use of VoIP could save the North Wales service an estimated cumulative sum of over £500,000, from 2008 to 2016.

Notice that all of the functionality of the IP monitoring centre is now digitised – that is, under software control. This means that the computers, soft phones, servers, networks, software, etc. are under the constant supervision of an ICT maintenance manager whose role – whether outsourced or not – is critical to the

[4] *Retro-fitting to an existing system in existing premises may be more costly. This is because an additional network, built using a CAT 5 cabling or a wireless LAN, would have to be provided on top of the existing non-IP infrastructure. Planning and installing such a system would be constrained by existing physical layout, and naturally a wireless solution would be preferred in such a circumstance.*

effectiveness of the telecare operation. The ICT manager must deal with a more complex system than stand-alone or interconnected computers, and this may be a hidden cost of running an IP-based TMC that may offset the savings made on call costs.

KP 2	**The communications costs of an IP-based TMC is essentially reduced to zero, but there may be additional costs in maintaining the increasingly-complex IT system. This approximates to a cumulative cost saving of over £500,000 between 2008 and 2016.**

3.3.3 Communications flexibility

A major advantage of an IP-based TMC is the increased flexibility that a completely software-managed resource brings, particularly one which shares customers over a wide geographic area and also where the responsibility for delivering care is shared by several organisations.

The IP-based TMC becomes a “virtual” organisation, which means that it can present itself to different users of the service in different ways. For example, the service may have no central office, or share different geographical locations, and yet the call numbering system presented to the users can be any (allowable) nominated set. Within the monitoring centre, allocation of extensions can be made “on the fly”, and numbers can follow the call-handler to, for example, their home. From home, a broadband connection allows the call-handler to have access to the complete functionality of the TMC, including virtually zero-cost voice calling. If an 0800 or 0845 number was used to contact the TMC in the event of an episode, the call would be routed to the appropriate call-handler, no matter where they were located.

The routing of the TMC calls is completely programmable, offering huge flexibility in where the monitoring centre is located (i.e. centrally, distributed across participating counties, or groups of singleton call agents). An IP-based TMC is therefore flexible enough to accommodate changing patterns of organisational structures, so the existence of the call-centre does not dictate continuity of participation for all time by all stake-holders.

KP 3	**The programmable communications capability of an IP-based TMC means that the organisational structure of the monitoring centre can grow and adapt to changing needs, both of the client base and of the delivery organisations.**

3.3.4 Market Drivers

The market in the UK for IP-enabled call-centres is lagging behind that of North America. However, there are some highlights. BT - the biggest UK telco, and in the top 10 telecommunications and IT companies in the world - is making significant investments in the development of the IP market, and is one of the first major telcos to publicly commit to the elimination of the traditional telephone network in favour of a single IP platform[4]. Other telcos are already focussing their investment strategies towards the internet, although of course mobile phone operators do not wish to see a competitive mobile IP market (based on wireless LANs) growing to threaten their expensive infrastructure investments, so they tend to be rather more downbeat about IP than fixed-line operators. Broadband ISP Orange (previously known as Wanadoo[5]) leads the market in VoIP for domestic and small-business customers, with an estimated 90,000 users currently. The providers of IP-based call-centre technologies tend to be big players in the IT industry (such as Cisco[6], Nortel[7] or BT[8]) although there are smaller UK players such as MX Digital[9] who might offer good tailored packages for a specialist Telecare market.

An interesting question arises concerning the readiness of **current** Telecare Call Centre Providers to have the software necessary to interface to an IP-based telecommunications infrastructure. Anecdotally, the main players (such as Tunstall, Initial-Attendo or Jontek) may have first-generation systems ready by the end of 2007. However, reports of "working on it" need to be amplified, and timescales confirmed, with the current PSTN-based service providers. Current service providers bring their extensive knowledge and experience of this market to bear, whereas new entrants – though perhaps more conversant with the new technology – would have to learn how to work in this unique setting. However, it should be noted that any changeover to an IP-Based monitoring centre will not necessarily mean that any one call centre solution will be compatible with equipment from all home equipment manufacturers.

KP 4	**The adoption of an IP-based monitoring centre at this time will not guarantee compatibility with the home equipment from all manufacturers.**

This is because the application level protocol that describes the alarm types and locations within the home (e.g. BS7369, TT92, or equivalent) remains a separate entity to the IP protocol, which is only used for transmitting the data across a network. Unless a common and comprehensive telecare application protocol can be agreed upon and implemented by ***ALL*** equipment manufacturers then many of

the interoperability issues that exist today will still be present even with an IP-based system.

It is no surprise that telecoms equipment manufacturers are delivering fewer and fewer traditional voice products to the market because service providers are quickly mobilising strategies for new-generation IP systems, monitoring centres included. Over 10% of all new Call Centres in the UK (2005 figure) use a complete IP solution, whilst 47% of all Call Centres run VoIP alongside the more traditional phone technology[10]. Therefore, the market drivers are pointing to the decline of traditional hybrid Call-Centre technologies towards single-platform IP solutions. This may drive the cost of traditional TMC solutions down as they become more obsolete, whilst at the same time establishing a premium for newer, more cost-effective and flexible IP services as vendors seek to recoup development costs. Competition in this new marketplace is fierce, so there will be scope to negotiate a good purchase price.

KP 5	**The market drivers point to IP systems eclipsing traditional hybrid TMC technologies. The procurement cost of IP-based systems is likely to remain currently similar to or in excess of the systems they are replacing, but traditional systems' costs are likely to fall in price as they become obsolete. The best value IP systems will be found during an intensely competitive procurement exercise. Note that there will be a cost differential between "new-building" and "retrofitting" an IP-based facility, so integrating any new equipment with existing infrastructure should be carefully considered when developing a TMC strategy.**

Additionally, if part of the infrastructure already in place or planned uses access via the internet/intranet for major functions such as data storage and retrieval, then it would be straightforward and sensible to add VoIP to that existing IP infrastructure.

3.4 Potential disadvantages of IP-based TMCs

3.4.1 The need to be a knowledgeable customer

Clearly, putting all data and communication eggs in the one IP basket is a greater risk if the customer of the equipment vendors (the Telecare provider) is not fully conversant with the complexities of the technology upon which the service is based. The success of the IP strategy depends on being a knowledgeable customer of the IP vendor and service provider. This means being able to draw up a clear specification of system functions and having a reasonably clear view of change drivers for the Telecare services. The latter point is important because of the ability of an IP-based system to be flexible, reconfigurable and future-proof. It must be verified at the procurement stage if the system can live-up to the predicted evolution of the Telecare service.

Running, maintaining and managing an all-IP system is a more complex IT operation, and, though this may be outsourced to a suitable expert company, it is essential to have a local understanding of how best to use the technology to exploit the benefits, and avoid the possible pitfalls, of this new approach.

KP 6	**Being a knowledgeable procurer and manager of all-IP systems is essential for extracting the best value from them.**

Additionally, there will be a training cost for staff to use the new systems effectively. However, this should be minimal as the underlying technology of how the voice communication works is "hidden" from the clients and the monitoring centre staff. Indeed, the human/computer interface might become more intuitive, straightforward and easier-to-use as all functions become integrated in a single screen presentation to staff – as for example in "soft phones".

3.4.2 Security

Security is currently the biggest concern in choosing to build an IP TMC. Unlike data communications, VoIP traffic is essentially communicated in real time, and so the security of the voice packets has to be ensured using (almost) real-time security software. The carrying of voice on IP networks gives fresh opportunities for malicious attacks – SPIT (the voice equivalent of email SPAM), Denial of Service and eavesdropping included. Private Networks should be protected by robust firewalls and have appropriate anti-spyware and anti-virus software. Responsible vendors provide the necessary ongoing security updates for monitoring centre systems, but as VoIP grows in popularity, so too does the attention of those who may find it easier to attack poorly-defended and vulnerable systems. This is all part of the unavoidable Darwinian nature of the internet, but it should be known that extra effort will need to be expended to ensure the continuation of the organism that is the telecare system.

KP 7	**Security of an IP-based TMC is a critical issue, particularly where a 24-hour life-support service is implemented. Although the threats grow with increasing market presence, responsible vendors will provide the necessary software protection against malicious attacks. Thorough routine system maintenance is therefore critically-important.**

3.4.3 Back-up systems

Being computer-based and electrically-powered, some faults and maintenance downtimes are likely to occur infrequently. It is essential to have a limited back-up system in place to be able to handle inbound and outbound calls by the normal telephone network (which is powered independently from the National Grid). As

any public internet connection would not be compromised by a mains power failure, it would be beneficial to maintain electrical mains power in any monitoring centre (or sub-Centres) by a local automatic back-up power generator.

KP 8	**Limited back-up systems are required for data and voice services in the inevitable but unlikely event of IP network failure. Local power generation may be included as a back-up option.**

3.4.4 Regulation and other limitations

The regulatory environment for VoIP is still evolving. Consequently, the quality of service and availability issues for VoIP in the public internet are less well-established than for telephony. However, the voice calls over the TMCs private network would be managed internally, so these issues are of minor consequence. It will not be acceptable either to the Regulator or to the general public to see a reduction in the quality or availability of VoIP carried over a broadband public network, so in the longer-term, these issues will not have a major impact.

Dialling emergency services via 999 is currently not possible with VoIP (probably because equipment is not installed to trace the source of an internet call), but again it is most likely that internal calls between the partners in such a telecare service, including the emergency services, would not use the public 999 service to meet a client need.

KP 9	**Some current limitations of the regulatory environment and the use of 999 should not have a major impact on the operation of a TMC based on IP technology.**

3.5 Recommendations from PART I

Clearly, the aspirations of the North Wales Telecare Initiative are to introduce and grow a cost-effective, efficient and future-proof system for delivering telecare and telehealth services in the region. Additionally, the market is becoming established for IP-based monitoring centre solutions that can, without doubt, match these aspirations. Choosing to do so by procuring the increasingly-obsolete alternative technology may be cheaper initially, but will effectively “lock-out” many future applications of telecare and telehealth that will increasingly use IP backbones – both the public internet and private IP networks – to support new and vital services.

Although there are some current potential difficulties in using an all-IP platform (in the main keeping the networks secure and being expert in procuring and running such a system), it is clear that the benefits are significant (including

comparable capital costs, lower running costs, service and management flexibility, and applications future-proofing). The market in this new technology is maturing, and many vendors will compete for the TMC business; whereas the hybrid systems will become obsolete and will become less and less supported.

However, at this time, it would be prudent to introduce a note of caution regarding the establishing of a specification for the monitoring centre of the future. The vendors of current TMC equipment in the UK have had to address protocol compatibility issues in ways that foreign suppliers have not done (and usually underestimate). These systems have the capability of allowing care phones (and future home telecare hubs) to be programmed and reprogrammed remotely, reducing the need for expensive visits of technicians to the home to change parameters. This will apply to all future devices but will also enable legacy devices to be programmed i.e. there is backward compatibility built in. There are in the order of 750,000 working care phones in the homes of dispersed service users in the UK at this time. Replacement with IP phones will not occur overnight. It follows that the growth in broadband-enabled care phones will inevitably be slow especially as they haven't yet emerged on the market. It is likely that the current generation of care phones will survive without replacement for between 5 and 7 years, and this will determine the timescales for call centre upgrade. Bearing in mind the fact that this report is to consider a time-scale of 5 to 10 years, then it implies the need for a short term strategy (perhaps 2007 to 2012) and a longer term approach. It is therefore recommended that the North Wales Telecare Project Board seriously considers investment in an IP-based TMC in 2010 ready for implementing from 2012 and does so by;

P1.1	**Clearly specifying the performance requirements of such a system.**
P1.2	**Considering the pros and cons of "new-build" against "bolt-on" IP-based TMC**
P1.3	**Clearly defining the communications and organisational architecture that the system addresses, both now and, as far as is possible, into the future.**
P1.4	**Becoming a knowledgeable procurer, through becoming expert on the technology and understanding how the evolution of the service maps on to the new capabilities of such a system.**
P1.5	**Identifying quality vendors of such a system, and using a highly-competitive procurement process to get up-front costs to be the same as planned-for costs of a "traditional" approach.**
P1.6	**Entering binding agreements with vendors and maintenance operators to provide guaranteed levels of security, quality and availability of such a service.**
P1.7	**Planning a test-bed for new Telecare applications and services in North Wales that exploits broadband communications within and to and from the homes of vulnerable people and their carers, integrated with an IP-based TMC.**

This research shows that, should such a recommended approach be taken, the benefits of reduced running costs, operational flexibility and application future-proofing will all be realised at the same time as minimising the risks involved in adopting a new technology.

Supporting these recommendations will hugely benefit the future well-being of vulnerable adults in North Wales, and put the region in the vanguard of telecare service delivery.

4. PART II - Broadband Availability and its use in a Telecare Service

4.1 Introduction

Part I of this document focused on the benefits that can be obtained from an IP-based TMC. These benefits yield a streamlined and cost-effective infrastructure which will bring major advantages to the telecare service provider. This section discusses the benefits that IP-based technologies will bring to vulnerable individuals who receive a telecare service.

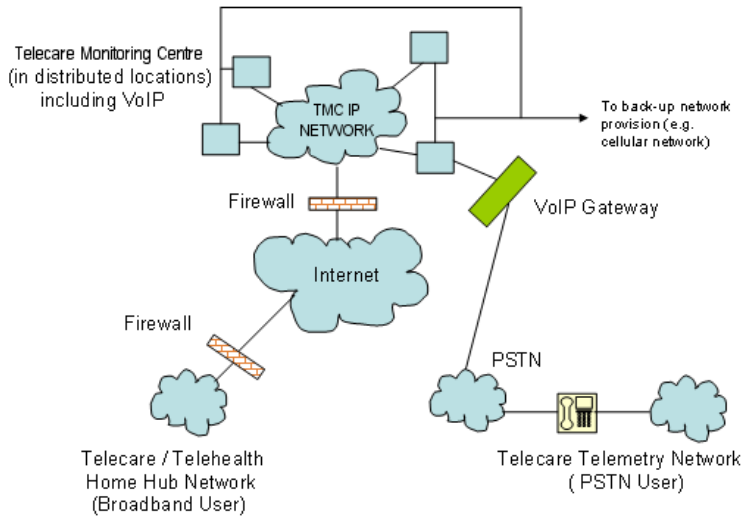

Figure 2. Future telecare / telehealth network connectivity options.

Apart from general systematic cost savings and a better overall service, users may not otherwise be aware of any improvements in the type of service with which they interact. However, the end-to-end deployment of IP will open up new possibilities for next-generation services in the home. This is because the monitoring centre, the network that connects it to the individual and their environment, and the communications network in the home (usually wireless and commonly called the “Home Hub”) are all compatible and all based on IP (see Figure 2).

Also shown in Figure 2 is how today's telecare connection to the TMC based on the standard domestic telephone line would be configured to co-exist alongside an IP solution. Today's PSTN-based service is useful for sending alarms and low levels of data.

The costs of broadband have fallen rapidly over the last two years with the lowest priced systems costing less than £15 per month. If it could be demonstrated that this type of technology could be used to the benefit of vulnerable and excluded groups then such costs could, in principle, be justified as part of a care package. Again, there may be beneficial packages available from Internet Service Providers for this particular service to large numbers of their customers who might otherwise be unconnected to the internet.

Notice that the user of a telecare service need not know that they are connected to the internet, nor need they use the connection for any other purpose. It is a form of unwitting digital inclusion. The concept of a domestic computer – with keyboards, mouse and screen – does not apply here, as the technology will consist of apparatus to connect a local data server to the relevant gateway at the monitoring centre. It will reside in a beige box in a domestic cupboard or will become another 'set-top-box' type device. Similarly, no special technology will be used to receive visual images, as the normal domestic TV already does this.

Broadband provides a connection that is "always on". There is no need to make a physical connection when an event is detected and continuous real-time monitoring is possible. The speed of the communication is about four times faster from the home, and about 30 times faster into the home compared with a standard dial-up connection – although most current care phones don't even have this capability. Many rely on 'DTMF' dial tones to transmit information at a significantly slower rate than even dial-up speeds (units that do employ a modem are generally those that are used for lifestyle monitoring applications). It goes without saying therefore that none of the care phones currently on the market are capable of exploiting broadband connections (i.e. are IP enabled) in service user homes. The increased bandwidth allows the delivery of reasonably high-quality video signals from the TMC, and lower quality moving-picture data out from the home. Continuous high-speed communications opens up opportunities for many new service concepts to be provided (See Section 4.8)

4.2 Take-up and Availability of Broadband in North Wales

There is often concern about the rate of **take-up** of broadband in Wales compared with other parts of the UK and the rest of the world. However, in the

context of a telecare service, relative take-up rates are irrelevant. This is because the people forming the client base of this service are not in the forefront of requiring or demanding broadband for the purposes to which it is most commonly put – email, photo-sharing, on-line shopping and banking, chat rooms, downloading music, etc.

Generally, telecare service users having broadband as a delivery means would not know or care that they were requiring this communications capability, and may not initially use it for any other purpose (although encouragement to extend their use of broadband may be a beneficial side-effect). Comparative rates of take-up by telecare users in different regions may be an interesting yardstick, but this cannot be meaningfully compared with the take-up of the internet for, say, downloading entertainment.

KP 10 **In telecare, the key issue is not take-up of broadband, but availability.**

If a broadband service is not available to users, it is impossible to meet their future telecare needs. Availability is governed by three factors – infrastructure availability, service availability and affordability, the latter being outside the scope of this report.

4.3 Broadband Exchange Availability (infrastructure availability)

Across North Wales, there are approximately 11 exchanges not broadband-enabled, but they serve a very small number of households or small businesses. The following exchanges in each county were not broadband enabled as of January 2006[5];

Anglesey:	All Enabled (0)
Flintshire:	All Enabled (0)
Wrexham:	Llanarmon D C (1)
Denbighshire:	Bryneglwys, Cyffylliog (2)
Conwy:	Capel Curig, Llannefydd (2)
Gwynedd:	Abergynolwyn, Bontddu, Ganllwyd, Pennal, Rhiw, Rhydymain (6)

For example, before the broadband registration scheme closed in 2006, there were only an average of 16 people per exchange in the exchanges not enabled who were interested in taking-up a broadband service. Despite the concerns of those few people effectively denied service, it is understandable from a

[5] http://www.samknows.com/broadband

commercial viewpoint that the investment needed to upgrade these exchanges would never produce a breakeven condition.

The broadband infrastructure in North Wales would therefore appear to be able to serve the overwhelming majority of the population. Gwynedd would appear to be the county with the greatest number of people who do not have access to broadband. However, one might also propose that the non-enabled exchanges in Gwynedd are in fairly remote areas where there are likely to be fewer people with a long-term health disability (simply because there are fewer people and because Gwynedd has the lowest level of self-reported poor health in the region). Perhaps the identification of vulnerable people living in places where broadband is not available is a good indicator of a much increased risk to their daily wellbeing.

KP 11	**Broadband availability is acceptably high in North Wales for supporting a telecare service, with only 11 small exchanges (with few people attached) not enabled.**

4.4 Distance over which "broadband" is available (service availability)

Of course, having the local exchange enabled is not a guarantee that a broadband service will be available. For complex technical reasons, there is a limit to the speed of the service available, which is inversely proportional to the distance from the premises to the exchange. The greater the distance between the premises and the exchange, the greater the signal degradation, and drop in service quality. A high-speed service (1 – 2 Mbps downstream and 256 kbps upstream) can be delivered over approximately 5 km from the exchange over copper wires in good condition. Beyond that sort of distance, the service capability diminishes, but a functioning "broadband" service may exist up to about 7 km. Beyond this range, the service effectively reduces to that of a slow dial-up modem speed of 56 kbps. For some limited telemetry applications this minimum speed might be sufficient, but it certainly rules out any video-based services.

It is very difficult to state the locations where service would not be available from an enabled exchange. This is because the quality of the copper cable and other environmental factors determine the range over which a high-speed service can be provided. Indeed, there may be a very few households which cannot achieve good performance living close to, say, Wrexham's main exchange – the so-called "not-spots". However, such scenarios are quite rare, and can always be accommodated by backing-off performance or providing an alternative copper pair if available.

KP 12	**There will be a very few locations where full broadband service is not available even although the local exchange is enabled. A less functional IP-based service may still be offered in such circumstances.**

4.5 Locations in North Wales with highest densities of people > 65 years

From the 1991 Census, the total population aged 55+ then is shown in Figure 3. This will roughly equate to the current population of the over 65's today, probably a fair reflection of the geographical client base for a telecare service in the six Unitary authorities across the region.

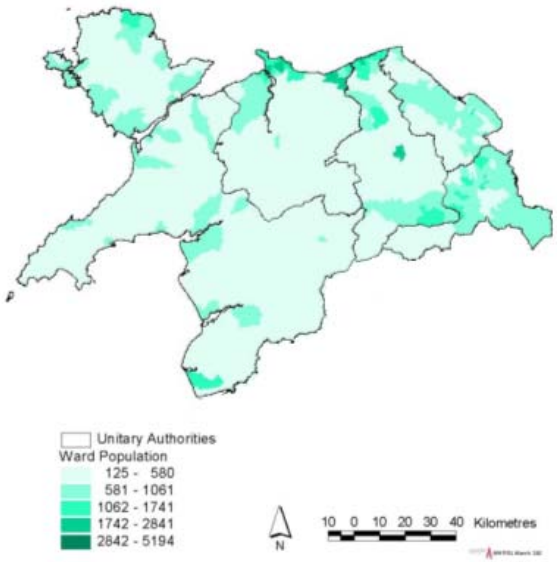

Figure 3. Total North Wales population aged 55+ by ward (Census 1991).

A rough typography of the locations of highest density of over 65s is;

Centres of Population (>65)		Retirement locations and hinterlands (>65)		Rural locations and hinterlands (>65)
Holyhead	St Asaph	Llanfaelog	Porthmadog	Abergele and hinterland
Caernarfon	Wrexham	Malltraeth	Blaenau Ffestiniog	Corwen
Bangor - Bethesda	Mold	Menai Straits area	Tywyn – Aberdyfi	Llangollen
Llandudno	Ruthin	Beaumaris	Nefyn	Ruabon
Colwyn Bay	Barmouth	Benllech	Pwllheli	Overton – Eglwys Cross
Rhyl	Dolgellau	Amlwch	Criccieth	
Prestatyn	Denbigh			

Note that all other rural or retirement locations have a lower density of over-65's (125 – 180 per ward). If the population of the over-65s reflects the overall population density, it may be expected that all of the locations listed above will be well-served by broadband.

KP 13	**The population of elderly people in North Wales are concentrated in areas where broadband is enabled.**

4.6 "Guesstimate" of the overall availability of broadband to the client group in North Wales

Because of the uncertainties noted above about the lack of a very few enabled exchanges (principally in Gwynedd), distance limitations and environmental considerations associated with broadband, and lack of detailed information about the likely location of current and future users of a telecare service, it is difficult to say how many people would be disadvantaged (due to lack of availability) if broadband communications became the mainstay of the service.

As the majority of elderly people live along the coastal strips of Conwy and Denbighshire and in Flintshire and Wrexham, there would seem little or no lack of broadband infrastructure with which to serve them. There seems to be a preponderance of elderly retired people in the Isle of Anglesey, and here too is well-served. The majority of elderly people in Gwynedd seem to stay near to the coast, but the estuaries of the Mawddach and Dyfi and their hinterlands seem to have the most non-enabled exchanges.

KP 14	**Further research is needed into the specific areas around the Mawddach and Dyfi Estuaries to better understand a concentration of retired people in an area where most of the non-enabled exchanges in Gwynedd are located.**

Apart from this rather specific area of Gwynedd, where further research is needed to see if there might be a problem of availability to the client base of a telecare service, it would seem that there would be few difficulties in implementing a widely-available broadband telecare service in North Wales. Any exchange/ distance limitations can be resolved by trading-off some performance characteristics whilst retaining most of the advantages of the service. It will be inevitable that there will be a very few people who cannot get a fully-functioning broadband service – and they might feel aggrieved at getting a lesser service - but this, in our best guess, will be approximately in the <5% range of all clients.

In the worst-case scenario, BT is bound by Ofcom, through its Universal Service Obligation (USO)[11] to provide the following specific further services, all of which have to be offered at uniform prices across the UK (key areas highlighted in italic);

- A connection to the public telephone network at a fixed location, following a reasonable request, *which includes functional internet access;*
- At least one scheme for consumers with special social needs who have difficulty affording telephone services;
- Public call box services; and
- *A range of services for customers with disabilities*.

"Functional" here could mean "fit-for-purpose", and a telecare service supports people with recognized "disabilities", so it is possible that BT is obliged to provide a basic IP connection (if only at 56kbps) throughout the region. The guesstimated <5% of customers who may not be able to be connected with high-speed broadband may still use a lower-speed, but a still-functional, IP service from BT.

KP 15	**Should a broadband IP-based telecare service be introduced in North Wales, the best "guesstimate" of the proportion of the client-base to whom the service would be available is >95%. The remaining < 5% would not receive the same speed of delivery and therefore not access some of the innovative applications that would result. However, a basic level IP-connectivity could still be provided (perhaps under BT's USO) that would be faster than today's telecare telemetry systems using the PSTN.**

4.7 The future dominance of IP in communications – BT's 21CN

The optimism about almost-universal availability of broadband is strengthened by the actions of BT, who are the first major telecommunications company to act to migrate from the old PSTN towards an all-IP network infrastructure. This is called 21CN, and Appendix 2 provides some background information about it. Several key learning points extracted from the Appendix, are;

KP 16	**21CN will be a key enabler for new telecare services in the next decade.**

KP 17	**The roll-out of 21CN started in November 2006, with the migration of 350,000 customers from the old PSTN to the new network taking place in *South Wales*. BT expects that 50% of its national customer base will have migrated by the end of 2008, and the roll-out to be completed by the end of 2011.**

KP 18	**Approximate 21CN switch-over dates for the six counties of North Wales are: Denbighshire – End 2009; Conwy – Start 2010; Wrexham, Flintshire, Gwynedd and Anglesey – 4th Quarter 2011.**

KP 19	**As 21CN develops, it is proposed that all residential, Small to Medium Enterprises and Enterprises will have high-speed connections to it, delivered over copper (in the form of ADSL or other DSL technologies) or over optical fibre. THE SOLE EXCEPTION TO THIS PRESUMPTION IS FOR LEGACY PSTN, WHERE PROVISION WILL CONTINUE TO BE MADE FOR ANALOGUE VOICE.**

KP 20	**It should be emphasized that the roll-out of 21CN will help to grow the national public IP network that will support the continued expansion of broadband everywhere, including North Wales. The fact that 21CN is not scheduled to be implemented in four counties in the Region until 2011 will not detract from the recommended action to exploit broadband technology to deliver new telecare and telehealth services in North Wales between now and 2011.**

4.8 Future Telecare Services based on Broadband IP networks

The move from the PSTN to a broadband network providing new services based on IP will enable innovative applications and services in telecare. The services will be far richer in quality, sophistication, sense of intimacy and reality, complexity (although this will not be recognised by the user), speed, continuity and availability within the home. A few examples are described in the next paragraph.

Older people living independently at home may find reassurance in the ability of a trusted carer being able to monitor their well-being using a webcam. There are obvious sensitivities about such a proposal, and the consent of the individual would be paramount, but the ability to securely-access such visual assurance is possible. Local and inexpensive wireless networks can distribute upstream video signals or downstream video messages securely around the home, so portability and availability of video interface equipment anywhere in the house is guaranteed. Such a visual capability would allow direct consultation with formal carers and health professionals. Multimedia communications (vision, sound, text) opens up new communication possibilities for those with **physical impairments** (for example speech-to-text applications, or supporting lip-reading or signing). Friendly avatars used to assist people with learning difficulties or dementia with prompts, may be effective. Getting the assistance of the monitoring centre in a dialogue with an unwelcome visitor over the entrance-door video-surveillance system may add to the security of vulnerable people in their home. In the situation where the **informal carer** (usually a relative) lives in the same house as the vulnerable individual, the dedicated 24 hour attention required to look after, say a person with dementia, can lead to depression and social isolation. A broadband connection gives access to resources, contact with other people, access to other interests, and a means to reduce domestic workload (through for example home-shopping). Similarly, up-skilling carers by promoting access to better information, training and advice would be a useful by-product. Indeed, providing routes to working from home through the broadband connection may be helpful to raise the self-confidence of tied carers. These enhanced possibilities for communication services may not need traditional computer-based skills. For example, there are now electronic display devices[12] that mimic traditional message boards, where messages can be written and images sent just by tapping on the surface. Received video messages can be viewed without complex buttons to press by a device that looks like a book[13]. **People with mental health problems** may find telepsychology (face-to-face but remote counselling) a useful resource, whilst **people with physical impairments** might increasingly find a role for domestic robotics which co-operate using the IP network backbone.

Generally, **all** telecare and telehealth users will benefit from the greater number of sensing systems that can be connected from the home to the monitoring centre (the increased **multiplexing capability**) which all can be monitored "in real time". This offers the possibility of continuous monitoring of individual "vital health signs" and their physical environment, as well as video-centric communications, help and advice services, and indeed entertainment and news services tailored for their need in their community. It is a future rich in new and exciting possibilities, brought about by the introduction of IP in both the TMC and broadband connectivity to the home. Without these innovations, telecare is not likely to develop beyond the simple systems that we have at the moment.

KP 21	**Many important future applications in telecare will be accessible and easy to implement if the North Wales Project opts for a service based on IP technologies, both in the monitoring centres and in the home environment, using broadband internet connections to maximise the future potential applications opportunities.**

4.9 Recommendations from Part II

Two main factors provide confidence in the recommendations given below:

Firstly, it is thought that broadband communications in North Wales are currently available to over 95% of the Telecare client base in North Wales, with the remaining <5% being able to use a reduced speed service that could be nonetheless based on IP.

The movement to an all-IP based communications network by 2011 at the latest (BTs 21CN) gives confidence that planning to exploit the benefits of broadband in telecare will be supported in an ongoing manner, whereas the old PSTN – although continued for those with analogue phones that do not wish to migrate – will quickly disappear. A telecare service based on the existing PSTN will find it difficult to continue in its present form, making it unwise to pursue that option.

It is therefore recommended that;

P2.1	**Experience is gained through pilot trials in North Wales of the use of broadband in vulnerable people's homes to support advanced telecare and telehealth services.**
P2.2	**Identify and work with those technology providers who offer such advanced telecare applications, using expert evaluation of the effectiveness of new services to support the wellbeing of the people of North Wales.**
P2.3	**Further study is made into the consequences for an estimated <5% of homes that may not achieve the faster rates of broadband communication, and develop a strategy for providing a reduced range of services for these people (which will nevertheless still be an improvement on PSTN telemetry systems currently used).**

P2.4	**Open a channel of communication to BT to see how they may work in partnership with the Authorities to resolve the remaining issues of non-availability, bearing in mind their obligations under the USO and their wider Corporate Social Responsibility agenda.**

Supporting these recommendations will hugely benefit the future well-being of vulnerable adults in North Wales, and put the Region in the vanguard of telecare and telehealth service delivery.

5. APPENDIX 1 - Estimate of Call Volumes and Cost Savings through the use of VoIP

It was stated earlier that the up-front cost of an IP-based TMC is not likely to exceed that of older products, but that running costs (maintenance, security, back-up, etc.) may be higher in such a life-critical situation. The costs of network connections and payments to a service provider for communications services are likely to be similar. The use of an extranet to connect diverse agencies in different locations will save any charges for traversing the public network, but it is likely that provisions are already in place to minimise that possibility.

The magnitude of the cost savings to be made on call charges is difficult to ascertain exactly, as it depends on call volumes. Traffic depends on the estimated scale of the telecare service, and the savings depend on knowledge of future tariffs of both traditional telephony and VoIP. In this estimate, it will be assumed that all of the calls from which savings can be accrued are from the monitoring centre to the clients' homes or carers in the community, and that the calls are to land-lines at a local rate. It will be assumed that the cost of a call is 20p averaged over all durations over the standard public telephony network, and that the cost of a similar VoIP call is zero. Five VoIP calls therefore saves £1.

The number of homes connected to the Telecare Service in the relevant North Wales area is estimated to be 18,000 by 2008. Due to the predicted growth in the population of elderly people, a proportionate growth of a further 5,000 vulnerable people will be added to that number by 2016, making an estimated number of homes connected 23,000 due to demographic reasons alone. This does not take into account any growth in the take-up of Telecare in the overall population. If we assume a modest 5% growth per year in the numbers using a service, the figure grows to around 30,000 by 2016. The graph below (Figure 4) is only a rough estimate of the numbers of vulnerable households involved, and assumes a linearised annual growth from 2008 to 2016.

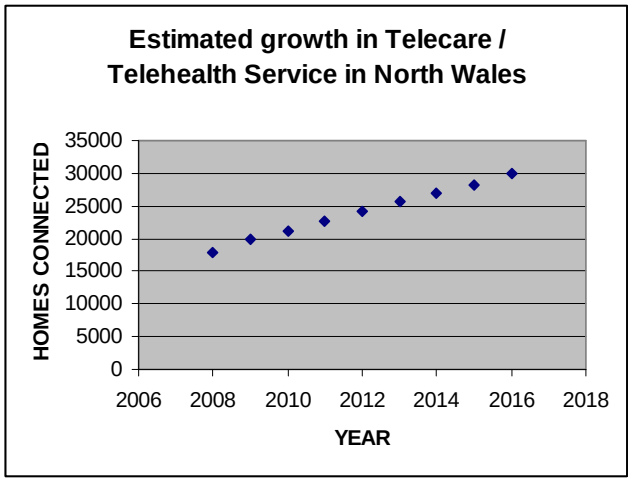

Figure 4. Estimated growth in telecare services in North Wales.

It is further assumed that, on average, there is one call made out from the monitoring centre per month to every home. Applying these predictions to the estimated cumulative cost savings of using VoIP, it can be seen from Figure 5 that in the 8 years until 2016, over £0.5 million pounds will be saved by making the decision to exploit VoIP in 2008. This calculation does not take into account any cost-inflation of standard telephone calls.

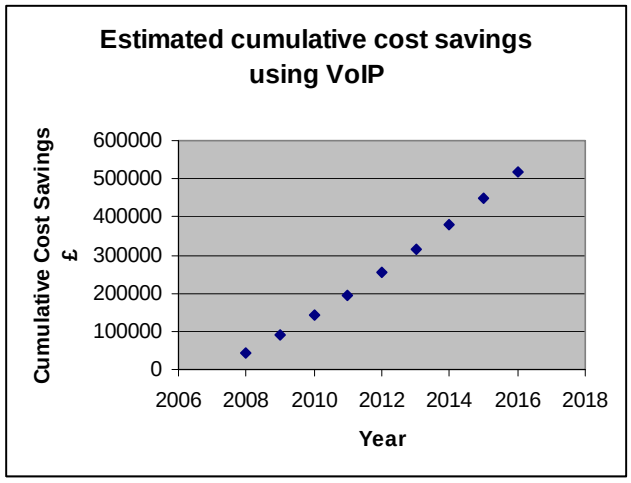

Figure 5. Estimated cumulative cost savings using VoIP.

6. APPENDIX 2 - BT's 21CN explained

BT is the largest provider of fixed-line communication services in the UK. As such, its national plans for the roll-out of a "21st Century Network" or 21CN[14] should be explained in this context, as it provides the greatest impetus to a radical investment in IP-technology - £10 billion over the next 5 years. It will be a key enabler for new telecare and telehealth services in the next decade.

6.1 The 21CN construction

The main reason that BT has embarked on a strategy of moving from a network based on a Public Switched Telephone Network (PSTN) to an IP-based network is to save money – it will accrue £1 billion of savings per annum by migrating all of its diverse information-transport systems to a single infrastructure. This will happen first in the main network – that is the main links that carry huge amounts of traffic between the major cities in the UK. More efficient and cost-effective communications will result, but the benefits will accrue mainly to BT – the customer will recognise little added benefit. The structure of that main network will consist of about 10 main "core nodes", around 100 "metro nodes" and many "multi-service access nodes", the latter being where many access technologies (copper, fibre, wireless) are aggregated into a single backhaul network technology. There is a further logical node – called the iNode – that effectively manages the other nodes, providing such functions as authentication, profiling, location-finding, address books, etc. This description of 21CN, although perhaps difficult to grasp in two sentences, is much simpler than the current PSTN network, which has layers and layers of overlapping technologies with interfaces between them and separate management systems to monitor and control them.

Where 21CN will have a more direct impact on consumers and businesses is where the plans for the access network and the customer premises networks will take effect. As 21CN develops, it is proposed that all residential, Small to Medium Enterprises and Enterprises will have high-speed connections to it, delivered over copper (in the form of ADSL or other DSL technologies) or over optical fibre.

THE SOLE EXCEPTION TO THIS PRESUMPTION IS FOR LEGACY PSTN, WHERE PROVISION WILL CONTINUE TO BE MADE FOR ANALOGUE VOICE.

In other words, if customers currently have analogue telephony and cannot get access to high-speed connections from the home or business premises, then the analogue phone will be retained. It may then be concluded that 21CN does not pose any threat to the continuity of existing Telecare services based on the PSTN.

6.2 Compatibility with existing telecommunications equipment

Ordinary PSTN equipment will remain in use if that is requested. Where DSL technologies are used in the 21CN access network, it is expected that existing telecommunications equipment will remain compatible with it. Where optical fibre is used in the access network – and this may not be common for residential customers until 2015 and beyond – there are some questions about compatibility

of existing equipment. In terms of translation to an IP format, this will simply occur within the home-hub rather than at the edge of the main network. However, fibre systems generally do not carry electrical power, and therefore equipment that is powered from the local exchange may become redundant or may need local mains power adaptors (the latter is probably not an economic solution).

However, in reality, most customers who will exploit a fibre access network will do so for the provision of new services which will require updated telecommunications equipment. Those customers who wish to stick with PSTN will be able to use existing PSTN equipment.

6.3 Powering of equipment

A major issue for a service such as telecare which is based on 24/7 availability, is in the powering of customer premises' equipment. To quote Ofcom;

> *"Ofcom's current thinking is that providing line powering is likely to continue to be a reasonably practicable measure for providers of analogue telephone services and ISDN2 services to take. This is because Ofcom understands that this capability is inherent in the technology and standards used to provide these services. However, Ofcom recognises that this is not necessarily the case for some VoIP services, and our current thinking is that using current technology it seems unlikely that provision of line powering for services other than traditional analogue telephony and ISDN2 would be reasonably practical."* [6]

Therefore, there seems a reluctance on behalf of Ofcom to require that future VoIP services will require the use of equipment powered independently from the exchange. This leaves an IP-based service from the home open to the possibility of mains power failure leading to a denial of service, unlike the current situation with PSTN. Of course, DSL services still use powered copper wires, and therefore the powering issue will not be an issue for most current and future broadband users. However, in the distant future where fibre is used in the local loop between the exchange and the customer premises, independent powering of terminal equipment and the "home hub" is a problem that may require solutions such as local back-up battery supplies or alternative cellular communications.

6.4 Customer premises networks

The customer premises will form the fifth node in the 21CN design. The evolution will be towards the creation of "home hubs", where all of the traffic within the

[6] http://www.ofcom.org.uk/telecoms/groups/nvs_index/ec_resp

premises will be aggregated and communicated over the access network to the main network.

To quote from the BT website [15], 21CN will support;

- Home hubs to enable households to manage PCs, laptops, entertainment centres, domestic appliances and home security systems on a wireless network - ideal for home working and managing busy family lives.
- Creating shared directories: your personal phone number list can be shared with your computer, your mobile, your personal organiser or other devices.
- Flexible bandwidth will enable consumers to boost the power of their broadband temporarily at the click of a button for example to stream a video. This will make downloading easier and faster enabling consumers to request additional bandwidth as and when it is required.
- Combating identity fraud by using biometrics to make it easier for people to safely and securely sign up for services such as on-line shopping.

21CN meets the vision of a single communications platform for all communications needs. *Ipso facto*, all communications services of the future must adapt to this single platform capability, and must use the underlying communications protocol of IP.

It is likely that it is in this home or small business environment that the greatest need for IP-interfacing equipment – such as in telecare monitoring systems – will be felt.

It should be stressed that although the resulting network will use IP-technology as the information-transport means, this does not mean that the network is “the Internet”. It is a bounded and closed network, with gateways to the global Internet. Within it, personal data security and new service capabilities will be enhanced, speed of communication will be improved, and overall costs reduced.

6.5 Implementation of 21CN

The roll-out of 21CN started in November 2006, with the migration of 350,000 customers from the old PSTN to the new network taking place in South Wales. BT expects that 50% of its national customer base will have migrated by the end of 2008, and the roll-out to be completed by the end of 2011.

6.6 Projected roll-out dates for North Wales

Approximate switch-over dates for the six counties of North Wales are;

Denbighshire: End 2009

Conwy: Start 2010

Wrexham: 4th quarter 2011

Flintshire: 4th quarter 2011

Gwynedd: 4th quarter 2011

Anglesey: 4th quarter 2011

Although not an exact prediction, this indicates that four of the six counties are near the end of the 21CN roll-out programme.

It should be emphasized that the roll-out of 21CN will help to grow the national public IP network that will support the continued expansion of broadband everywhere, including North Wales. The fact that 21CN is not scheduled to be implemented in the Region until 2011 will not detract from the recommended action to exploit broadband technology to deliver new telecare services in North Wales between now and 2011.

7. Glossary

Term / Acronym	Description
TMC	Telecare Monitoring Centre
IP	Internet Protocol – a procedure for packets of information to be routed across an internet-like network.
PSTN	Public Switched Telephony Network – an acronym that now represents the older form of the telephony network, where voice calls were switched mechanically or electronically from source to destination.
Broadband	The common name for fast IP-based communications at home or at work, typically offering fixed-line speeds of up to 2 Megabits per second from the network and 256 kilobits per second into the network. Usually connects to the Public Internet or a private network using the Internet Protocol.
DSL	Digital Subscriber Line – the term for the technology required to provide broadband connections over existing copper wires, sometimes with another letter (A, S or V) to denote a variant.
VoIP	The use of IP-based communications to carry voice traffic, thereby largely avoiding the use of the existing telephone network.
PBX	Private Branch Exchange – the term for a telephone switch usually in a private premises which allows for management of extensions and other call services.

Term / Acronym	Description
LAN	Local Area Network – the term for a packet-based network, usually in a home or small business, which allows computers and peripherals to communicate, usually at a rate between 10 Megabits per second and 100 Megabits per second.
Ofcom	The Regulatory Body for the communications sector.
USO	Universal Service Obligation – a set of basic minimum obligations made by Ofcom upon BT (and Kingston Communications in Hull) to provide a range of services at uniform cost and universal availability.
21CN	BT's abbreviation for its "21st Century Network", which is a programme to migrate from the PSTN towards an all-IP based national network.

8. REFERENCES

[1] http://networks.silicon.com/telecoms/0,39024873,39161426,00.htm

[2] http://news.zdnet.co.uk/communications/0,1000000085,39285171,00.htm

[3] In www.voip.org.uk and http://www.ofcom.org.uk/media/mofaq/telecoms/voip_faq/

[4] http://www.btplc.com/21CN/

[5] http://www.orange.co.uk/time/broadbandaccess/

[6] http://www.cisco.com/en/US/products/sw/voicesw/ps556/index.html

[7] http://www.nortel.com/solutions/providers/enabling_tech/voip/index.html

[8] http://www.bt.com/index.jsp (then "Corporate Services" and "IT networks" for a list of relevant products and services)

[9] www.mxdigital.co.uk

[10] As reference [2]

[11] http://www.btplc.com/age_disability/phoneservices/commitment/legal/index.htm

[12] Philips Electronics NV, prospective product "In Touch", reviewed along with other new concepts in http://www.gadgetcentre.com/news/article/mps/UAN/614/SP/632603678977448381276/v/3

[13] For example; http://www.paramountzone.com/picasso-digital-photo-frame.htm

[14] http://en.wikipedia.org/wiki/BT_21CN

[15] http://www.btplc.com/21CN/

Other Useful Links:

- Amcat_Exploring_VOIP_Whitepaper_05_r1.pdf from www.amcat.com
- www.bris.ac.uk/poverty/wales_files/NHS-RAR_5.pdf
- www.pure-ip.com
- www.statistics.gov.uk/census/
- http://www.internettelephonecalls.co.uk/
- http://www.computerweekly.com/Articles/2006/11/27/220221/managed-and-hosted-voip-muddling-through.htm