

# Feasibility Study: Telecare in Scotland Analogue to Digital Transition

## Product 1 Report

NHS 24, Scottish Centre for Telehealth and Telecare



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## 1. Executive Summary

The Scottish Government, via The Scottish Centre for Telehealth and Telecare, has commissioned FarrPoint to undertake a feasibility study to investigate the transition of Telecare within Scotland from analogue to digital technology. This is a constituent part of a wider Technology Enabled Care Programme aligned with the National Telehealth & Telecare Delivery Plan aiming to enable greater choice and control in healthcare and wellbeing services for an additional 300,000 people by March 2016, enabling more citizens to remain at home and in their communities.

This study relates to Workstream 5 within the Technology Enabled Care Programme:

- **Workstream 5: Exploring the scope and benefits of switching current provision of Telecare from analogue to digital Telecare.**

In completing the overall feasibility study, a number of staged products were agreed as deliverables:

- Product 1 - Evidence Base and Profile;
- Product 2 - Implementation Guide and Cost Benefit Analysis;
- Product 3 - Trial Site Design.

This report details the findings of the first Product, examining the transition of Telecare in Scotland from analogue to digital. The Product has audited the current digital status of Telecare solutions in Scotland and has examined the potential benefits that a move to digital Telecare may deliver.

Prior to examining the benefits and practicalities of moving Telecare from analogue to digital, it is important to first define what is meant by Digital Telecare. For the purposes of this study FarrPoint has developed the following definition of Digital Telecare:

*A Telecare solution is considered to be Digital if it carries information end-to-end, from sensor / monitor, to the Alarm Receiving Centre agent's workstation / telephone in a digital form without any conversion occurring. In technical terms, this means that data will be carried end-to-end using Internet Protocol (IP) format.*

To establish the current digital status of Telecare solutions in Scotland questionnaires were sent to all ARCs that are operated by, or on behalf of, Scottish public bodies. 81%



of questionnaire responses were received. The responses are consistent with those received by SCTT and JIT in previous, similar exercises. Headline findings are that:

- it is estimated that there are 22 ARCs delivering telecare solutions for, or on behalf of, Scottish public bodies;
- it is estimated that 38% of ARCs are providing services for more than one public body;
- the 22 organisations that provided questionnaire responses are serving a total of approximately 153,000 subscribers and receive around 4 million incoming Telecare alarm calls per annum. These calls are answered by a total of 256 full-time equivalent agents, an average of 12.8 agents per ARC;
- Tunstall is the dominant provider of Telecare ARC solutions, being used by 12 respondents. Jontek and Chubb solutions are used by two and three respondents respectively. The remaining respondents use other solutions. The ARC solutions deployed vary in their age and software release;
- a range of suppliers' controller and sensor/monitor equipment is used, although there are examples of some providers using a single provider's equipment for their ARC system and all controllers, sensors/monitors.

No Scottish Telecare solution currently meets the definition of digital Telecare. There are examples of deployments based on digital technology, for example geofencing and video camera use, but these are limited in scale and number and tend to be deployed as standalone solutions, separate to the main Telecare systems. A number of Telecare providers are currently starting the process of procuring new ARC solutions and are considering solutions that offer a greater degree of digital capability than used at present, however, these procurements are in the early stages and no decisions have yet been made on the nature of the new solutions that will be delivered.

The range of supplier equipment and age of the current Scottish Telecare systems is a factor that will need to be considered in the next Product of this study when the high level implementation guide for digital Telecare is developed. The fact that ARCs are starting from different positions, with some more 'digital ready' than others will mean that there are a number of challenges in developing a single standard approach for the deployment of digital Telecare.

Telecare providers would currently struggle to procure a Telecare solution that met the above definition of digital Telecare and delivered all of the potential benefits identified.



This is because none of the larger suppliers currently offer an end-to-end digital solution, although some are closer to being able to offer this than others. Lack of customer demand, and the absence of recognised standards for digital Telecare, are factors contributing to this situation. This is another factor that that will need to be considered as part of the high level digital Telecare implementation guide produced in the next Product of this study. It is clear that a direct move to a fully digital Telecare solution is probably not viable, and an approach based on an incremental digital deployment is more likely to be appropriate.

This incremental digital deployment approach is being used in Sweden. The initial focus of digital Telecare has been the shift to digital connection between in-home controllers and the ARC. This is to address the reliability issues experienced following the main Swedish telecom provider's shift to using digital technology in their core networks, and the end of their obligation to provide analogue exchange lines. This shift from analogue exchange lines meant that there was a compelling event driving the need to adopt digital Telecare. There are currently no similar plans for the decommissioning of analogue phone lines in the UK, however, there are reports that BT is seeking this issue to be included within the scope of the Digital Communications Review currently being completed by Ofcom, and so this is an area that should be monitored.

Currently 40,000 of Sweden's 220,000 Telecare subscribers have been shifted to this digital technology. The initial focus of the digital Telecare rollout has been on subscribers in rural areas as the Swedish telecoms provider is decommissioning analogue exchange lines in these areas first. Given the incremental deployment of digital technology, the current Telecare solutions in Sweden do not meet the definition of digital Telecare.

The experience from Sweden, along with the discussions held and questionnaire responses received from Scottish Telecare providers, have allowed a range of potential benefits of digital Telecare to be identified. These potential benefits fall into four main themes:

- **Reliability** – Potential benefits relating to improving the reliability and quality of Telecare services, or ensuring the continuity of Telecare;
- **Efficiency** – Potential benefits relating to improving the efficiency of Telecare. These relate both to efficiencies gained through improvements in delivery



methods and utilising increased sharing of information/partnership working to broaden services;

- **Additional Functionality** – Potential benefits obtained by using digital technology to deliver new Telecare functionality and services;
- **Telehealth** – Potential benefits obtained by using digital Telecare technology to support the delivery of Telehealth services.

At this stage of the study, potential benefits have been identified by FarrPoint, but no further analysis of them has been completed. The Cost Benefit Analysis completed in Product 2 of this study will establish the value and viability, or otherwise, of each of these potential benefits.

A number of the potential benefits identified relate to the additional capacity, flexibility, and future-proofing that digital Telecare could deliver. These reflect the fact that digital Telecare provides an enabling platform which could be used to deliver change and a range of new services and applications, and not just those directly related to Telecare. The nature of this change is not currently fully understood, and is, to a large degree, dependent upon the output from the other four Workstreams of the Technology Enabled Care programme. Programme-level co-ordination will need to ensure that the Workstreams take account of each others' findings and that cross-dependencies and potential overlap in business cases is identified. It is likely that costs identified in the Digital Telecare business case will act as an enabler for benefits delivered other Workstreams. For example, using the digital Telecare connection to subscribers' homes could also support the delivery of video-conferencing (Workstream 2) or home health monitoring (Workstream 1) services.



## 2. Introduction

### 2.1 Background

The Telehealth and Telecare National Delivery Plan from the Scottish Government, CoSLA and NHS Scotland, sets out the vision and direction for a Scotland in which the use of technology will be integrated into healthcare development and delivery, to transform access and availability of services in our homes and communities.

Technology-enabled care is vital to the successful delivery of this vision. In support of this, the Scottish Government has launched a three year Technology Enabled Care Development Programme comprising five related workstreams:

- **Workstream 1: Expansion of home health monitoring** as part of integrated care plans to move beyond the small/medium scale initiatives that have been introduced in a small number of areas to substantial programmes across Scotland, building on the United4Health programme;
- **Workstream 2: Expanding the use of video conferencing** using the experience of the NHS video conferencing systems to enable partner organisations across all health and social care sectors to participate and benefit, as well as growing its use for clinical/practitioner consultations;
- **Workstream 3: Building on the emerging national digital platforms** of Living it Up and ALISS to expand supported self-management information, products and services for Scottish citizens. This will include direct access to advice and assistance for the public through use of home and mobile technology as well as 'second line' support for clinicians and staff who need to use complementary technology and who access and share information from telehealth and Telecare devices;
- **Workstream 4: Expanding the take up of Telecare**, with a particular focus on upstream prevention, support for people at transitions points of care and people with dementia and their carers;
- **Workstream 5: Exploring the scope and benefits of switching current provision of Telecare from analogue to digital Telecare.**

FarrPoint was awarded the contract for Workstream 5. This feasibility study report is the first deliverable of Workstream 5.





## 2.2 Scope of the Workstream 5 Feasibility Study

The purpose of Workstream 5 is to explore the scope and benefits of switching the provision of Telecare in Scotland from analogue to digital.

There are three Products within this Workstream, all of which are presented in this report.

- **Product 1: Evidence Base and Profile**

Product 1 creates a clear definition for Digital Telecare services in Scotland, and presents information on the existing profile, i.e. the degree of progression towards that definition that has already occurred. Additionally, the potential benefits that Digital Telecare may offer are recorded for further analysis and review in Product 2.

- **Product 2: Implementation Guide plus Cost Benefit Analysis**

Product 2 presents a high level implementation roadmap for organisations seeking to make the transition to Digital Telecare, along with a detailed cost benefit analysis for Digital Telecare using potential benefits identified in Product 1.

- **Product 3: Trial Site Design**

Product 3 designs a number of trials to be established in March 2016 and conducted in 2016/17 to collate additional evidence and best practice for moving from analogue to Digital Telecare. The trial will aim to prove the robustness of the cost benefit analysis and implementation guide from Product 2.



### 3. Definition of Analogue and Digital Telecare

Prior to examining the benefits and practicalities of moving Telecare from analogue to digital it is important to first define what is meant by these terms.

The following sections provide a high level overview of the components that comprise a typical analogue Telecare solution, a potential Digital Telecare solution, and a definition of 'Digital'.

It is important to note that the topologies presented in this section are example solutions provided only to highlight the main system components. In reality the Telecare solutions currently deployed in Scotland use products from a range of suppliers; may be integrated with other corporate IT systems; and will be of varying ages. It is also important to note that the two examples represent two extremes: wholly analogue and wholly digital. In reality there are a range of potential hybrid solutions between these two positions containing both analogue and digital components.

Generic terms are used for each of the system components, rather than specific product names used by manufacturers.

#### 3.1 Example Analogue Telecare Solution

Figure 3.1 shows a typical high level topology of an analogue Telecare solution.

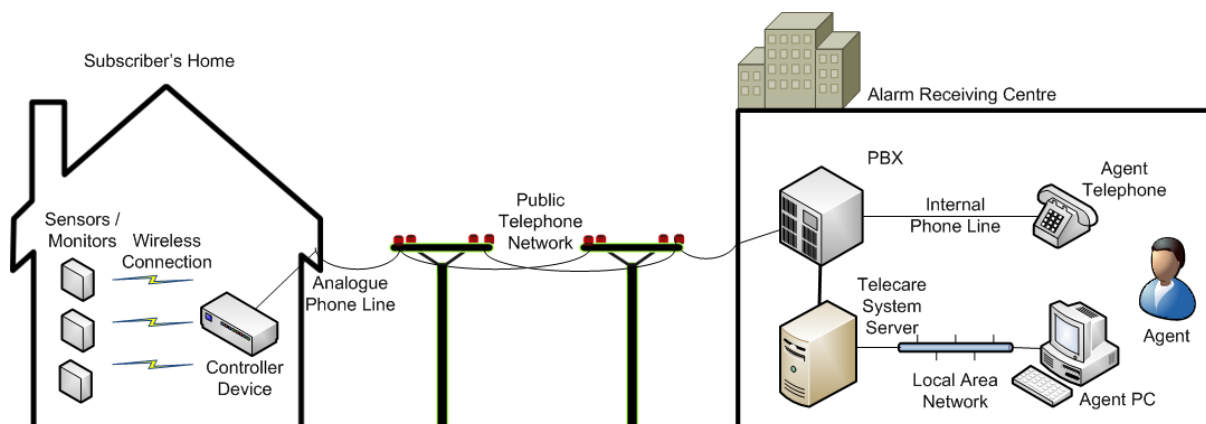


Figure 3.1: Example Analogue Telecare Solution (source: FarrPoint)

There are three main elements to the solution, each of which contain a number of components:

- The subscriber's home;



- The public telephone network;
- The alarm receiving centre.

### **The Subscriber's Home**

The key component within a subscriber's home is the **controller unit**. This is responsible for receiving alerts from a variety of sensors/monitors in the home and communicating with the alarm receiving centre. Controller units are typically located on a table, or are wall mounted, and require connection to power and a telephone line.

A range of fixed or mobile **sensors/monitors** can be located in the home alerting to a range of conditions such as smoke, flood, bed occupancy, fall detection and mobile alarm pendants. Typically, sensors connect to the controller unit using a short-range radio frequency band reserved for Social Alarms / Telecare systems, at 869MHz. Sensors can also be wired to the controller unit, which is more common in sheltered housing complexes than single houses due to the increased costs of fixed cabling.

When a sensor/monitor is triggered, either through reactive monitoring (i.e. smoke alarm) or via manual intervention (i.e. pressing the call button on a pendant), it sends a signal to the controller device. The controller then makes a telephone call to the alarm receiving centre using a pre-programmed number. When the call is answered by the alarm receiving centre, the controller transmits information on its identity (i.e. where the call is coming from) and the details of the sensor alarm that has triggered (i.e. why it is calling).

The controller device is connected to a standard **analogue phone line** in the subscriber's house. This is usually the subscriber's existing telephone line as there is not normally a need for a dedicated phone line to be installed. Typically, the controller device communicates with the equipment in the alarm receiving centre using **Dual Tone Multi-Frequency (DTMF) signalling**, or proprietary (manufacturer specific) variants of this signalling. DTMF is a signalling technique that dates back to the 1960s and allows information (digits) to be sent over a telephone connection using a combination of audible tones of different frequencies. DTMF signalling is a wholly analogue solution able to transmit only very basic information; essentially numbers on a telephone keypad.

Once the controller device is connected to the alarm receiving centre, if required, the agents in the receiving centre can use the connection to talk to the subscriber. The



controller device can contain a speaker/microphone to allow this, or a dedicated speaker phone may be used.

### **The Public Telephone Network**

Calls between the controller unit in a subscriber's home and the alarm receiving centre are carried over the public telephone network (also often referred to as the **Public Switched Telephone Network, or PSTN**).

In reality the public telephone network is a number of interconnected networks owned by many suppliers. This means that a subscriber can rent a telephone line (also called an Exchange Line) from one supplier, and make calls to someone on another network. Historically British Telecom (BT) was the sole supplier of telephone lines in the UK, however, these are now available from a number of suppliers such as Virgin Media, TalkTalk, and Sky.

Any calls made by a subscriber will be carried to the nearest telephone exchange (or data centre) as an analogue signal. Once the call reaches the exchange it will be converted into a digital form to allow it to be sent over the supplier's internal network. Increasingly the digital standard used on the network is **Internet Protocol (IP)**, being the same standard that is used to send information over the Internet. Many of the newer telephone networks have used IP to carry telephone calls since they were installed. In the case of BT, it is in the process of completing its transition to IP as part of its 21<sup>st</sup> Century Network (21CN) refresh programme.

Once the call reaches the intended destination (the called number), it is converted back into an analogue form and is delivered to the telephone line of the recipient.

The key point to note is that although the subscriber is making a call over an analogue phone line, the call is primarily carried in digital form over the telephone network without the parties being aware of the conversion(s).

### **The Alarm Receiving Centre**

Calls from a subscriber's controller unit are received at the **Alarm Receiving Centre (ARC)**. The calls are answered by a telephone switch (called a PBX or Private Branch Exchange) and delivered to a server (computer) that provides the Telecare call handling system.



Typically, on receipt of a call from a remote controller unit, the ARC call handling system will automatically answer the call and exchange DTMF tones with the subscriber's controller unit. Using its internal database of subscribers and alarm sensor codes, the ARC system will be able to identify the subscriber and the reason for the call. This allows an incident to be triggered in the handling system to be answered by an agent.

Depending on type of ARC system in use at the monitoring centre, alarms will be prioritised and dealt with using a set of protocols or guidelines. Some alerts received may be automated and maintenance related i.e. low battery conditions within sensors.

### 3.2 Example Digital Telecare Solution

Figure 3.2 shows a typical high level topology of a Digital Telecare solution. It should be noted that this topology is very similar to that of the analogue. The main difference (which cannot be shown in the diagram) is not the number and/or location of system components, but in the protocols that they are using, further details on these protocols are provided below.

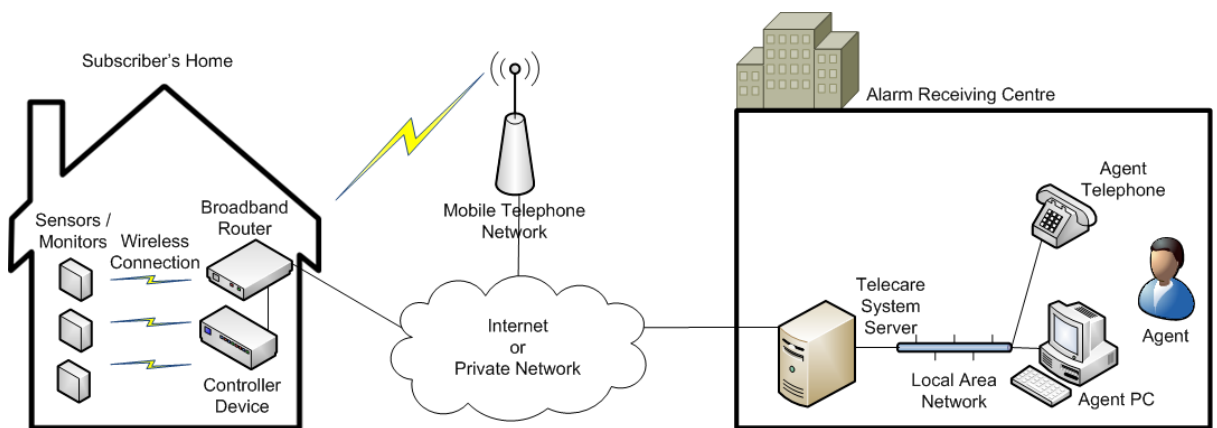


Figure 3.2: Example Digital Telecare Solution (source: FarrPoint)

#### The Subscriber's Home

Within the subscriber's home in a digital model, components are very similar to that of analogue in that much the same functions are required. Controller units are typically located on a table, or wall mounted, and require connection to power and either a **broadband connection** and/or will have a SIM to connect to the **mobile telephone network**.



A range of fixed or mobile **sensors/monitors** can be located in the home alerting to a range of conditions such as smoke, flood, bed occupancy, fall detection and mobile alarm pendants. Connection to the controller can either be as for analogue (i.e. radio or hard wired) or use digital technologies such as Bluetooth or WiFi. The benefit of digital technologies is that they allow more content/information to be exchanged with intelligent sensors and can be “two way” which allows for interrogation.

When a sensor/monitor is triggered, either through reactive monitoring (i.e. smoke alarm) or via manual intervention (i.e. pressing the call button on a pendant), it sends a signal to the controller device. The controller device is very likely to be always on-line and connected to the ARC, or a number of ARCs, so a near instantaneous exchange of messaging can take place (i.e. there is no need for the controller to dial an ARC as in the analogue model, which can take up to two minutes). As the capacity of the communication medium being used is much higher than with the analogue model, more information can be exchanged between the controller unit and the ARC, for example the alarm, status and likely causes.

The controller device is connected to a **Broadband Line** in the subscriber’s house or a **Mobile Telephone Network**. In the case of broadband line this could potentially be an existing line already being used by the subscriber, or a dedicated line for Telecare purposes. For a unit connected to the mobile telephone network, a dedicated SIM is used to connect to the network and data is transmitted in the same way that a smart phone connects to the Internet.

Agents in the alarm receiving centre can use the connection to the controller device to speak to the subscriber, if required. This can be achieved using digital voice, similar to technology used by services such as Skype or FaceTime. As with the analogue model, the controller device can contain a speaker/microphone to allow this conversation, or a dedicated speaker phone may be used. Given the higher data capacity of the digital link between the subscriber and the alarm receiving centre, other means of communication with the subscriber are possible, for example video calls could also be held with subscribers where suitable screens/cameras are available.

### **Internet or Mobile Network**

The digital communications link between the subscriber’s home and the alarm receiving centre is most likely to be provided using a standard consumer **Internet** (broadband)



service from one of a number of providers such as BT, Virgin, TalkTalk, Sky, etc. These connections provide high speed, always on IP connections to the Internet.

As data from the subscriber's home is carried over the public Internet it is likely that data encryption will be used to maintain privacy. To ensure the security of the alarm receiving centre, it is likely that security devices (firewalls) will also be used.

As an alternative to connections being carried over the Internet, it is possible that a subscriber's home could be connected to a **Private Data Network**. Under this approach the organisation operating the alarm receiving centre (such as a Council) would connect the subscriber's home to a private network meaning that data is sent directly to the alarm receiving centre, without it being carried over the Internet. This type of connection, whilst more secure than the Internet connection, would attract additional costs. In addition this approach would raise a requirement to ensure that Telecare data was kept separate from data traffic from the wider corporate use of the network. Issues such as PSN compliance for the corporate network are likely to be considerations when developing these security arrangements.

As a further alternative approach, the connection to the subscriber's home could be provided over a mobile telephone network. This is particularly useful where a subscriber does not have an existing telephone line or broadband service, or where a connection is only required on a temporary basis. To use this method, the controller device in the subscriber's home would be fitted with a SIM card to allow it to connect to the mobile network. The controller device would then use this mobile connection to send data to the alarm receiving centre over the mobile network and the Internet (in the same way that a smart phone browses the Internet). The data capacity of the mobile telephone connection is dependent on the type and strength of signal available in the subscriber's home. The lowest data capacity would be provided by GSM/GPRS/EDGE connections, with higher capacity being offered by later **3G and 4G** generations of mobile coverage. Note that 4G can potentially offer similar levels of data capacity to a 'wired' broadband service. Given Scotland's geography mobile coverage and speed is likely to be an issue in the more rural areas.

### **The Alarm Receiving Centre**

In a digital model the ARC equipment will be very similar, if not identical, to that in the analogue model as many modern systems already have the ability to accept inputs in both forms.



The main difference is that an analogue telephone switch is not required in the ARC as there is no requirement for the system to answer analogue telephone calls. As connections and conversations with subscribers are fully digital these can be handled by the Telecare server itself.

### 3.3 Definition of Digital

It is important that the term 'Digital' is clearly defined prior to the report presenting the extent to which it currently exists in Scotland, and how Telecare could further utilise digital technology.

The example described in Section 3.1 presented a fully analogue system. In reality organisations using a solution very similar to this can describe it as being partly digital, because there are elements that are digital and manufacturers describe their solutions as 'digital'. Specific examples of Digital elements within Analogue designs include:

- Alarm Receiving Solutions are often marketed as being digital, either because they run on computer servers and software (which are inherently digital), or because they can interface with digital/IP telephone networks, or other systems, in the alarm receiving centre.
- Instead of the alarm receiving centre connecting to the public telephone network using analogue phone lines, 'digital' phone lines, such as ISDN30 (Integrated Services Digital Network) can also be used.

As will be seen later in this report, the examples above do not deliver the benefits of moving to digital Telecare and so there is a need to define 'Digital' in such a way to distinguish between these 'partly-digital' elements within an analogue solution, and 'true' digital.

For the purposes of this study we define 'Digital Telecare' as follows:

**A Telecare solution is considered to be Digital if it carries information end-to-end, from sensor / monitor, to the Alarm Receiving Centre agent's workstation / telephone in a digital form without any conversion occurring. In technical terms, this means that data will be carried end-to-end using Internet Protocol (IP) format.**





## 4. Current Scottish Telecare Profile

### 4.1 Methodology

A key part of Product 1 is to establish the current status of the Alarm Receiving Centres operated by, or on behalf of, public bodies in Scotland. The organisations that operate ARCs are primarily Local Authorities or health partnerships and housing associations. In some cases, multiple organisations operate an ARC in a given geography, and there are examples of organisations sharing an ARC.

JIT/SCTT completed an audit of ARCs in October 2012 and found 19 ARCs operating across Scotland<sup>1</sup>. To establish the current status of Telecare services, this audit exercise was repeated by FarrPoint. The existing ARCs were sent a questionnaire that sought to obtain information on the current position, developments planned and benefits/issues foreseen.

In order to explore the Digital aspects of Telecare, the questionnaire asked a range of questions covering current status, particularly type of ARC (own or provided externally), services offered, supplier, model of system, refresh cycle, capability to accept digital/analogue alarms, number of lines and full time equivalent agents, number of incoming calls, and others. The questionnaire also asked about plans to develop additional services or transition to Digital.

The questionnaire was sent to 27 potential Telecare suppliers in June 2015. Contact details for each of the organisations were provided by JIT.

The initial deadline for reply was 26th of June 2015, however due to limited responses further reminders were made by email and telephone in order to attempt to increase participation. Of the 27 bodies approached 22 replies were received (an 81% response rate).

A summary of the organisations issued with a questionnaire plus response status is contained in Figure 4.1.

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<sup>1</sup> "Alarm Monitoring and Response Services in Scotland", Doreen Watson and Tony O'Sullivan, October 2012.



Organisation	Questionnaire Response Received?
Aberdeen City Council	No
Angus Council	Yes
Appello (formerly Careline )	Yes
Astraline	No
Bield HA	Yes
Communicare247 (formerly Argyll Telecoms )	Yes
Cordia LLP	Yes
Dumfries & Galloway Council	Yes
Dundee City Council	Yes
East Ayrshire Council	Yes
East Dunbartonshire Council	No
East Lothian Council	Yes
East Renfrewshire Council	Yes
Edinburgh City Council	Yes
Eldercare	No
Falkirk Council	Yes
Fife Council	No
Hanover Telecare	Yes
Highland Council	Yes
North Lanarkshire Council	Yes
Perth & Kinross Council	Yes
Scottish Borders Council	Yes
South Ayrshire Council	Yes
South Lanarkshire Council	No
Stirling Council	Yes
West Lothian Council	Yes
Western Isles Council	Yes

Figure 4.1: Summary of Questionnaire Responses (source: FarrPoint)

The remainder of this section presents a summary of the key points obtained from the responses.

Appello and Communicare247 between them serve around 200,000 subscribers. However, these two organisations provide limited or no services for the Public Sector. Given this, to avoid skewing subscriber numbers, etc., their responses are not included in the some of the analysis in the remainder of this section.



## 4.2 Summary of Current Telecare Provision in Scotland

Responses to the Telecare questionnaire were not received from all organisations, and so it is not possible to state definitively how many organisations are delivering Telecare in Scotland. However, the previous survey completed by SCTT/JIT in 2012 found 19 ARCs being operated for, or on behalf of Public Bodies in Scotland. Three organisations not identified in the previous study responded to our questionnaire indicating that they delivered Telecare services (The Highland Council, Scottish Borders Council, Appello). If it is assumed that the previously identified 19 Telecare providers continue to deliver Telecare services, then this leads to an estimate that **there are currently 22 organisations delivering Telecare services on behalf of Scottish Public Bodies**. There are a further four organisation who were not identified as a Telecare provider in 2012 and have not provided a response to our questionnaire, this means that the current Telecare providers could be as high as 26.

Using information obtained from the 2012 survey of ARCs, of the 13 public sector owned/operated ARCs for which we received responses, it is estimated that 5 (38%) are shared facilities that provide services to more than one organisation.

A summary of some of the key metrics captured from the responses received are contained in Figure 4.2. As can be seen, the 20 ARCs serve a total of around 153,000 subscribers and receive approximately 4.0 million incoming Telecare alarm calls per annum. These calls are handled using a total of 240 full-time equivalent agents (an average of 12.8 FTE agents per ARC).

Organisation	Full Time Equivalent Agents	Incoming Telecare Alarm Calls Per Annum	Number of Subscribers
Angus Council	10	N/A	2,700
Bield Housing	25	408,000	12,800
Cordia LLP	26	480,000	22,900
Dumfries and Galloway Council	8.31	145,519	3,900
Dundee City Council	16	179,000	6,000
East Ayrshire Council	22	220,000	4,000
East Lothian Council	13.5	171,000	5,500
East Renfrewshire Council	18	130,000	2,085
Edinburgh City Council	9	280,000	8,500
Falkirk Council	11	142,000	5,000



Organisation	Full Time Equivalent Agents	Incoming Telecare Alarm Calls Per Annum	Number of Subscribers
Hanover Telecare	24	882,000	42,000
Highland Council	2	48,000	5,582
North Lanarkshire Council	19	400,000	14,600
Perth & Kinross Council	4	79,000	3,450
Quarriers	7	N/A	N/A
Scottish Borders Council	8	73,927	2,666
South Ayrshire Council	2	90,000	2,000
Stirling Council	11	158,060	3,882
West Lothian Council	13.5	177,868	5,000
Western Isles Council	6.6	22,700	870
<b>Total</b>	<b>255.9</b>	<b>4,087,074</b>	<b>153,435</b>

Figure 4.2: Summary of Key Metrics from Questionnaire Responses (source:FarrPoint)

### 4.3 Summary of Current Technology in Use in Scotland

Figure 4.3 summarises the ARC solutions currently in use by the organisations that provided a response.

ARC Solution	Number of ARCs
Tunstall PNC5	1
Tunstall PNC6	5
Tunstall PNC7	1
Tunstall (version not stated)	5
Chubb Saturn	3
Jontek 3G	2
Others	3

Figure 4.3: Summary of ARC Solutions Currently in Use in Scotland (source:FarrPoint)

The results show that most organisations are using Tunstall ARC equipment, either PNC5, PNC6 or PCN7 (the latter being the latest software release from Tunstall). There are also systems from Chubb and Jontek in use.

All of the ARC solutions in use allow third party monitors/sensors from a range of manufacturers to be used, although some technical limitations do apply. From the questionnaire results, a small majority of ARCs use monitors/sensors from various manufacturers, with others exclusively using a single supplier (Tunstall).



Manufacturers of monitors/sensors include:

- Tunstall;
- Tynetec;
- CareTech;
- Possum;
- Just Checking;
- Buddi;
- Chubb.

Of the above, the most widely used is Tunstall.

The sensors provide a wide range of monitoring including, but not limited to: community alarms, Telecare responders, gas, flood, CO2 and bed monitors, door contacts, incontinence monitors, temperature sensors, fall detectors, automated key safes, intruder, fire, panic and lone worker alarms.

The frequency with which monitors/sensors are replaced by ARCs varies, although most replace equipment as batteries expire or equipment fails. This means that equipment is typically replaced every 5-10 years.

The majority of sensors/monitors are analogue devices. In addition to these there are some digital devices in use, for example Just Checking, Safer Walking GPS devices, CCTV monitoring, etc. These devices tend to be provided using solutions separate to the main ARC solution (i.e. they are standalone solutions).

#### 4.4 Current Use of Digital Telecare Solutions in Scotland

None of the public bodies that provided questionnaire responses stated that their ARC was digital. From examination of the questionnaire responses, FarrPoint concurs that **at present no Scottish ARC meets the definition of Digital Telecare.**

There are some examples of digital technology being used at some ARCs, however, these tend to be small-scale applications that are not integrated into the main ARC solution. Other than these small-scale digital deployments, **all current Scottish ARCs are wholly analogue solutions.**

Eight of the responses received stated that organisations had ambitions to move to digital solutions. Of these, East Lothian and Falkirk Councils are beginning the procurement process for replacement ARCs and are actively considering digital/ hosted solutions.

Although not directly relevant to this public sector ARC analysis, it is interesting to note that two of the private sector ARCs that provided responses (Appello and



CommuniCare247) either partially or wholly meet our definition of a digital Telecare solution. Appello operates a hybrid solution able to accept connections via either analogue or digital technology whereas CommuniCare247 only accepts digital IP signals.



## 5. Case Studies

In this section we present an overview of a number of Case Studies demonstrating how alarm receiving centres currently operate in Scotland and how digital technology is deployed in Telecare elsewhere.

The Scottish examples are from City of Edinburgh Council and Bield Housing, representing two of the largest Telecare operations nationally in the public sector.

The example of a digital solution is from Sweden, recognised as having one of the most advanced Telecare deployment's in Europe.

### 5.1 City of Edinburgh Council

City of Edinburgh Council operates a 24x7 alarm and response service manned by Council staff for a subscriber base of 8,500 individuals within the city.

As part of the Council's "Technology Enabled Care" service, the ARC works with a response team who visit subscribers' homes where required. The Council also has a team responsible for the installation and maintenance of Telecare equipment in subscribers' homes.

The Council uses a JonTek ARC and a standardised range of Telecare monitors/sensors in subscribers' homes, from Possum, Tynetec and Chubb. In addition to home-based monitoring, the Council offers a geofencing service, although this service is operated on behalf of the Council by Bield Housing.

The Council's ARC receives 300,000 calls per annum and in 2014/15 9,000 of these calls resulted in a requirement for the response team to visit the subscriber's home. Of these visits, approximately 200 resulted in an unscheduled hospital admission.

47% of subscribers pay for their Telecare service themselves, with typical costs between £300 and £400 pa including installation and operation. Subscribers also provide their own telephone line. In addition to providing Telecare services for its own subscribers, the Council also provides services for a number of housing associations with properties in the city.



The ARC is staffed by dedicated agents with numbers varying during the day. During the peak call period (0700-1000), there are typically two agents taking alarms/calls, and another two agents calling subscribers in response to inactivity alarm triggers.

In the event of an alarm being triggered, or unusual activity being noticed, the ARC agents can schedule a visit from the response team, or alternatively can call the subscriber's GP, or a family member.

The ARC has performance targets for the time taken to answer an alarm call. These are based on the Telecare Services Association standard that all calls are answered within 60 seconds. In addition to this, the Council has a target of 45 minutes for its response team to attend at a subscriber's home in the event of an alarm call requiring a visit.

Communications between the ARC and subscribers' homes are currently exclusively analogue and almost all use subscriber's existing analogue phone lines. There are a small number of deployments that use mobile/GSM connections to cover scenarios where subscribers do not have a phone line or where Telecare is being installed on a temporary basis. An ISDN30 connection is used to deliver calls to the ARC.

The Council has recently upgraded its ARC software to provide the ability to interface with digital connections, although this functionality is currently not in use. The Council currently has no plans for a digital migration of its services

The ARC operates on a standalone computer network, separate to that used by the rest of the Council. The Council has a standby ARC located in a separate location to be used in the event of its primary ARC becoming inoperable.

The performance of the Telecare solution is generally very good, however, there have been reports of some issues relating to the audio quality of some calls and also of the reliability of calls made where subscribers use telephone providers who have 100% digital core networks (e.g. Virgin and TalkTalk). However, neither of these are seen as a significant issue and had largely been overcome.





### 5.3 Bield Housing

Bield Housing Association operates a 24x7 alarm and response centre under the name Bield Response 24 (BR24). The service has a subscriber base of 12,800 individuals. This comprises subscribers living in Bield's supported housing and subscribers who are provided with services by Bield on behalf of a number of local authorities and other housing associations.

The service handles an average of 50,000 calls per month; 30,000 of these being incoming alarm calls and 20,000 outgoing calls. The ARC does not have a response team of its own; in the event of an alarm call being received that requires a visit to a subscriber's home the ARC calls either the warden (in the case of the subscriber being a Bield resident) or the appropriate Council / housing association.

In addition to providing Telecare services, Bield also offer other services for its subscribers and third parties such as:

- Lone worker protection;
- Out of hours housing repair requests;
- Geofencing;
- "Sure call" voice broadcasting.

This latter 'Sure Call' service has resulted in a significant reduction in the amount of agent time that is spent making calls to subscribers. The service makes automated calls, or sends text messages, to subscribers, for reassurance calls, or to remind to take medication. Agent intervention is only required where a subscriber does not answer a call, or responds requesting a callback. Bield estimates that this feature has reduced the amount of staff time spent on this type of call from 70 hours to 35 minutes a day (a development manager in each of 70 developments previously spent an hour a day manually calling each resident, a review of residents needing this service, combined with the automation of calls has reduced the time required to 35 minutes total).

The service uses the Jontek 3G digital alarm receiving centre and a range of subscriber equipment from Tunstall, Tynetec, Chubb and Possum. All monitors/sensors connect to the alarm receiving centre using analogue telephone lines, although some alarms are also equipped with GSM connectivity for backup alarm continuity (although GSM



offers digital connectivity this is not used, instead the solution makes a dial-up call and sends analogue tones over the connection). At the ARC, connectivity is currently provided using 32 analogue telephone lines, however, there is currently a project underway to replace these with a single ISDN30 in order to reduce costs and improve sound quality on calls.

Bield is currently coming to the end of a five year systems and processes review. The conclusion for future development of its systems is that everything must eventually move to digital given the additional features this will provide. However its subscriber base is not yet ready for that step and it is Bield's opinion that there is a generational gap between those subscribers who would use the new features and those who would not. This aligns to a certain extent with their equipment refresh policy of 5-10 years.

When BT started developing its 21st century network in the early 2000s, Bield Housing upgraded all its social alarms to work on digital networks. This upgrade did not implement fully digital alarms but retained analogue alarms that could communicate over the new digital networks.

Bield are considering a development in consultation with the Scottish Fire and Rescue Service for remote control and reset of fire alarm panels in its housing complexes. The aim of this initiative is to be able to reset the panel to normal operation after an alarm and the attendance by the Fire and Rescue Service. This is due to a change in policy by the Fire and Rescue Service in that it will no longer perform the fire panel reset and instead requires the system owner or system maintainer to do so. It is highly likely this development will require IP connectivity from Bield's ARC to the fire panels in its complexes.

Bield also has another potential use case for digital in its housing complexes in the form of video cameras in common areas and lift entrances. These would reduce the number of false alarms from pull cords as currently these require attendance by wardens, which can lead to delay in response.

Bield has no firm plans for upgrading its Telecare system to digital technology.



## 5.4 Sweden's Experience of Digital Telecare

Sweden is seen as a leading country in Europe for Telecare, both in terms of the take-up of the service, and the use of digital technology in delivery. There are currently 220,000 Telecare subscribers in Sweden, of which 40,000 have transitioned to digital.

Social alarms (Telecare) became widespread in Sweden in the late 1980s as part of a larger plan to make social care preventive, rather than reactive.

The deployment was initially based on the same sort of analogue technology as currently used in the UK. However, in 2007, Sweden's largest telecoms provider, TeliaSonera, published its long term plans to decommission the analogue exchange lines and replace them with bundled broadband and voice over IP packages.

As part of this upgrade, TeliaSonera was also completing a process of upgrading its core network to become a "next generation network (NGN)" using IP based technology. This change generated concern from the Telecare industry as social alarms had not been designed to operate over these networks. In 2007 the Swedish media started reporting that the NGNs were having an adverse effect on social alarms, when a 76-year old man died 9 hours after a heart attack because his social alarm failed to connect via his telephone. The fact that the new infrastructure could not reliably support analogue based social alarms became a matter of public concern.

Public pressure, and the planned decommissioning of analogue exchange lines, prompted the government to start a programme to digitise social alarms and adapt to the new digital telecoms infrastructure.

An initial step changed the connectivity in subscribers' home from using an analogue phone line to GSM. However, this was found to be unreliable and so a true end-to-end digital connection method was sought.

As there was no standard technical protocol for digital social alarms (using IP), Sweden took the lead in developing an open and secured protocol for data transmission over the Internet called Social Care Alarm over IP (SCAIP) based on existing open Internet standards. The protocol was designed to accommodate both speech and alarm message codes and was completely open thus allowing manufacturers to develop their alarm controllers to this common standard.



Key advantages of the SCAIP protocol include the fact that alarm calls can be made even if the subscriber's phone is in use. The protocol also includes a regular exchange between the controller and the ARC every minute to ensure that the connection remains active and that issues such as equipment or power failure can be detected. This connection also allows real time statistical analysis to be conducted by the ARCs. The project has concluded that modern IP based social alarms have a 99.9% uptime when connected to a GSM network.

It should be noted that the SCAIP protocol currently only addresses the connection between the controller and the ARC. Within a subscriber's home, sensors/monitors are still analogue and so suffer from some of the associated limitations of this technology.

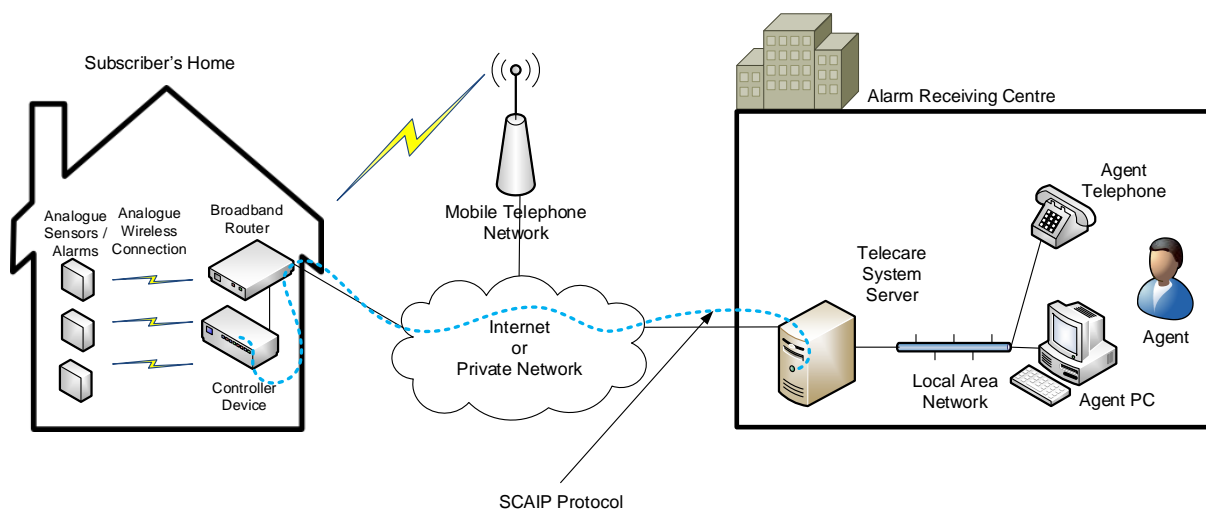


Figure 5.1: SCAIP Protocol (source: FarrPoint)

Sweden's Telecare services are provided by the 290 local municipalities, with the government being responsible for providing centralised advice and services. Following the development of the SCAIP protocol, a framework contract was let for a range of suppliers to provide equipment and services using the protocol. A total of 253 municipalities signed up to use this framework.

The scope of the framework was for suppliers to provide subscribers with the equipment and services they required to allow them to use Telecare. This included the Telecare equipment and the connection to the subscriber's house, using one of a number of GSM or fixed broadband providers. The suppliers on the framework retain ownership of the Telecare equipment, and as they are responsible for providing the



connection to the subscriber's home, this means that they retain full responsibility for resolving any issues with the Telecare service provided to a subscriber. Currently 40,000 Digital Telecare solutions have been deployed, with the rollout planned to continue until the end of 2016. The initial focus of the digital Telecare rollout has been on subscribers in rural areas as the Swedish telecoms provider is decommissioning analogue exchange lines in these areas first.

As part of the Swedish Government's framework contract, two call centres were also procured and municipalities are able to choose to have their subscriber's calls answered by these nationally provided call centres. Currently 165,000 subscribers' Telecare solutions (75% of subscribers) are monitored from these national centres.

Subscribers have not experienced an increase in service costs since the transition to digital began as installation costs are covered by the local municipality. They also cover the cost of the alarm and controller unit and loan it to the subscriber for the duration of their subscription. Service costs vary with a typical subscriber paying an average of 100kr (approximately £9.00) per month.

As a result of the shift to digital technology the Swedish Health Institution are carrying out a number of trials to test more advanced methods of Telecare including video monitoring of vulnerable subscribers, and video calling. However, it is noted that this facility is provided on a separate standalone system, rather than using the digital Telecare solution given the limited bandwidth currently supported on the digital solution.

The digital Telecare technology potentially allows information from subscribers to be shared more easily with a range of public bodies, although legal considerations mean that this has not yet progressed past a number of small-scale trials.



## 6. Market Direction and Technology

### 6.1 Telecare Equipment and Service Suppliers

In this section we provide a high level overview of the market for Telecare equipment and service suppliers. Although a number of suppliers are mentioned below, this section does not aim to provide an exhaustive analysis of all suppliers in the marketplace. In addition, we have deliberately avoided discussing detail on specific supplier's equipment/services and plans in order to avoid issues of commercial confidentiality.

There is a well-developed infrastructure for social alarm services in the UK provided by housing associations, local councils and private sector companies. The majority of local councils provide a social alarm scheme run by themselves or outsourced to a private sector organisation, however there is also a significant private subscriber market who receive alarm services directly from a private sector service supplier. Social alarm services are provided to those living in sheltered and ordinary housing.

As detailed in Section 4.3, alarm receiving centres in Scotland currently use ARC systems from one of three suppliers: Tunstall, Jontek, and Chubb. Some of these suppliers also manufacture controllers and sensors/monitors, whilst some only provide the ARC solution alone. All the ARC systems support, to differing extents, the connection of controllers and sensors/monitors from third party manufacturers. Within Scotland it was found that controllers and sensors/monitors from a range of manufacturers was in use, including:

- Tunstall;
- Tynetec;
- CareTech;
- Possum;
- Just Checking;
- Buddi;
- Chubb.

The choice of which controller and sensor/monitor is used for a particular requirement is dependent on compatibility with the ARC solution and cost. Aesthetics of the in-home/wearable devices also seems to be a factor that is becoming increasingly important to subscribers.



Although often marketed as being 'digital', current ARC solutions vary in their 'readiness' to accept digital connections from subscribers' homes. None of the solutions deployed in Scotland currently accept digital connections, and the degree of upgrade required to allow this to happen varies. Some older ARC solutions will require both software and hardware upgrades before they can commence the shift to digital, whereas some more modern solutions may require only a relatively minor software upgrade. There are solutions in the marketplace that support existing digital standards, such as the SCAIP protocol used in Sweden, where Neat and Caretech provide most of the equipment, however we found no current use of this technology in Scotland. Further detail on this digital technology change process will be provided in the results of Product 2 of this study.

Suppliers of both ARC systems and subscriber equipment are aware of the likely shift to digital technology and many are actively developing solutions to address this requirement. Similar to the experience in Sweden, initial efforts appear to be based on digitising the connection between the controller and the ARC solution, initially with these devices talking to existing analogue sensors/monitors. However, suppliers are also looking at the shift of sensors/monitors to digital using wireless technologies such as Wi-Fi, Bluetooth, and ZigBee.

The advantages of a shift to digital technology include:

- a significant improvement in both responsiveness and reliability of the connection between controller and the ARC;
- digital sensors/monitors can be regularly polled by the ARC to ensure that they remain connected and functional;
- an increase in the range and sophistication of sensors/monitors that can be connected;
- an increase in the range of applications and services that can be offered using the Telecare solution, including Telehealth applications and services.

Although the reason for the current lack of digital solutions in the marketplace can be open to debate, some suppliers highlighted the lack of demand from Telecare providers for digital technology. Other factors constraining the development of digital Telecare include:

- no existing British or EU standards for IP Telecare products;



- current analogue technology is both mature and stable;
- penetration of fixed and mobile broadband in Scotland (and the UK) does not yet match that of analogue phone lines;
- Limited penetration of Internet technologies amongst existing Telecare users (e.g. broadband and smart devices) with an associated lack of knowledge and confidence in using these.

Telecare suppliers are increasingly able to offer varying deployment models based on cloud (or hosted) solutions. Deployment models can vary: some offer a solution where the supplier provides the customer with access to a hosted Telecare solution, with calls still being routed to the customer's own agents. Alternatively a fully outsourced model could be used where the supplier answers the calls and alarms on the customer's behalf.

This hosted deployment model is primarily marketed on the efficiency and cost savings it offers. Hosted solutions provide services for a range of customers and so the costs are spread over a number of organisations, rather than falling wholly to an individual body. Where a call/alarm answering service is procured, the model can also offer efficiencies in terms of use of agents' time, particularly overnight when the number of alarms/calls are lower.

## 6.2 Social Alarm Standards and Protocols

Historically, Telecare manufacturers have utilised their own proprietary communications protocols, resulting in minimal interoperability from one system to another. BSI standard BS7369 was developed to overcome this and provide a signalling protocol to support the exchange of information regarding source and cause of the alarm between the alarm controller and the ARC. The introduction of next generation networks in the UK led to BS7369:1991 being declared obsolete by BSI.

The current standard protocol for Telecare in the UK is BSI standard BS8521:2009 which defines how alarm and identification data is sent over analogue telephone lines using Dual Tone Modulation Frequency (DTMF). BS8521:2009 also defines additional security and safety features such as remote door lock release. BS8521 is largely the same as BS7369 but includes an amendment to the timing used by analogue signalling protocols in order to allow them to more reliably communicate over telecom providers'





next generation networks. Other standards define regulated radio frequency bands for wireless analogue alarms (EN 300 220-2) and equipment performance (EN50134). The Telecare Services Association uses the EN50134 series of standards as the basis of its accreditation regime.

Sweden was one of the first countries to develop a standardised open protocol for IP-based Telecare (SS91100:2014) named the Social Care Alarm over IP (SCAIP) protocol. It was developed to provide an open, completely transparent, non-proprietary standard able to be used worldwide. The protocol is based on Session Initiation Protocol (SIP) which sets up a session in which voice, media and information can be streamed between the alarm controller and the ARC. It was published by the Swedish Standards Institute in 2014 and is currently being used in a high proportion of alarms in Sweden. This is set to increase as the transition from analogue to digital matures.

In the UK, the working group that developed BSI standard BS8521:2009 has continued development of Telecare communications and a new protocol for Telecare over IP has been developed: NowIP. The NowIP whitepaper was finalised at the end of 2012 and testing concluded that it will successfully operate over the UK telecommunications infrastructure. Currently, manufacturers Tynetec, Jontek, Verklizan and Green Access have tested the standard between their systems.

NowIP is a protocol that has been developed by the industry, but it is not currently an agreed standard. SCAIP is a Swedish standard, but has not yet been adopted as a standard elsewhere. This means that there is currently no UK or European standard for IP based Telecare. A European standard working group, led by representatives from Sweden, has been established to develop a European standard for IP Telecare, however, at present, the timescales for this standard being developed are unknown and it is thought unlikely that the standard will be available in the next three years.

### 6.3 Telecom Providers

As detailed in the previous Section, one of the key drivers behind Sweden's shift to digital Telecare was the decision by the country's largest telecom provider to move to digital connections to the home.



Bell Labs conducted research into PSTN Industry and Service Provider Strategies for BT in 2013<sup>2</sup>. An overview of the findings states that:

*“When considering wireline voice services only, the business case for large SPs [Service Providers] may not justify retiring PSTN assets and moving subscribers to next generation networks; revenues from triple-play or broadband access must be considered in order to justify the case to move a subscriber. This financial balance will change in the future as PSTN platforms approach End of Life (EoL) and operational expenses per subscriber line increase. For small SPs whose footprint in the telecom market is dominated by data and wireless services, the business case may already indicate that shutdown of PSTN would be beneficial.*

*Migration to next generation Broadband is seen as an inevitable end state, due to PSTN technologies reaching eventual EoL. In addition, PSTN subscription rates for most Providers are in decline as subscribers move their service to voice over broadband or mobile solutions. However, PSTN shutdown is not expected to happen in most regions until approximately 2020 or beyond.”*

*Bell Labs, PSTN Industry Analysis and Service Provider Strategies: Synopsis, April 2013.*

This analysis suggests that the decommissioning of the analogue PSTN is likely in the medium or long term, however, there are currently no firm plans from BT to start the decommissioning process.

Ofcom undertakes a Digital Communications Review<sup>3</sup> every 10 years, and commencement of the latest review was announced in March 2015. There have been media reports<sup>4</sup> that as part of this review, BT is seeking a relaxation of its existing obligation to provide analogue telephone services UK wide.

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<http://www.btplc.com/Thegroup/RegulatoryandPublicaffairs/Consultativeresponses/Ofcom/2013/NarrowbandMarketReview/BellLabsAnalysisforBT-PSTNIndustryAnalysisandServiceProvider.pdf>

<sup>3</sup> <http://stakeholders.ofcom.org.uk/telecoms/policy/digital-comms-review/>

4

<http://www.telegraph.co.uk/finance/newsbysector/mediatechnologyandtelecoms/telecoms/11696314/BT-aims-to-shut-down-traditional-phone-network-to-help-it-battle-US-tech-giants.html>



As the review is currently in the initial consultation stage, with next steps published at the end of 2015, the outcome will not be known in time for inclusion in this report. It should be noted that even if BT is allowed relaxation of its analogue service obligation, the shift to digital lines is still likely to take many years to complete.

To deliver digital Telecare a broadband connection is required to a subscriber's home. This broadband can either be fixed (i.e. DSL or cable broadband) or delivered using wireless (i.e. connecting to a mobile telephone network). Although figures for broadband availability in the UK are extremely high, many of the remaining areas unable to obtain broadband, or obtain high speed broadband services, are in Scotland. The Scottish Government and Highlands & Islands Enterprise are currently completing projects to improve the speed and availability of broadband services. However, in the short/medium term obtaining access to broadband services capable of supporting advanced Telecare / Telehealth services is likely to remain an issue in some areas of Scotland, particularly in remote/Island communities.



## 7. The Potential Benefits of Digital Telecare

### 7.1 Methodology

In gathering information for Product 1, FarrPoint conducted a number of interviews with stakeholders within, and working with, the health and social care sector. These included local authorities, housing associations, NHS, Telecare equipment/service vendors and standards bodies. Whilst not exhaustive, a wide range of opinion was sought and experiences collated. Appendix B contains details of the individuals and organisations that were consulted during the exercise.

In measuring the benefits of digital Telecare, two primary areas were explored:

- The benefits digital technology will provide;
- The wider benefits (Telehealth and others) that could be facilitated.

Consultees' responses to the above areas of investigation are detailed in the remainder of this section, along with FarrPoint's findings from desk based research.

It should be noted that the purpose of Product 1 of the feasibility study is to identify the potential benefits of a shift to digital Telecare. The value, or otherwise, of these benefits is examined in the cost benefit analysis exercise completed as part of Product 2. Therefore, all potential benefits are presented without qualification.

In order to group the benefits, a number of key themes are presented, each of which are examined separately over the remainder of this section:

- **Reliability** – Potential benefits relating to improving the reliability and quality of Telecare services, or ensuring the continuity of Telecare;
- **Efficiency** – Potential benefits relating to improving the efficiency of Telecare. These relate both to efficiencies gained through improvements in delivery methods and utilising increased sharing of information/partnership working to broaden services;
- **Additional Functionality** – Potential benefits obtained by using digital technology to deliver new Telecare functionality and services;
- **Telehealth** – Potential benefits obtained by using digital Telecare technology to support the delivery of Telehealth services.



The following sections examine the potential benefits within each of these key themes. The potential benefits identified are summarised in Appendix C, it is this list that will be used as the basis of the cost benefit analysis completed in Product 2 of this study.

## 7.2 Potential Reliability Benefits

The Telecare industry has come to expect high standards of reliability with the use of very mature and relatively simple analogue technology. In recent years the introduction of IP in telecommunications providers' core networks has introduced reliability issues, caused by the conversion of analogue signals to digital and back again. ARCs have reported instances of calls failing and having to redial as a result of problems with the quality of the DTMF signals received at the ARC. A digital Telecare solution does not use analogue signalling and so **the use of an end-to-end digital Telecare solution would remove the issues associated with the conversion of signals across provider networks.**

Some ARCs have reported that audio quality can be poor on calls using analogue lines. Some ARCs are replacing the analogue lines connecting to their systems with ISDN lines, but these still rely on analogue lines into subscribers' homes and require multiple conversions of voice information. **The use of a digital Telecare solution would carry calls end-to-end in a digital format and so could result in improved voice quality for both the ARC agent and subscriber. It is also possible to provide "High Definition Audio" via a digital connection providing more enhanced clarity.**

Analogue Telecare solutions can only notify an alarm if they can make a phone call to the ARC. If the phone line in a subscriber's home is in use, either because the subscriber is already making a call, or because the phone has been accidentally knocked 'off hook', then the Telecare system is unable to alert. This issue is particularly relevant to sheltered housing complexes which traditionally rely upon a central controller with sensors deployed in several residents' dwellings. This controller is often connected to a single phone line which means that only one resident's requirements can be dealt with at a time. An example of this would be if one resident in sheltered housing had activated an alarm call for a reassurance-type (i.e. less-urgent) conversation with an ARC agent which would tie-up the phone line for its duration. If a more urgent alarm from another resident was triggered while the first call was in progress, then the ARC would be unaware of this. **Digital Telecare solutions can notify the ARC of alarm conditions even when a subscriber's phone line is engaged or a call with the**



**subscriber is in progress. Digital Telecare solutions can also notify the ARC of multiple alarm conditions simultaneously (particularly relevant to sheltered housing and other multi-resident situations).**

At present, sensors/monitors in subscribers' homes connect to the Telecare controller via analogue technology (mostly by radio, but also sometimes via wired connections). This allows only for very basic communication between the devices. Note that this is the case even with the current deployment of digital Telecare in Sweden where, despite the link between controller and ARC being digital, the communication between the controller and the sensors/monitors in the home still uses analogue technology. Typically, a sensor/monitor will contact the controller when it has been triggered, or in some cases to signal that its battery level is getting low. This limited communication with sensors/monitors means that there is very limited visibility of these devices from the controller/ARC. If the controller/ARC does not receive any signals from a sensor/monitor then it is not known whether this is because the sensor/monitor is operating correctly, and merely has nothing to report, or because the sensor/monitor is incorrectly configured or has failed completely, and so is not able to signal an alarm state.

There have been examples of fatalities as a result of failures or misconfigurations of sensors/monitors that have not been detected by the controller or ARC, including an example in Inverness in 2013<sup>5</sup> <sup>6</sup>. **The use of digital sensors/monitors would allow regular, two-way, and more detailed communication to be completed with the controller device. This would allow the controller to regularly check that sensors/monitors were still operating correctly, allowing device failures to be quickly identified.** In a similar fashion to the communication between the controller and sensors/monitors, **the digital connection between the controller and the ARC would allow the ARC to complete regular checks that the controller is operating correctly.** This is the approach that is currently implemented on the digital Telecare devices in Sweden where controllers are 'polled' every minute to check that they are operating correctly. **Moving to a digital connection end-to-end between sensor/monitor and ARC, provides the ARC with visibility of the system's overall health.** Additional benefits of this would be: allowing the ARC to check that a sensor/monitor was visible and thus operating correctly following its installation, (whilst

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<sup>5</sup> [http://www.heraldscotland.com/news/13122250.Death\\_leads\\_to\\_Telecare\\_review/](http://www.heraldscotland.com/news/13122250.Death_leads_to_Telecare_review/)

<sup>6</sup> <http://www.inverness-courier.co.uk/News/Review-for-failed-fire-alarm-system-13092013.htm>



staff are still on-site); and regular audit by the ARC of the equipment deployed in subscribers' homes.

BT have stated their plans to eventually decommission analogue phone lines in parts of the UK due to the decreasing demand for the service as well as the analogue network technology reaching its end of life. As stated earlier in this report, it is not clear when BT will be permitted to start this process, however, **a shift to digital would ensure that Telecare services were unaffected by the future decommissioning of analogue phone lines.**

### 7.3 Potential Efficiency Benefits

Current analogue Telecare solutions can only support a limited degree of flexibility in how alarm calls into the ARC are routed and shared. This is due to the fact that calls come into the ARC on analogue (or ISDN) phone lines meaning that the only way to send calls to an alternative location is by redirecting these calls to another phone number. This approach is complex, inflexible, time-consuming, and costly. There are a number of scenarios when ARCs may have a requirement to redirect calls to another number, for example in a disaster recovery scenario when a power or equipment failure at the ARC means it becomes inoperable.

**The shift to digital Telecare means that there is a high degree of flexibility in how alarm calls are routed and shared.** All signalling and calls between the subscriber's controller and the ARC are carried over a data network, potentially the Internet. This means that any location with a network connection and suitable equipment could potentially act as an ARC. There are a number of scenarios where this could offer potential benefits:

- Using the example above, **digital Telecare could increase ARCs' ability to cope with Disaster Recovery.** In a disaster situation, where an ARC became inoperable, calls could be redirected to another location relatively easily. This could be an alternative location operated by the Telecare provider, or in order to avoid the cost and complexity associated with each Telecare provider maintaining a standby ARC facility, it would be possible for Telecare providers to put reciprocal Disaster Recovery agreements in place meaning calls were routed to each other in the event of system failure.



- **The increased flexibility in call routing could allow calls to be routed intelligently based on factors such as time of day and call volumes.** This kind of intelligent call routing is already used extensively within a wide-range of call and contact centres, including in the public sector.

Intelligent call routing could be used to redirect calls overnight, a period when call volumes are generally lower, to an alternative location. This alternative location could be an ARC that acts on behalf of a number of Telecare providers to handle overnight calls. This arrangement would mean that each of the Telecare providers would no longer need to maintain an overnight staffing of agents.

Intelligent call routing could also be used to allow ARCs to cope with unexpected peaks in call volumes. In the event of an unexpected peak, calls that could not be handled by the ARC could overflow to an alternative location. This could be other staff (non-agents) within the Telecare organisation, or to an alternative ARC.

- **Increased flexibility in call routing would more easily allow the number of ARCs to be reduced.** The flexibility introduced by digital technology means that there is no technical limitation to the location of the ARC relative to the location of subscribers and that calls could easily be redirected to an alternative location if required. It is estimated that there are currently 22 ARCs in Scotland. The 13 ARCs providing services for public bodies that responded to our questionnaire were collectively serving nearly 69,000 subscribers. It is not possible to extrapolate from this to produce an estimated figure for Scotland, however, the figure for the 13 ARCs alone is informative when compared with the fact that in Sweden two ARCs serve 200,000 Telecare users. This suggests that from a purely technical perspective there is scope for consolidation of alarm centres in Scotland. Consolidating alarm centres would offer benefits in that less ARC equipment would be required and improved efficiencies in the utilisation of agents could be realised. The level of efficiencies that could be obtained from consolidating ARCs would need to be balanced against ensuring that Telecare services were resilient and addressed any requirements where particular local knowledge was required.

It should be noted that digital Telecare is not a prerequisite for consolidating alarm centres, however consolidation is easier to achieve with digital





technology. Consolidation could be achieved with existing installations, although there are a number of challenges associated with this, given the need to re-programme large numbers of residential devices, and deal with increased call charges. Using the example of Sweden serving 200,000 subscribers from two ARCs, only 40,000 of these subscribers are using digital technology (between the ARC and controller unit).

Similar to the flexibility in routing alarm calls, **the shift to digital Telecare means there is a high degree of flexibility in where ARC equipment is located and who uses it.** This flexibility supports a number of options relating to the location of equipment and agents. It is likely that this potential benefit would be implemented in conjunction with some of those listed above relating to call routing. Some examples of where this flexibility could provide potential benefits are:

- If connections between all of the ARC system's components are digital, then they do not need to be co-located. Within a Telecare provider's organisation this means that **ARC agents do not need to be co-located, potentially meaning that a dedicated Telecare facility is not required.** Agents could be located across a number of locations, or even potentially be home-based if this better suited working patterns.
- An alternative application of this flexibility is **the potential for a number of Telecare providers to share ARC equipment and so reduce costs.** As an example, two (or more) ARCs could jointly procure an ARC solution to be installed at a single location. Each Telecare provider would operate a service, but each of the ARCs, and their agents, would utilise a shared set of equipment.
- A further variation on the above example is where **Telecare providers no longer need to procure their own ARC equipment and instead procure their ARC as a cloud hosted service from an external supplier.** Under this model, ARC equipment would be procured and operated by a commercial supplier, and would be physically located in a facility owned by, or operated for, that supplier. Telecare providers would still maintain a Telecare centre staffed by their own agents, but these agents would connect, over the Internet or private network, to ARC equipment provider by the external supplier. The external supplier would use the ARC equipment to deliver services to multiple Telecare providers. Telecare providers would no longer need to procure and maintain their own equipment, and would instead shift to a revenue based



approach for paying for Telecare services from the supplier. We are aware that a number of Scottish Local Authorities are currently investigating this delivery approach as it may reduce their operating costs by leveraging economies of scale.

- Another implementation of a cloud hosted service, which take the shift of responsibility to the supplier a step further, is where **Telecare providers opt to fully outsource responsibility for providing ARC equipment and operating the ARC to an external supplier.** In this model the supplier would be responsible for answering alarm calls from subscribers. The Telecare provider would be contacted by the supplier in the event of some form of on-site or other response being required.

The above scenarios addressed ARC implementations based on cloud hosted deployments. However, even if this approach is not taken and Telecare providers still opt to use an in-house model where they procure and maintain their own ARC solution, digital Telecare may offer some potential additional efficiencies.

Digital Telecare solutions are likely to run on a similar range of equipment to a number of other core corporate IT applications. This means that **there is potential for the digital Telecare solution to share or utilise elements of an organisation's existing IT infrastructure.** Examples of this could be the Telecare solution running on an organisation's existing virtualised servers, or utilising an existing IP telephony / contact centre solution to deliver calls to agents.

The IP technology that would be used by digital Telecare systems is now very mature and commonplace in businesses and residential settings, as it is based upon open standards which facilitate innovation and competition. There is also work underway to develop EU standards for digital Telecare systems. **The fact that digital Telecare solutions will use mature technology and established standards is likely to increase competition in the marketplace, and so reduce equipment costs.** The use of published standards, rather than proprietary protocols will mean that Telecare equipment from suppliers will be compatible allowing Telecare providers to mix and match different supplier's equipment as the need arises.

Current analogue Telecare solutions are only able to deliver the outputs from sensors/monitors to a single location (the ARC). **Digital Telecare solutions have the ability to deliver sensor/monitor outputs to multiple or different locations.** This



could allow, for example, sensor/monitor output from a subscriber's home (either all or selected devices) to be sent to the ARC and another location (the subscriber's carer, for example, or in the case of a fire alarm, directly to the fire service). Similarly, **the fact that data from sensors/monitors is received at the ARC in digital format, this would allow the information to be more easily stored and shared with other parties**. Examples may be sharing details about a subscriber's activity monitors, fall detectors, etc with their GP and/or social worker. Clearly privacy and data protection issues would need to be considered prior to implementing this kind of data sharing.

A further benefit that could be derived from the collection and storage of information digitally from subscriber's monitors/sensors is that the **Digital Telecare information could be used for data analytics or "Big Data"**. This analysis may mean that new population trends would become visible, for example being able to predict events based on trending behaviours and potentially avoid hospital admissions.

#### 7.4 Potential Additional Functionality Benefits

**Under the digital Telecare model the controller in subscribers' homes becomes a form of 'digital health hub' via which a range of Telecare, Telehealth, and other digital services can be delivered. Digital Telecare provides a higher capacity connection between subscribers' homes and the ARC which provides the capability for the deployment of more sophisticated sensors/monitors and other devices.** Many of the potential additional functionality benefits resulting from digital Telecare relate to Telehealth applications and these are detailed separately in the following section.

**Digital Telecare could assist with the increased automation of tasks within the ARC.** This could be in the form of carers being automatically contacted in the event of a fall detector being triggered, automatically calling subscribers whose activity monitors have not registered movement within a defined period, or with the automation of reassurance calls. This latter example has already been implemented by Bield Housing and (as detailed in Section 5.2) is credited with reducing the staff time associated with these kind of calls from 70 hours to 35 minutes a day. Note that it is possible to implement elements of this automation on existing analogue Telecare solutions (as Bield Housing has done), however, it is likely that a digital Telecare solution will increase the scope and intelligence of the automation that can be deployed, and make it easier to implement.



**Digital Telecare systems could interface with building management systems and home automation solutions.** In larger premises, building management systems are commonly deployed as digital systems with the building sensors and controllers communicating using IP networks, which also allow for remote monitoring and control of the building environment. This kind of digital building monitoring and control is now becoming more common in the home environment in the form of home automation technology, which is becoming increasingly available and affordable. Home automation technology is now available which allows for the remote and automated monitoring of a range of in-home devices, such as alarm systems<sup>7</sup>, heating<sup>8</sup>, lighting<sup>9</sup>, smoke detectors<sup>10</sup>, and utility meters<sup>11</sup>.

Within a sheltered housing environment, digital Telecare could allow the ARC to integrate with the building management system to remotely monitor and control the building environment, and remotely respond to building incidents, such as resetting fire panels, for example. Within the home environment, integration with home automation systems would also allow the ARC to monitor and control a range of devices and equipment in the home, providing an additional level of monitoring and control than that currently available.

**The bandwidth provided by the digital link between the ARC and subscribers' homes means that video-based Telecare applications can be supported.** It should be noted that this bandwidth will also support video-based telehealth applications, which are detailed separately in the next section. Within a subscriber's home, video cameras could be used to check on subscribers in the event of a fall or inactivity monitor being triggered (to check for false alarms) or a smoke detector (a 'burnt toast' check). These kind of applications are currently being trialled in Sweden, albeit using a standalone system, rather than being integrated into the Telecare solution. Video cameras could also be used to augment existing arrangements for remote access to subscribers' homes allowing the ARC to activate a camera mounted at the front door in the event of someone pressing the doorbell.

**Digital Telecare, and the use of IP standards, means that Telecare monitoring could be implemented on subscribers' own digital devices (for example,**

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<sup>7</sup> <https://www.ismartalarm.com/>

<sup>8</sup> <https://www.hivehome.com/>

<sup>9</sup> <http://www2.meethue.com/en-GB/>

<sup>10</sup> <https://nest.com/uk/smoke-co-alarm/meet-nest-protect/>

<sup>11</sup> <http://www.britishgas.co.uk/smarter-living/control-energy/smart-meters.html>



**smartphones or tablets), rather than dedicated devices procured and maintained by the Telecare provider.** This is likely to offer cost savings to the Telecare provider and also widen the scope of monitoring that can be completed. At present it is possible to envisage Telecare applications that could run on smartphones and tablets, particularly applications that take advantage of the increasing availability of GPS tracking and health monitoring capability of these devices.

Digital Telecare sensors/monitors are likely to be smaller than their analogue equivalent. Feedback on the early digital devices (and more modern analogue devices) is that they are also more aesthetically pleasing than many of the analogue devices currently deployed. **The fact that digital Telecare equipment is smaller and more aesthetic than many of the currently deployed analogue devices may assist with take-up of Telecare services amongst user groups reluctant to be seen as requiring Telecare.**

**Digital Telecare may also be able to take advantage of the ‘Internet of Things’,** where an increasing range of devices in the home are also becoming digital and network enabled. A very wide range of devices in the home could soon become digitally enabled and so could be monitored by Telecare providers, to augment or replace existing sensors/monitors in the home. These devices include everyday items such as fridges, washing machines, toasters, kettles and toothbrushes, which could be used as a form of activity monitor in the home.

**The broadband connection delivered to subscribers’ homes to provide Digital Telecare, could also be used to assist in addressing social and digital exclusion issues.** Users of Telecare are likely to be within the demographic least likely to have existing access to the Internet and digital public services. Only 37% of adults aged over 75 have ever used the Internet, compared with a figure of 87% for the whole adult population<sup>12</sup>. Similarly, 30% of disabled adults have never used the Internet<sup>13</sup>. A prerequisite for delivering Digital Telecare is a broadband connection into subscribers’ homes. If a subscriber did not have an existing broadband connection, then one would need to be provided (either a ‘wired’ or wireless broadband connection). Once installed, this broadband connection could also be used by the subscriber to access a

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<sup>12</sup> Source: Office for National Statistics, Internet Access Quarterly Update, Q1 2014. (<http://www.ons.gov.uk/ons/rel/rdit2/internet-access-quarterly-update/q1-2014/index.html>)

<sup>13</sup> Ibid.



range of public and other digital services (subject to them also being provided with a digital device on which to access the Internet and appropriate training).

## 7.5 Potential Telehealth Benefits

Historically, Telecare and Telehealth have been regarded as distinct and separate initiatives. Telecare has focused on alarms monitoring the home environment and the occupant and is now regarded as a mature service. Telehealth has developed more recently to encompass a range of activities from electronic delivery of health information, to monitoring of health status through methods ranging from self-assessment through questionnaires, to electronic transmission of physical measurements such as weight, blood pressure and glucose levels.

Whilst Telecare is now deployed at scale in many countries, Telehealth remains in a much more formative and developmental stage with a wide spectrum of smaller scale trials and limited deployments; although deployment at scale is now a common objective. Three workstreams within the TEC Programme are addressing areas concerned with Telehealth in detail: these are discussed briefly below.

### Workstream 1: Expansion of Home Health Monitoring

In Scotland, and elsewhere, Telehealth trials have identified benefits, including avoided A&E attendances, reductions in admissions and inpatient bed-days, improved patient health status and satisfaction, plus reduced clinical costs.

In broad terms **a consensus is developing across Europe that Home Health Monitoring will have a significant role in future healthcare delivery based on improvements and cost reductions in the technology, better integration with existing healthcare processes and improved organisational arrangements, and demand from patients and the public.**

**At the disease level the evidence appears strongest for Home Health Monitoring for diabetes, heart failure, COPD and hypertension.** Additional offerings such as lifestyle advice and monitoring, cognitive behavioural therapy, monitoring of IBD symptoms, remote exercise classes and video links for speech therapy, are also being investigated. mHealth (mobile health) is of increasing interest as it reflects the more widespread ownership of smartphones and the use of Health apps.



TEC Workstream 1 is developing a national model for home health monitoring reflecting the experience that has been gained to date and from the ongoing United4Health programme which is targeting home health monitoring for 7,700 people across the West of Scotland with diabetes, heart failure or COPD. This conceptual model identifies four tiers of monitoring of which levels 3 and 4 **would involve significant data exchange between the patient and a 'monitoring centre'**:

- Tier 3: Care Management includes use of health coaching, phone applications, simple telehealth and SMS text and other SMS based solutions as part of anticipatory care intervention. Home monitoring devices will be used to enable and support behavioural change, self-management and patient led decision making;
- Tier 4: Case Management involves Home Health Monitoring provided on a 7 day per week basis as part of an integrated clinical pathway.

The conceptual model as planned and implemented within United4Health involves website access, local PC or smart phone applications, and periodic update to a central receiving point of patient input information or data from locally attached devices. Most of the data exchange currently is periodic and suitable to a local broadband connection and communication across the Internet, or, increasingly, communication across the mobile telephone network. Importantly, some of the most successful applications make use of simple questionnaires and SMS technology.

Our understanding is that Workstream 1 is not currently assuming widespread availability of dedicated digital lines to patient homes over and above existing broadband connections and smartphone connections. There is increased use of Bluetooth to communicate from measuring devices to the broadband connection which is replacing patient transcription of results. Additionally, there is encouragement to suppliers to provide, and there is rising use of, software applications which patients can download to run on their own laptops or tablets which sit between measuring devices and the broadband connection.

Although United4 Health is intended to evaluate models and approaches for delivering Telehealth at scale and is still to be fully evaluated, the expectation is developing that Telehealth will in future have applications for a significant number of people across Scotland given the incidence of disease and the range of possible future applications.





## Workstream 2: Expanding the Use of Video Conferencing

In the videoconferencing area, NHS Scotland has an existing deployment that supports remote communication for NHS clinical professionals and management. There are also clinical applications, for example supporting minor accident departments and enabling remote clinical consultations, which can save significant travelling time. The intention is not only to widen this within health, but also to local authority establishments, the independent sector (care homes), and citizens at home.

**Digital lines installed for Telecare monitoring purposes would offer an opportunity for Teleconferencing and given that this is, in general, a vulnerable population, there is likely to be some scope for additional use for Telehealth videoconferencing purposes to provide remote consultations, advice and support.**

## Workstream 3: Building on the Emerging National Digital Platform

Scotland has a number of digital platforms for citizens. The most significant is Living it Up which enables self-assessment of lifestyle and providing information on local services, community groups and support for self-management. A second platform, ALISS, is a search and collaboration tool for health and wellbeing resources in Scotland. Workstream 3 is exploring the definition of a national digital platform including the services that this might encompass. This may include extension to citizen input and sharing of information with health and care workers.

## Future Development

Looking forward, it can reasonably be expected that Telehealth use will develop from the current trials based approach to larger scale standardised services. These will be integrated into, and complement, existing care packages for patients and citizens. Additionally, **there will be some overlap with citizens who need Telecare services and also Telehealth services i.e. individual citizens will require an overall integrated package that monitors their physical environment and also their health status, including advice and support services, as appropriate to their individual unique circumstances.**

Current Telehealth solutions are implemented with specifically developed hardware and software, much like current Telecare solutions. Although the two services do differ in the information that is being collected and monitored, **the communication**





**infrastructure used to deliver both services can be common and there may be opportunities from a more integrated approach.**

The move to digital connections and appropriate terminal equipment could allow these two separate services to be more integrated, and consequently able to provide a subscriber with a single, personally tailored package for remote environmental and health monitoring and care. **There may also be advantages in common or shared organisational delivery and support arrangements.**

**Additionally, a single integrated approach to both Telecare and Telehealth could allow the accumulation of patient data from all sensors and measuring devices in a patient's home to be transmitted to the necessary recipients from a single terminal device. Not only would this provide the patient with a single solution it may allow for better data analytics as there are more aspects of the patient's activity and health that are collected.**

However, it is not clear that such an integrated approach will necessarily be the best way forward, particularly as Telecare remains in a significant phase of development and growth and this should not be inhibited. The relative benefits and disadvantages will require further exploration.



## 8. Product 1 Conclusions

This first product into the transition of Telecare in Scotland from analogue to digital has audited the current digital status of Telecare solutions in Scotland and has examined the potential benefits a move to digital Telecare may deliver.

For the purposes of this study digital Telecare is defined as follows:

*A Telecare solution is considered to be Digital if it carries information end-to-end, from sensor / monitor, to the Alarm Receiving Centre agent's workstation / telephone in a digital form without any conversion occurring. In technical terms, this means that data will be carried end-to-end using Internet Protocol (IP) format.*

To establish the current digital status of Telecare solutions in Scotland, questionnaires were sent to all ARCs that are operated by, or on behalf of, Scottish public bodies. 81% of questionnaire responses were received. The responses are consistent with those received by SCTT in previous, similar exercises. It is estimated that there are 22 ARCs delivering telecare solutions for, or on behalf of, Scottish public bodies. No Scottish Telecare solution currently meets the definition of digital Telecare. There are examples of deployments based on digital technology, for example geofencing and video camera use, but these are limited in scale and number and tend to be deployed as standalone solutions, separate to the main Telecare systems.

The current Scottish Telecare systems use solutions from a number of suppliers and range in age, although Tunstall is the most common supplier of ARC equipment. This is a factor that will need to be considered in the next Product of this study when the high level implementation guide for digital Telecare is developed. The fact that ARCs are starting from different positions, with some more 'digital ready' than others, will mean that there are a number of challenges in developing a single standard approach for the deployment of digital Telecare.

Telecare providers would currently struggle to procure a Telecare solution that met the above definition of digital Telecare and delivered all of the potential benefits identified. This is because none of the larger suppliers currently offer an end-to-end digital solution, although some are closer to being able to offer this than others. Lack of customer demand, and the absence of recognised standards for digital Telecare, are factors contributing to this situation. This is another factor that that will need to be



considered as part of the high level digital Telecare implementation guide produced in the next Product of this study. It is clear that a direct move to a fully digital Telecare solution is probably not viable, and an approach based on an incremental digital deployment is more likely to be used.

This incremental digital deployment approach is being used in Sweden. The initial focus of digital Telecare has been the shift to digital connection between in-home controllers and the ARC. This is to address the reliability issues experienced following the main Swedish telecom provider's shift to using digital technology in their core networks, and the end of their obligation to provide analogue exchange lines. Currently 40,000 of Sweden's 220,000 Telecare subscribers have been shifted to this digital technology. Given the incremental deployment of digital technology, the current Telecare solutions in Sweden do not meet our definition of digital Telecare.

The experience from Sweden, along with the discussions held and questionnaire responses received from Scottish Telecare providers, have allowed a range of potential benefits of digital Telecare to be identified. These potential benefits fall into four main themes:

- Reliability – Potential benefits relating to improving the reliability and quality of Telecare services, or ensuring the continuity of Telecare;
- Efficiency – Potential benefits relating to improving the efficiency of Telecare. These relate both to efficiencies gained through improvements in delivery methods and utilising increased sharing of information/partnership working to broaden services;
- Additional Functionality – Potential benefits obtained by using digital technology to deliver new Telecare functionality and services;
- Telehealth – Potential benefits obtained by using digital Telecare technology to support the delivery of Telehealth services.

At this stage of the study, potential benefits have been identified, but no further analysis of them has been completed. The Cost Benefit Analysis completed in Product 2 of this study will establish the value and viability, or otherwise, of each of these potential benefits.

A number of the potential benefits identified relate to the additional capacity, flexibility, and future-proofing that digital Telecare could deliver. These reflect the fact that digital



Telecare provides an enabling platform which could be used to deliver change and a range of new services and applications, and not just those directly related to Telecare. The nature of this change is not currently fully understood, and is, to a large degree, dependent upon the output from the other four Workstreams of the Technology Enabled Care programme. Programme-level co-ordination will need to ensure that the Workstreams take account of each others' findings and that cross-dependencies and potential overlap in business cases is identified. It is likely that costs identified in the Digital Telecare business case will act as an enabler for benefits delivered in other Workstreams. For example, using the digital Telecare connection to subscribers' homes could also deliver video-conferencing (Workstream 2) or home health monitoring (Workstream 1) services.



## Appendix A – Glossary

Term	Definition
Alarm Receiving Centre (ARC)	<p>“Community alarm and Telecare services require an Alarm Receiving / Monitoring Centre capable of receiving and responding to alerts raised by the equipment in order to initiate the appropriate action. Many areas have established a 24 hour call monitoring centre to perform this function, where one or more trained operators (call handlers) provide an immediate, skilled, sensitive response to the person, or to the alarm. This part of the service is referred to as an Alarm Receiving Centre (ARC), monitoring centre, or call handling service.”</p> <p><i>Joint Improvement Team</i></p>
ALISS	A Local Information System for Scotland.
Analogue	The transmission of voice or data using audible tones.
Bluetooth	Bluetooth is a standard created for short range, point-to-point, wireless communication.
British Standards Institute (BSI)	The national standards body for the UK. Produces standards of quality for goods and services.
Cloud / Hosted Solution	<p>A model of subscribing to computer based services. In a cloud/hosted solution the hardware required to provide the service is owned by the service provider and located in their data centre. The service provider then uses this equipment to provide services to a number of customers. Customers access the equipment via the Internet or a private data network.</p> <p>This model of service delivery is frequently marketed as a lower cost alternative to a customer buying and maintaining their own hardware and housing in their own premises (the in-house approach).</p>
COPD	Chronic Obstructive Pulmonary Disease.
Digital	The transmission of voice or data in a discrete binary form. In the case of voice, analogue voice is ‘digitised’ into a digital form.
DSL	Digital Subscriber Line. A technology used for delivering Internet broadband services over analogue telephone lines.
Dual Tone Multi-Frequency (DTMF)	A method of transporting data over a telecommunications network that uses audible tones to represent data.
FTE	Full Time Equivalent.
Geo-fencing	A geo-fence is a technology which uses GPS (the same as used by satellite navigation) to track vulnerable service users. If a user travels outside a pre-programmed area (a geo-fence),



Term	Definition
	for example further than 1 mile from their home, then an alarm is raised. The technology reports on the user's location to allow a responder to find them.
GSM/2G/GPRS/EDGE/3G/4G	<p>Standards for mobile telephones describing how telephone connect to a mobile provider's network.</p> <p>Multiple standards are in use today and more modern phones are 'backwards compatible' to allow them to connect to older networks.</p> <p>All standards support the transfer of digital data via the mobile network. Older standards (GSM/2G/GPRS/EDGE) can only provide low speed data transfer. More modern standards (3G/4G) offer faster transfer speeds, in the case of 4G speeds can be similar to a home "wired" broadband connection.</p>
IBD	Inflammatory Bowel Disease
Internet Protocol (IP)	The most common computer networking protocol. Used on the Internet and a large number of other private computer network. It supports a unique addressing scheme which allows devices on a network to know where to send data.
Mobile SIM	A subscriber identity module (SIM) is a small device (usually a small plastic card) which contains a unique secure identifier for a mobile device which allows it to connect to a specific carrier's network.
Next Generation Network (NGN)	A telecommunications network built to transport data in its native digital form, generally using IP.
Private Branch Exchange (PBX)	A phone system used by medium/large companies and organisations to allow calls to be made between, to, and from internal users.
Private Data Network	A Private Data Network is typically used by organisations who need to transfer data between sites without the data crossing the Internet.
Public Switched Telephone Network (PSTN)	A national telephone network comprised of a number of providers interconnected networks. The PSTN provides connections to users via a range of methods, but most commonly via copper wires connected to the user's premises.
Session Initiation Protocol (SIP)	A communications protocol for initiating and controlling multimedia sessions between two hosts (computers) over IP data networks.
SMS	Short Message Service – better known as Text Messaging.
Social Care Alarms over IP (SCAIP) Protocol	An open protocol that establishes a connection between an alarm sender and receiver over an IP network. Defines how to handle event messages and multimedia streams.



Term	Definition
Social Care Alarms over IP (SCAIP) Standard	A standard that details how the protocol handles multimedia communication streams between the alarm sender and receiver over an IP network.
Subscriber	A user of public Telecare / telehealth services.
TEC	Technology Enabled Care.
Telecare	<p>“The provision of care services at a distance using a range of analogue, digital and mobile technologies. These range from simple personal alarms, devices and sensors in the home, through to more complex technologies such as those which monitor daily activity patterns, home care activity, enable 'safer walking' in the community for people with cognitive impairments/physical frailties, detect falls and epilepsy seizures, facilitate medication prompting, and provide enhanced environmental safety.”</p> <p><i>Scottish Government: A National Telehealth and Telecare Delivery Plan for Scotland to 2016: Driving Improvement, Integration and Innovation</i></p> <p>“The remote or enhanced delivery of care services to people in their own home or in a community setting by means of telecommunications and computerised services. Telecare usually refers to sensors and alerts which provide continuous, automatic and remote monitoring of care needs, emergencies and lifestyle changes, using information and communication technology (ICT) to trigger human responses, or shut down equipment to prevent hazards”</p> <p><i>Joint Improvement Team 2011</i></p>
Telehealth	<p>“The provision of health services at a distance using a range of digital and mobile technologies. This includes the capture and relay of physiological measurements from the home/community for clinical review and early intervention, often in support of self management; and "teleconsultations" where technology such as email, telephone, telemetry, video conferencing, digital imaging, web and digital television are used to support consultations between professional to professional, clinicians and patients, or between groups of clinicians.”</p> <p><i>Scottish Government: A National Telehealth and Telecare Delivery Plan for Scotland to 2016: Driving Improvement, Integration and Innovation</i></p>
WiFi	WiFi is a technology that allows wireless networking between devices.



## Appendix B – List of Consultees

The table below details the individuals who FarrPoint spoke to during completion of this study. We would like to thank all concerned for their valuable input to our work.

Contact	Organisation
Professor George Crooks OBE	NHS 24 / Digital Health Institute.
Pamela Rennie Moir Mackenzie Russell Scott	NHS 24 / Scottish Centre for Telehealth and Telecare
Andrew Nelson	Tunstall
Heather Laing	Edinburgh Council
Sharon Ewen Fiona Millar	Bield Housing Association
Rob Turpin	British Standards Institute
Per-Olof Sjöberg Claus Popp Larsen	Digital Health Lab, Swedish Institute of Computer Science
Alistair Hodgson Amanda Leithead Doreen Watson	Joint Improvement Team
Raymond McGill	East Lothian Council
Ian Whitelaw	Falkirk Council
Jill Atkey	Appello
Tom Morton	Communicare247





## Appendix C – Summary of Potential Benefits

<b>Potential Reliability Benefits</b>
The use of an end-to-end digital Telecare solution would remove the issues associated with the quality of analogue signalling causing calls to fail.
The use of a digital Telecare solution would carry calls end-to-end in a digital format and so could result in improved voice quality for both the ARC agent and subscriber. It is also possible to provide “High Definition Audio” via a digital connection providing more enhanced clarity.
Digital Telecare solutions can notify the ARC of alarm conditions even when a subscriber’s phone line is engaged or a call with the subscriber is in progress. Digital Telecare solutions can also notify the ARC of multiple alarm conditions simultaneously (particularly relevant to sheltered housing and other multi-resident situations).
The use of digital sensors/monitors/ would allow regular, two-way, and more detailed communication to be completed with the controller device. This would allow the controller to regularly check that sensors/monitors were still operating correctly, allowing device failures to be quickly identified.
The digital connection between the controller and the ARC would allow the ARC to complete regular checks that the controller is operating correctly.
The fact that there is a digital connection end-to-end between sensor/monitor and ARC would potentially provide the ARC with visibility of the solution’s health and configuration, right through to the end devices.
A shift to digital Telecare would ensure that Telecare services were unaffected by any future decommissioning of analogue phone lines.
<b>Potential Efficiency Benefits</b>
The shift to digital Telecare means that there is a high degree of flexibility in how alarm calls are routed and shared.
Digital Telecare could increase ARCs’ ability to cope with a Disaster Recovery situation.



The increased flexibility in call routing could allow calls to be routed intelligently, based factors such as time of day and call volumes.
Increased flexibility in call routing would more easily allow the number of ARCs to be reduced.
The shift to digital Telecare means that there is a high degree of flexibility in where ARC equipment is located and who uses it.
ARC agents do not need to be co-located, potentially meaning that a dedicated Telecare facility is not required.
There is potential for a number of Telecare providers to share ARC equipment and so reduce equipment spend and support costs.
Telecare providers would no longer need to procure their own ARC equipment and instead could procure their ARC as a cloud hosted service from an external supplier.
Telecare providers could opt to fully outsource responsibility for providing ARC equipment and operating the ARC to an external supplier.
There is potential for the digital Telecare solution to share or utilise elements of a Telecare provider's existing IT infrastructure.
The fact that digital Telecare solutions will use mature technology and established standards is likely to increase competition in the marketplace and so reduce equipment costs.
Digital Telecare solutions could have the ability to deliver sensor/monitor outputs to multiple or different locations.
The fact that data from sensors/monitors is received at the ARC in digital format, would allow this information to be more easily stored and shared with other parties.
Digital Telecare information could be used for data analytics or 'Big Data'.
<b>Potential Additional Functionality Benefits</b>
Under the digital Telecare model, the controller in subscribers' homes becomes a form of 'digital health hub' through which a range of Telecare, Telehealth, and other digital services can be delivered.



Digital Telecare provides a higher capacity connection between subscribers' homes and the ARC and this provides the capability for the deployment of more sophisticated sensors/monitors and other devices.

Digital Telecare could assist with the increased automation of tasks within the ARC.

Digital Telecare systems could interface with building management systems and home automation solutions.

The bandwidth provided by the digital link between the ARC and subscribers' homes means that video-based Telecare applications can be supported.

Digital Telecare, and the use of IP standards, means that Telecare monitoring could be completed on subscribers' own digital devices (for example, smartphones or tablets), rather than dedicated devices procured and maintained by the Telecare provider.

The fact that digital Telecare equipment is smaller and more aesthetic than many of the currently deployed analogue devices may assist with take-up of Telecare services amongst user groups reluctant to be seen as requiring Telecare.

Digital Telecare may also be able to take advantage of the 'Internet of Things'.

The broadband connection delivered to subscribers' homes to provide Digital Telecare, could also be used to assist in addressing social and digital inclusion issues.

### **Potential Telehealth Benefits**

A consensus is developing across Europe that Home Health Monitoring will have a significant role in future healthcare delivery based on improvements and cost reductions in the technology, better integration with existing healthcare processes and improved organisational arrangements, and demand from patients and the public.

At the disease level the evidence appears strongest for Home Health Monitoring for diabetes, heart failure, COPD and hypertension.

TEC Workstream 1 is developing a national model for home health monitoring. The conceptual model identifies four tiers of monitoring of which levels 3 and 4 would involve significant data exchange between the patient and a 'monitoring centre'.



Digital lines installed for Telecare monitoring purposes would offer an opportunity for Teleconferencing and given that this is, in general, a vulnerable population, there is likely to be some scope for additional use for Telehealth videoconferencing purposes to provide remote consultations, advice and support.

There will be some overlap with citizens who need Telecare services and also Telehealth services i.e. individual citizens will require an overall integrated package that monitors their physical environment and also their health status, including advice and support services, as appropriate to their individual unique circumstances.

Current Telehealth solutions are implemented with specifically developed hardware and software, much like current Telecare solutions. Although the two services do differ in the information that is being collected and monitored, the communication infrastructure used to deliver both services can be common and there may be opportunities from a more integrated approach.

There may be advantages in common or shared organisational delivery of Telecare and Telehealth and support arrangements.

Additionally, a single integrated approach to both Telecare and Telehealth could allow the accumulation of patient data from all sensors and measuring devices in a patient's home to be transmitted to the necessary recipients from a single terminal device. Not only would this provide the patient with a single solution, it may allow for better data analytics as there are more aspects of the patient's activity and health that are collected.

