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‘Digital by Default’ and the ‘hard to reach’: Exploring solutions to digital exclusion in remote rural areas

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Abstract

In the UK, the geography of Information and Communication Technology (ICT) infrastructure required for Internet connectivity is such that high speed broadband and mobile phone networks are generally less available in rural areas compared with urban areas or, in other words, as remoteness and population sparsity increase so too does the likelihood of an area having no or very poor broadband connectivity. Against a policy backdrop of UK Government efforts to bring forward network infrastructure upgrades and to improve the accessibility of broadband services in locations where there is a weak commercial investment case, this paper considers the options for the ‘final few’ in the prevailing ‘Digital by Default’ public services context. The paper outlines the Rural Public Access WiFi Services project, a study focused upon enabling Internet connectivity for commercially ‘hard to reach’ rural areas in the UK. The Rural Public Access WiFi Services concept and the experiment are introduced before findings from a pilot deployment of a broadband service to households in a remote rural area, who may be classified as ‘digitally excluded’, are presented. The paper then reflects on our field experiment and the potential of the Rural Public Access WiFi Services service model as a solution to overcoming some of the digital participation barriers manifest in the urban–rural divide. Early indications show that the Rural Public Access WiFi Services model has the potential to encourage participation in the Digital Economy and could aid the UK Government’s Digital by Default agenda, although adoption of the model is not without its challenges.

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Introduction

'The web has transformed almost every aspect of public, private and work life' (Cabinet Office, 2014: no page numbers). It underpins a new economy and is reshaping government through new ways of communicating and delivering public services. The Digital Economy (DE) has also opened up new opportunities for societal well-being across many domains of life, for example the economy (Yiu and Fink, 2012), flow of information and e-commerce (Broadband Stakeholder Group, 2014), health (Parliamentary Office of Science and Technology, 2014) and education (Davies and Eynon, 2013). Businesses and governments – national and devolved – in the UK and elsewhere are seeking to capitalise upon these opportunities in terms of reduced operational costs and improved service delivery. In a knowledge-based society, digital inclusion is important for social equality to ensure access to the many benefits the Internet offers (Broadbent and Papadopoulos, 2013; Warren, 2007). However, a sizeable minority of the UK population, 13% (6.4 million) of adults, have never used the Internet (Office for National Statistics, 2014a) with, on average, 18% saying that they do not have Internet access at home (Ofcom, 2014a): they therefore are unable to participate in the DE. There is a growing social and economic gap between those who are connected and those who are not, the 'digitally excluded'.

Digital exclusion, defined by Warren (2007: 375) as 'a situation where a discrete sector of the population suffers significant and possibly indefinite lags in its adoption of ICT through circumstances beyond its immediate control', is of particular relevance to rural areas and of specific interest to rural policy in the UK and elsewhere. The market dependency of the landscape of connection has resulted in communities with outdated telecommunications infrastructure and consequently 'off the digital map' – most notably in remote, rural areas. Evidence supports the existence of an urban–rural digital divide and, more specifically, a 'deep rural' versus 'shallow rural' and 'urban' divide (Farrington et al., 2015; Philip et al., forthcoming). This translates threefold: first, the provision of fixed and mobile ICT infrastructure exhibits far more variability in terms of availability, speed and cost in rural than in urban areas; second, from a rural perspective, the benefits of online connectivity in the countryside may be relatively greater than in urban areas, due to barriers of distance to alternatives (Commission for Rural Communities, 2009; Royal Society of Edinburgh, 2014); and third, the reality is that many individuals who live in rural areas are unable to capitalise upon the opportunities broadband offers because, where they live and work, the ICT infrastructure is not 'fit for purpose'. This situation is one where individuals experience limitations on what they are able to do online, a barrier not to be confused with 'don't want to be online'.

Against a UK Government policy backdrop that ultimately seeks to harness the economic growth benefits of the Internet through widening broadband access across the UK and progressing mobile telecommunications enhancements, this paper reflects on the policy vision and the reality of broadband services. In the sections that follow, we outline the policy drivers in the UK as regards the provision of broadband access and then we consider the realities of the digital divide and how they are manifest

in a rural context. The remainder of the paper, set in these contexts, draws upon work undertaken as part of the Rural Public Access WiFi Service (PAWS) study, research funded by the dot.rural DE Hub based at the University of Aberdeen. We focus on the 'final few' as regards infrastructure provision and discuss the potential of the Rural PAWS experiment as a solution to overcoming some of the barriers apparent in the urban–rural divide, encouraging participation in the DE and, in turn, supporting the UK Government's Digital by Default agenda.

The vision: Government supported ambitions for a digital society

On both sides of the Atlantic, public policy discourse and strategies place emphasis upon maximising the diffusion and use of broadband communication and information services (Preston et al., 2007). In the United States, improving Internet access is 'road mapped' in a National Broadband Plan (Federal Communications Commission, 2010) and includes recommendations and related goals in areas of government policy. In Canada, attempts to address broadband provision in remote areas have been seen in targeted funding initiatives such as provincial governments' public–private partnerships (Carson, 2014).

The Digital Agenda for Europe, part of the Europe 2020 strategy, focuses on exploiting the potential of ICTs to 'foster innovation, economic growth and progress' (European Commission, 2015: no page numbers) and states that 'Europe needs download rates of 30 Mbps for all of its citizens by 2020' (European Commission, 2015: no page numbers).

In the UK, the Department for Culture, Media and Sport (DCMS) is responsible for the Broadband Delivery Programme and oversees the programme in England. The devolved administrations in Scotland, Wales and Northern Ireland are responsible for developing and managing their own broadband programmes under the UK policy umbrella. The roll-out of superfast broadband (SFBB) through fixed telecommunications infrastructure is a current UK-wide priority, with an aim to deliver the best broadband in Europe, in terms of speed, coverage, take-up and consumer choice (Ofcom, 2014b).

The UK Government's delivery vehicle, Broadband Delivery UK (hereafter BDUK), is tasked with achieving the transformation in UK broadband access. In a 'Universal Service Commitment', the Government committed to ensuring that 'virtually all households' in the UK will be able to access broadband connection speeds of at least 2 Mbit/s by 2017 (DCMS, 2009; House of Commons Business, Innovation and Skills Committee, 2010). Furthermore, 95% of UK premises are to benefit from access to far higher speeds, at least 24 Mbit/s (DCMS, 2013a). The UK Government's targets for SFBB availability are broadly consistent with a target set by the European Commission as part of its 'Digital Agenda' in that all homes should have access to 'superfast'[1] broadband by 2020.

To this end, the UK Government has allocated £530 million to stimulate commercial investment to 'bring high speed broadband to rural communities reaching 90% of UK homes and businesses' (DCMS, 2013b: no page numbers) and a further £250 million to extend SFBB to 95% of the UK and explore approaches to 'deliver superfast broadband to the remaining hardest to reach areas' initially through a £10 million competitive fund (DCMS, 2013b: no page numbers). Specific attention within the BDUK programme is afforded to rural areas in the guise of the Rural Broadband Programme, a recognition of the fact that it is not commercially viable for private sector

Internet Service Providers (ISPs) to install fixed broadband infrastructure in what are termed 'harder to reach areas'. In England, local authorities are responsible for taking forward projects to deliver improved broadband in their areas, with each area's programme set out in a local broadband plan. In Scotland, Highlands and Islands Enterprise and Scottish Enterprise are working alongside local government to deliver BDUK objectives. In Wales, BDUK fibre roll-out is taking place through the Superfast Cymru partnership between the Welsh Government and British Telecom (BT); a partnership approach is also adopted in Northern Ireland.

The emphasis in UK policy on SFBB is not without criticism. A focus on connection speed for the majority detracts from universal access across all of the UK. It favours investment and development in technologies that drive higher speeds such as fibre roll-out and high-speed cellular services and thereby diverts investment away from other, less 'headline grabbing' technologies such as those required to achieve universal access (House of Lords, 2012). BT's sole provider position in the roll-out of broadband to rural areas has attracted complaint (Public Accounts Committee, 2014) although it must be noted that BT was the only private sector organisation to express interest in the scheme. Further, market forces naturally favour the deployment of SFBB in densely populated urban and suburban areas. This exacerbates an urban–rural digital divide in terms of connection speeds: the 'faster' areas with better connection are getting 'faster, faster' (Farrington et al., 2015).

In parallel with BDUK efforts to upgrade fixed telecommunications infrastructure, a Digital Strategy – first published by the Cabinet Office in 2012 – is being implemented to re-engineer and transform how the UK Government provides services to the public. The term used for this transition is 'Digital by Default', defined by the Cabinet Office as 'digital services that are so straightforward and convenient that all those who can use them will choose to do so whilst those who can't are not excluded' (Cabinet Office, 2012: 2). Two concurrent goals of the Digital by Default agenda are to develop services that both 'allow straightforward access to information and services in times and in ways that are convenient to the users rather than the providers' and 'are more efficient and cost effective to develop and run' (Cabinet Office, 2012: 5). The UK Government has estimated that significant cost savings (of between £1.7 and £1.8 billion per annum) will result from moving to online service delivery (Cabinet Office and Government Digital Service, 2012: no page numbers).

A report from the UK's National Audit Office, *Digital Britain 2* (NAO, 2013) commended the approach outlined in the 2012 Digital Strategy, but also made key recommendations to the Government Digital Service (GDS), to include improving public awareness of the fact that many public services are available online and to improve communication and publicity regarding how the Government intends to support those currently offline. The NAO's 'assessment of users' capability shows that a significant number of people will need help as public services move from offline to digital provision, particularly those who are over 65, in lower socio-economic groups or disabled' (NAO, 2013a: 9). It is noted that 'those who are offline are more likely to be those who are particularly hard to reach' (NAO, 2013: 9). From an infrastructure provision perspective, the geographical nature of remote rural communities means that they comprise a significant element of the hard to reach group.

The information storage and transmission advantages of access to the Internet in a knowledge-based society confer substantial benefits on users with the reverse

also true (Warren, 2007). Non-users are, in relative terms, disadvantaged. It has been claimed that the UK Government is creating an 'information gap' (*Computer Weekly*, 2013; *ISPreview*, 2014a) that could have detrimental effects for those who are not online, an argument certainly fuelled by newspaper headlines such as: 'Go on the Internet – or lose access to government services, Francis Maude tells pensioners' (*Telegraph*, 2014). Absolute disadvantage occurs when 'offline services are actually reduced as a result of increasing dependence on the Internet, and in extreme cases are lost altogether as the Internet becomes the only way of communicating, locating and retrieving information, or making transactions' (Warren, 2007: 376).

Is a position really defensible by government where offline services are withdrawn yet a minority of the population are unable to access these now online services because they are unable to get online in the place where they live? It would appear not. The recent House of Commons Select Committee Inquiry into Rural Broadband and Digital-only Services was called due to concerns that

> a move towards 'digital-by-default' services is premature, and is based on an incorrect assumption that delivery of basic broadband coverage (2 Mbps) is complete and that adequate broadband coverage exists to enable the public, particularly in rural areas, to use exclusively online Government services. (House of Commons, 2015: 5)

Ashton and Girard (2013) describe households in Canada with internet connections less than 1.5 Mbit/s as being 'un-served' and those with connections of less than 4 Mbit/s as 'under-served', a reflection of the increasing requirements and demands of the digital society. Bandwidth availability and acceptability will increase accordingly and, as noted by many, 2 Mbit/s is already an outdated figure and one that merits review (DCMS, 2015; Ofcom, 2014c). We now turn our attentions to the barriers to digital inclusion, many of which are inextricably intertwined with these points.

The reality: Barriers to digital inclusion

It is increasingly critical, in seeking to address digital exclusion, to ascertain a clear understanding of who can access what and, in geographical terms, where. Given the complexity of a non-Internet user's characteristics, it remains a challenge to unravel the barriers to adoption as they present themselves in terms of absolute numbers at the micro scale. However, developing an understanding of underlying causal factors is pivotal to identifying potential solutions.

Barriers to telecommunications adoption have received a great deal of attention in the literature. Hudson (2013) considers access in terms of availability, affordability and adoption and, moreover, views access from provider and user perspectives – the former defined in terms of 'houses passed' and the latter in terms of 'households subscribed'. There are subtle differences in terms of Internet subscribers (those who have a contract with an ISP) and Internet users (those who consume an Internet service). In this paper, the term 'user' is applied generically. What is important in terms of unpicking the barriers to Internet adoption is the question of whether the issues to be addressed are concerned with the provision of infrastructure or due to other factors such as age and income levels, past experience, perceptions of usage and the potential benefits of being connected and, not least, the cost of the service to the consumer. In other words, adoption can be associated with *personal* attributes or with factors beyond the control of individual consumers. The role of *place* in digital adoption is often

overlooked (Farrington et al., 2015; Philip et al., 2015). This section considers the barriers to digital inclusion and draws attention to place attributes, intertwined with digital infrastructure provision and economics, as reasons for a lack of engagement with digital activities.

The digital divide: Personal attributes

Ofcom (2014a) reported that 82% of adults in the UK have home Internet access, but this leaves 18% who do not. Age is a key factor with six adults in every 10 of those aged over 75 never having used the Internet, accounting for three million non-users and 47% of all non-users (Office for National Statistics, 2014a). Various reports considering the attributes of non-Internet users (e.g. Ofcom, 2014a; Office for National Statistics, 2014b; Scottish Government, 2014) state that the most frequently cited reason for not having a connection is because they 'don't need it'. Whilst this figure suggests that many households without the Internet actively choose not to subscribe, 'there is still a large and important minority who state that barriers prevent them from connecting to the Internet' (Office for National Statistics, 2014b: 14). Approximately three in 10 non-user households (32%) indicate that they do not have the Internet in their household due to a lack of computer skills; additional barriers are cited as equipment costs (12%) and access costs (11%) (Office for National Statistics, 2014b: 14).

Although figures continue to show a year-on-year trend of increasing Internet access by households (Office for National Statistics, 2014a), the fact remains that a significant proportion of the UK's adult population are not online. Further, Dutton and Blank (2013) report that the likelihood that ex-users and non-users will get online in the future has declined, hence this element of the population will probably become more excluded as time goes on. In other words, those most positively disposed to become Internet users have already done so. Published accounts of non-Internet use rarely refer to situations where people would like to be online but are precluded from doing so due to infrastructure limitations: the focus tends to be on tackling financial barriers and a lack of IT skills hindering Internet use (see, for example Dwivedi and Lal, 2007; Van Deursen and Helsper, 2015).

The digital divide: Place attributes

The UK's telecommunications regulator's *UK Communications Infrastructure Report* (Ofcom, 2014c) provides an overview of the coverage, performance and capacity of networks and services used by the large majority of UK consumers. Metrics used to determine the quality of a broadband service are predominantly cited in terms of download speed (megabits per second, Mbit/s) – the maximum rate at which data can be downloaded from the Internet to a user's device (Ofcom, 2014d). Headline or advertised speed, used by ISPs to describe the packages that they offer to consumers, commonly differs to the actual throughput (download) speed experienced by the consumer when they are connected to the Internet at a particular time (see Ofcom's Voluntary Code of Practice, 2008: 4). The regulator indicates that the digital divide in the UK remains one that is linked to infrastructure provision: 'There is currently a significant disparity in the availability of superfast broadband services between rural and urban areas' (Ofcom, 2013a: 27), the main reasons being attributable to the cost of upgrading existing infrastructure outside of major population centres.

UK telecommunications infrastructure provision is predominantly fixed line (wired) or cellular (which supports mobile internet access). In fixed broadband

networks, cable connections, typically either copper or fibre, provide a physical connection between customer equipment in the home or business premises to the networking equipment in a nearby street cabinet or local telephone exchange which then links to the ISP equipment connecting to the Internet. The physical limitations of fixed broadband terrestrial infrastructures to provide the 'last mile' are a limiting factor in the upper speed of the broadband service and the cost of connection between the exchange and the backbone network (Sathiaseelan, 2014).

SFBB (Next Generation Access, NGA) networks are those capable of supporting download speeds of at least 24 Mbit/s from a UK Government perspective, 30 Mbit/s as defined by Ofcom and the EU. Typically this involves replacing copper cabling with high capacity optical fibre either to the home or premises (FTTH/FTTP) or often to a cabinet (FTTC) where copper technology is still used for the final connection to a customer's home. Whilst FTTC reduces the cost of fibre installation, retaining copper cable to the customer, speeds over 30 Mbit/s are only achievable over copper lines shorter than 1.2 km (Royal Society of Edinburgh, 2014) and is most cost effective when cabinets are shared between many subscribers.

Where SFBB connections are not available, consumers rely on standard broadband (First Generation Broadband Networks), typically delivered by Asymmetric Digital Subscriber Line (ADSL) technology over conventional copper exchange lines. ADSL transforms a standard telephone line into an internet connection cable capable of simultaneously carrying voice and data. Whilst the maximum speed of ADSL is often cited as 24 Mbit/s, the UK Government benchmark for SFBB (Ofcom, 2014c), the speed actually delivered varies depending on the length (distance from house to exchange), the installed plant (equipment) and the quality of the copper wiring, with some lines operating at much slower speeds. Bauer et al. (2010) outline the difficulties in providing sufficient data on accurate speed because of the array and complexity of factors affecting test methodologies and test conditions. Furthermore, peak times (usage) and user contention on services mean that broadband speeds are rarely consistent, especially when aggregating a small number of users onto a shared backhaul.

Ofcom (2013b) data reported for Local Authority areas show a general pattern of poor availability of high speed broadband across large swathes of predominantly remote rural northern and southern Scotland, northern England, East Anglia, south-west England and Wales in comparison to more densely populated suburban and urban areas of the UK and lower than average broadband speeds in rural compared with urban areas. Riddlesden and Singleton (2014) reinforce this picture: their analysis of crowdsourced Internet speed test data showed average speeds to be significantly slower in rural areas. Original analysis of Ofcom data on broadband availability, speed and mobile telecommunications coverage in England, Scotland and Wales (see Philip et al., forthcoming) provides further evidence for a stark urban–rural divide, with remote rural areas faring very poorly in comparison to their urban counterparts.

While the use of mobile services to access the Internet has increased sharply since 2010 (Office for National Statistics, 2014b), mobile Internet coverage (available over 3G and 4G services) is far from universal across the UK. In 2013, the regulator reported that there was no 2G (supporting only mobile telephone calls and text messages) geographic coverage from any operator across 12.7% of the UK land mass and no 3G signal from any operator across 22.9% of the UK land mass (Ofcom, 2013a). There are notable national variations in 3G geographic coverage – whilst

only 7% of the English land mass had no 3G signal from any operator in 2014 the figure for Scotland was 49% (Ofcom, 2014c). It is remote rural areas including, for example the Highlands and much of Southern Scotland, mid-Wales and the South-West of England, that have the poorest 3G coverage. 4G services were introduced in 2012 and, by October 2014 outdoor coverage had been achieved for 35% of UK premises, although (as of June 2014) 4G had not been rolled out to a number of rural counties across the UK (Ofcom, 2014c).

The UK Government committed £150m to secure mobile voice services (2G) for up to 60,000 premises that currently do not receive a mobile telecommunications service from any operator (approximately 75% of all 'not-spots') (Ofcom, 2013a). There are no formal plans for public funding to expand 3G network coverage to date. The UK Government wanted mobile telecommunications operators to allow roaming across all networks (made possible by sharing operator's masts), but operators have often preferred to increase coverage by building more masts themselves (*ISPreview*, 2014b). Thus, mobile service provision is poorest in areas where wired broadband provision is also poorest. As such mobile broadband services are not currently a means to achieve universal broadband service provision.

Recent information from the regulator (Ofcom, 2015a) states that the average actual speed for UK residential fixed-line broadband connections (as of November 2014) was 22.8 Mbit/s but 3.6% of UK premises cannot currently access speeds of at least 2 Mbit/s – the minimum speed recommended in the Digital Britain Interim Report (2009). Despite almost a third of all UK broadband connections now being superfast, Ofcom (2015b: no page numbers) note that 'faster cable and fibre services have lower availability in rural areas, and rural broadband speeds are typically slower, delivering around one third of urban speeds on average'. Earlier Ofcom analysis noted that 60% of these very slow connections are located in rural areas: one in five rural premises cannot access this minimum broadband speed (Ofcom, 2013c) and may thus be considered to be 'un-served' (Ashton and Girard, 2013). Rural consumers have expressed frustration with the speed of their connections with Farrington et al. (2015) reporting that nearly one-third of those who live in the 'deep rural' areas of England, Wales and Scotland say that their Internet speed is always too slow for what they want to do compared with only 6% in urban areas and 22% in shallow rural areas.

A 'second digital divide' (Dutton and Blank, 2013: 11) that goes beyond 'access' to the Internet and refers to the benefits of Internet use to 'next generation' users is likely to be felt most acutely in areas where slow speeds predominate because Internet users cannot fully exploit the benefits offered by faster next generation broadband services. Furthermore, current commitments to roll-out SFBB exclude 10% of the UK population, in the region of 6.5 million people, mostly those living in remote rural areas. Clearly, the broadband speed available to a user directly influences what can and cannot be done online. Low speeds make 'data heavy' download or upload activities either very slow or impossible. The availability of additional public funding and pressure for action to ensure more equitable delivery does not currently alter the economic reality that 'Extending SFBB coverage into the last third of the country is commercially challenging' (Ofcom, 2013a: 2). The driver for NGA service provision remains unchanged from when the Commission for Rural Communities (2009: 7) noted that it was 'economic benefit to the supplier and not benefit to the end user. To that effect,

provision will be rolled-out where most return can be made and not necessarily where there is greatest local economic, or indeed, social need'.

The economics of the divide

It is much less commercially viable for ISPs to offer broadband to rural communities than to more densely populated areas, as a result of technological reasons combined with supply and demand economics. The consequences are seen in lower speeds and/or higher costs for users, and a widening gap between average download speeds in urban and rural areas. A large telecommunications exchange can accommodate many users, allows for competition between service operators (offering a service at the exchange and allowing consumers to choose between service providers) and, as such, can achieve economies of scale, with the basic costs of the exchange and backhaul equipment spread over a greater number of connections. This lowers the cost per user. The economic advantages of a large exchange can rarely be achieved in rural areas. As such, the commercial roll-out of SFBB networks has focussed on areas of higher population density where network build costs per household are lower and the potential for profit is highest.

FTTC deployment to sparsely populated remote rural areas is considered less commercially attractive because of the population density argument and the fact that the distances involved in physically connecting all rural premises to a FTTC network make the costs very high. BDUK estimate that upgrades and/or access to the last 10% of households may cost up to three times that for the first two-thirds of potential users (BDUK, 2011). Figures from the European Investment Bank (Gruber, 2015) concur, indicating that building a NGA network with Europe-wide coverage would cost in the region of €220 billion, 50% of the cost being required to cover the 20% of the European population who reside in rural areas. In urban areas, the cost per home is reported as between €150 and €540; in rural areas this rises to 'beyond' €2700.

The economic arguments are well understood but increasingly pressure is being brought to bear to find ways and means of overcoming the technological and financial challenges of making broadband available for all. Some communities have taken matters into their own hands and developed their own broadband infrastructure – locally owned networks, sometimes termed 'alternets' (*Economist*, 2014), for example B4RN (Broadband for the Rural North) in Lancashire and Cybermoor and Fibre GarDen in Cumbria. Community-led broadband initiatives have an important role to play (Ashmore et al., 2015) but they are not without their challenges (Philip et al., forthcoming). As part of the DCMS £10 million innovation fund, other projects to test innovative ways to take broadband to Britain's most remote areas are under way (e.g. Locke, 2015) although the time that this has taken to come into effect has been questioned. The costs and capabilities of satellite broadband and other wireless technologies have also been considered (Analysys Mason, 2010). In the words of the House of Commons Environment, Food and Rural Affairs Committee, 'The difficult geographical nature of some communities must not be used as an excuse for a lack of broadband or poor broadband speeds' and 'It is vital that the last premises in the UK to have access to basic and superfast broadband are treated just as well as the first premises and are not left behind or forgotten' (House of Commons, 2015: 3).

Exploring innovative solutions

It is clear that alternative financial and technical models to reach the 'final few' are

needed. Whilst fixed-line broadband is favoured, it is not viable to reach everyone, and satellite and wireless alternatives combined with community-led initiatives that take into account local topography and community capabilities, all have a part to play. It is within this context that we introduce the Rural PAWS project.

The rural PAWS study

Rural PAWS is an interdisciplinary study drawing upon expertise in Internet engineering and rural geography. It explores opportunities to enable digital inclusion for businesses and households in commercially 'hard to reach' remote rural communities that currently lack, or have less than acceptable, access to broadband services. The study establishes the technical requirements to deliver a public service and explores whether users find this service adequate for their Internet practices and needs. In doing so, the study aims to pave the way to technological advances in the way digital infrastructure is architected, and approaches to evolving a service that is responsive to the needs for greater digital inclusion of communities as a part of the DE.

Rural PAWS technology

Rural PAWS provides free access to a satellite-based Internet service (installed at no cost to a participant) for a period of 12 months. While commercial satellite broadband can offer high speed broadband in our study the connectivity available is rate limited (currently at 1.5 Mbit/s download and 0.25 Mbit/s upload) for normal use. Access to commonly used applications such as email and social networking sites and basic online banking services is supported alongside an enhanced (faster) service to facilitate use of public services accessed through '.gov.uk.' websites (e.g. Driver and Vehicle Licensing Agency, Rural Payments Service) which we term 'whitelisted' sites. Extended use of online 'bandwidth-hungry' services such as the BBC iPlayer and YouTube is actively discouraged through the rate limitation. Limiting the service offered is purposive to explore the minimum level of service necessary to meet the UK Government's 'Digital by Default' expectations whilst seeking to avoid direct competition with subscription based, commercial ISP services (i.e. Rural PAWS does not wish to displace satellite ISPs from the market). Instead, Rural PAWS offers ready access to a minimal service to test the hypothesis that this may serve to stimulate local demand for improved connectivity (to the benefit of the market) as well as bring 'hard to reach' communities online and accordingly allow previously digitally excluded people to enter a digital society.

Piloting the technology

A case study community in remote rural south Shropshire has been the focus of Rural PAWS activities. This locale is designated by the BDUK programme as an 'intervention area': properties in this area (at the time the study commenced, in April 2014) had not received SFBB and no infrastructure development plans were proposed under the current funded programme. There are households in the case study community located on the edges of fixed broadband infrastructure coverage, unable to receive broadband via existing copper cables, and other households that are limited to very slow fixed Internet connection speeds because of their distance from the cabinet. 3G mobile provision in the area is negligible. Although some households subscribe to satellite ISP broadband services the case study community is characterised as one where a sizeable number of properties are 'digitally excluded' due to infrastructure limitations.

Deployment of the Rural PAWS technology comprised the installation of a satellite broadband service received through a terminal attached to the participants' homes and through a specially designed Rural PAWS project router installed in the home. A first-phase pilot experiment sought to explore usage of the Rural PAWS service by all members of participating households and to inform the development of a second deployment of the technology in the same area.

The experimental approach was 'in the wild' – a term used by DE scholars for the testing of new technology systems by groups of users in settings outside of the laboratory (Brown et al., 2011). Combined with narrow sampling parameters, recruitment was necessarily purposive and pragmatic. Selection criteria were threefold. First, the Rural PAWS service had to be deployed in an area identified as rural in the Department for Environment, Food and Rural Affairs Rural Urban Classification (2013) and as an intervention area which did not have, and was not planned to receive, digital infrastructure upgrades under the BDUK programme. Second, participants had to be those who currently were without a broadband connection, or whose existing connection was perceived to be very poor, in other words an inconsistent, patchy, low-volume and/or low-speed service. To illustrate this point, one Rural PAWS participant prior to the service installation (pilot phase) was using a mobile dongle to access Internet services and recorded that it took 4 min and 49 sec to load a webpage related to their farm business activities. Third, Rural PAWS participants were required to be computer literate or to have access to a support network, for example family/friends, able to assist with basic IT training. This was to reduce the risk that the Rural PAWS technology and service was not utilised and tested appropriately because of a lack of understanding on the part of the user. To provide connectivity to a household that wanted to get online but did not own an Internet-enabled device the research team provided an iPad for the duration of the project. Two secondary criteria ran alongside those already reviewed in an attempt to capture some business-related online requirements. The first was the ability to demonstrate both business and personal need for the Internet that could ideally be represented by participants who ran their business from their home. This was thought to be of particular relevance to facilitating the exploration of Internet behaviour in the farming sector where online only platforms for administrative activities such as Integrated Administration and Control System returns and/or cattle movements are now the norm. The second was the potential for developing a 'shared-use' facility (see, for example Middleton and Potter, 2008). The latter criterion was captured by including a pilot user household in the study that ran a campsite business adjacent to their home, offering (rate-limited) Internet access to their customers on site.

Informed voluntary consent to participate in the project was sought from all participants prior to formal sign-up to Rural PAWS, following the University of Aberdeen's research governance and ethical procedures and codes of conduct. Four households, containing 10 potential Internet users, agreed to participate in the pilot. Equipment was installed at each of the sites during April 2014. Attributes of the participating households are as follows:

- Three couple households (two 'older generation', one 'mid-life') and one family household – a 'mid-life' couple with two teenage children.
- Two existing Internet user households (one using fixed broadband, and one making attempts to use mobile

broadband) who both perceived that their existing Internet service was very slow, inconsistent and unreliable.
- Two non-Internet user households (neither had felt any need to be online and had no experience of using computers or other Internet-enabled devices) who were keen to become Internet users.
- All participating households are local business owners (three farm businesses, one tourist accommodation provider) for whom an Internet connection could be useful for some of their business activities.

Three distinct data sets were collected over the six-month period (April–October 2014) of the pilot project: (i) data from the Rural PAWS routers indicating usage and performance of the technology, (ii) 'in-situ' qualitative interviews with all members of participating households were conducted pre-deployment of the PAWS service (April) and mid-deployment (October) and (iii) participants kept diaries in which they were asked to record their Internet usage and to note anything they considered to be relevant about their experiences of the Rural PAWS service. These data combined allowed the research team to evaluate the experiment, refine the experiment for a second deployment phase and to reflect on the wider deployment potential of a Rural PAWS service model.

Findings

The pre-deployment interviews allowed us to understand participants' existing experiences of using the Internet. The two older generation households had no prior experience of using the Internet themselves, but were aware of things potentially of interest to them online. The women in these households thought that being online would allow them to use a new mode of communication with friends and family, to keep up with local news and events and to organise and conduct some of their shopping and leisure activities. The women were apprehensive about the mechanics of going online, one saying 'I don't think I can do it' (i.e. lack of computer literacy), but were willing to try. The men in these households were quite ambivalent about being online at the pre-deployment stage as suggested by the comment, 'You don't miss what you've never had'. The mid-life couple household were frustrated with their existing broadband service, delivered via a mobile dongle, finding it inconsistent, unreliable and very slow. They had not got round to organising the installation of a satellite broadband service in their home. As with other farming households in the area it was not possible to install a DSL broadband connection to their property. Satellite broadband provision was an alternative adopted by neighbouring farms of which the couple were mindful; a satellite broadband ISP partners with the National Farmers Union to deliver its services (*Farming UK*, 2015). This couple was aware of what could be done online and had the technical competence to exploit the Internet to meet their needs. The fourth household, the only multi-generational household in the study, were *next generation Internet users* (Dutton and Blank, 2011): they were trying to use their fixed home broadband service to support up to eight Internet-enabled devices. They were already active in all domains of Internet use (work, social, shopping, communication, etc.) and were putting their connection under considerable pressure. They were keen to see if the Rural PAWS technology could improve the 'basic' connectivity with which they had been living.

Analysis of the mid-deployment interviews and the user diaries provided an understanding of what users are doing online, data that over the course of the study can be framed in terms of how web

activity is intertwined with everyday life (Lindley et al., 2012). All farm business users (older-generation and mid-life couple) used the service to browse online information – weather forecasts, livestock market reports, breed societies, vehicles and machinery. The mid-life farming couple reported significant cost savings to their business and their household through their improved Internet connectivity, arising from, e.g. researching online a biomass system (now installed) and associated Renewable Heat Incentive payments, sourcing a second hand car (with savings), and completing sheep registrations and livestock movements online (Williams et al., 2014). In the couple's words access to the Internet has 'revolutionised how we do things' and, 'We would miss it too much now because we do everything online'.

The next generation user household continued to place their Internet services (including Rural PAWS) under pressure through their use demands (to include Internet browsing, email, social networking, watching video online, play games, online shopping, and downloading and listening to music). This household is part of the continuing trend in growing numbers of next generation users – the result of portability and access to multiple devices, and appear to be experiencing the ramifications of the second digital divide that goes beyond access to the Internet (Dutton and Blank, 2013).

Older generation research participant data concur with Ofcom reporting that older Internet users are likely to be newer Internet users and narrow users – those who make the fewest different types of online uses (Ofcom, 2014e). However, one of the older generation participants would not wish to be without an Internet connection now that they have 'made the leap' and joined the digital society – 'It's a lot better that I expected it to be . . . I'm enjoying it'. The other older generation couple, whilst they and visiting family members have used Rural PAWS, as suggested by – 'The grandchildren love it', feel that 'It's nice to have it here but it isn't essential'. They are yet to be convinced of the benefits of being online and may not retain an Internet connection when the Rural PAWS project ends and being on line would require them to pay to access the Internet – 'I don't really want it for work, that's the difference isn't it?' The other three households have indicated that they are 'getting by' with Rural PAWS for now and will consider the alternative options for an Internet service available to them at the end of the study.

We acknowledge that our pilot study households are few in number and do not present enough data to analyse trends, however our in-depth investigative approach of a microcosm of digital connectivity issues in the wider rural community does aid understanding of those issues. We have found that connecting non-Internet users is likely to lead to at least some 'hard to reach' households appreciating the utility of being online. This has encouraged them to explore the options of arranging a home broadband connection of their own, or reassess (in terms of costs and benefits) the financial imperative of the alternatives to fixed-line broadband such as satellite and wireless services. For the mid-life and next generation user households, participating in the Rural PAWS project has confirmed the importance of being online in their personal and business lives. They have understood the implications of a 'rate-limited' Internet service and have been encouraged to consider alternatives to fixed broadband connections.

As illustrated by one of our older generation participating households, not all non-Internet users can be convinced of the utility of being online. They may accept the need to use the Internet only for very specific functions or may choose not to use the Internet at all. This is the most difficult

sector of the population to engage in digital society and they remain a problem to those pursuing a public service Digital by Default provision model. Further research exploring the attitudes and opinions of non-Internet users who are given the opportunity to go online but who decide not to become permanent Internet users would be valuable.

At the end of the pilot stage of the study, Rural PAWS data suggests four broad categories of rural Internet user, each characterised by the interplay of user requirements of the Internet, understanding and acceptability of the 'free' Rural PAWS service, its capabilities and limitations, and perceptions of utility, value and ability to pay for an Internet service. Although these user categories are fluid in that users can move from one type to another as circumstances, requirements and understanding evolve, the typology helps advance understanding of the attributes and preferences of the digitally 'hard to reach' in rural areas of the UK and, potentially, other similar national contexts. Categories are summarised as follows:

(1) Ambivalent PAWS users: volume of use is small and predominantly only for the 'whitelisted' service requirements – a 'needs must' option for Digital by Default provision.
(2) Accepting PAWS users: understand and accept the limitations of the 'free' PAWS service and find that it actually meets their usage requirements.
(3) Disgruntled PAWS users: the service does not perform as users' expect; users want more from the freely provided service yet are not prepared to pay for improved service.
(4) Potential payers: PAWS is a stepping stone to a paid service; users are aware that they can pay and have made the decision to pay for a service of their choice – potential ISP customers (e.g. continuing as a paid subscriber to a satellite broadband service).

These early conclusions, drawn from the pilot phase of our research provide information that has been used to inform the development of the next phase of the study when more households, representing more attributes of the 'hard to reach' rural population, will have the Rural PAWS technology installed in their homes. We think that there is potential for other 'hard to reach' households who match our 'ambivalent' and 'accepting' categories to be users of a Rural PAWS type service in the future, and in so doing digital inclusion can be promoted amongst at least part of the 'hard to reach' population. From what our 'disgruntled' and 'potential payer' users have reported, there is clearly an appetite for better connectivity in territorially 'hard to reach' areas, evidence that could encourage ISPs to be creative in their attempts to reach this potential market. These findings highlight the opportunities that the Rural PAWS concept project must now address, challenges which are directly relevant to meeting wider digital inclusion aspirations that must be fulfilled if the Government's Digital by Default model is to be useable by the entire population.

Rural PAWS: promoting digital inclusion and facilitating the Digital by Default delivery of public services

Rural PAWS user categories suggest that there are potential government savings that could justify government investment in such a service – that supports the principles of access to 'whitelisted' Government and other public sector websites. Use of a rate-limited service with enhanced capacity for whitelisted sites could also stimulate demand for full-speed services, simultaneously encouraging the market and acting as a conduit to recruit users to a paid service, making this worthy of ISP attention. A partnership between the two is possible,

although it is crucial that the service provided complements other commercial (paid) service offerings, rather than competing for customers. Either way, this raises a number of options for packaging a Rural PAWS service and developing the technology to realise an operational service.

There are obvious advantages (continuous support, simpler billing) for the subscriber and operator if all potential users in 'hard to reach' areas become Internet users with a 'standard' monthly subscription to an ISP. However, other delivery models are worth considering to promote digital inclusion. The Rural PAWS model has the potential to become a platform for ISP providers to reach the 'hard to reach' market with a pilot service that would see broadband infrastructure installed that could subsequently lead to commercial service uptake from households previously in the 'non-Internet user' group, or at least allow these subscribers to benefit from online Government services. If potential subscribers can be convinced of the utility of being online and are willing to consider paying for an ISP service, there are a number of potential models that could be considered besides the normal monthly contract model. One option is a 'pay-as-you-go' model for a defined traffic volume or period – an approach explored in the UK Technology Strategy Board's Digital Advanced Rural Testbed Demonstrator (Skoutardis and Peters, 2011). A development of this option would allow users to opt into a 'value-added' service elevating the speed of the PAWS service for one hour when activated (e.g. paying a small amount for an hour of superfast service). These options would accommodate the breadth of ways in which households use the Internet: some may require high speeds infrequently; others are low volume users who would not feel they received value for money for a monthly contract. The demands of subscribers classified as 'ambivalent' and 'accepting' Internet users could be met under this model. The options assume that an Internet connection is available (who pays for the installation and continued connection is a moot point), but the attraction to the user would be that a subscriber only pays for the service they need. This 'pay as you go' option is proven to work with mobile phones (the user purchases a hand set and then 'pays as they go') and we think that it would be worth exploring the transferability of this model to home Internet provision when supported by the incentive to make Government Digital Services available to all. An alternative scenario would see the Rural PAWS model become the provider of last resort (a 'safety net') (Crowcroft et al., 2013) that ensures access to online public services for all but, to minimise costs, does not allow access to other, non-public benefit Internet activities. This model could be made available in a public place relevant to the remote rural community concerned, for example the village hall or community centre, the public house or places of worship.

The Rural PAWS model presents a series of additional challenges, not least those of funding the capital outlay – provision of networking equipment and installation costs. Whichever way Rural PAWS is viewed, there is a fundamental challenge in ensuring that all actors involved appropriately interpret the service offered by Rural PAWS and that stakeholders in the service can derive the benefits, responsibilities and accountabilities of the model. It is essential that users understand the limitations of the offered service, allowing them to then decide whether they wish to migrate to a paid service when their usage and/or online requirements increase. Disgruntled Rural PAWS users indicate a failure in delivery in that this group extrapolate their view of the limited service as representing the characteristics of a commercial offering, reducing confidence in commercial services.

They are thus unlikely to become future ISP customers. In the meantime, this group of users continues to incur operational costs within the service platform (including ISP customer support and capacity costs). Similarly, Rural PAWS provision in a public place will incur operational costs (either to the ISP and/or on the custodians, public service employees or volunteers providing the service). In both scenarios ensuring user understanding of the limitations of Rural PAWS at the outset is central to the acceptance of the service.

In Rural PAWS the service platform uses a 'differentiated services' framework. This is common in ISP services to classify and separate premium (e.g. business) traffic from residential (e.g. consumer) traffic and to elevate the service of the higher price traffic. In Rural PAWS the entry-level traffic is free. Traffic to selected (e.g. government) services is assigned the premium (unlimited) service. It might be anticipated that the institution or organisation responsible for funding and/or offering the free (to user) service can identify which traffic should be assigned the premium service, and can justify the costs of deployment of new infrastructure to enable ubiquitous access to digital services.

The second phase of the Rural PAWS study brought another four households (additional ten users) into the study. They joined the original pilot cohort and will participate in the study for a minimum period of six months, to allow the project team to engage stakeholders in dialogue and tackle key issues raised by the pilot project. In doing so, we aim to make a tangible contribution to policy with a clear linkage to impact to overcome digital exclusion in commercially hard to reach areas for broadband provision in the UK. In particular, we will seek to establish parameters for potential models of service provision that would be acceptable to private sector service providers, to public sector policy and to users.

Conclusions

In this paper, we have outlined a misalignment of digital connectivity policy aspirations and the realities of broadband services availability; a dilemma that is manifest in a number of ways and, the evidence suggests, is compounded in the rural context. A growing dependency upon the Internet fuels arguments that broadband should be universally available to all, and that those residing in rural areas should not be discriminated against in digital connectivity terms. A lack of access to what is increasingly considered to be a basic utility contravenes agendas of equality and fairness. Against the backdrop of the UK's 'Digital by Default' agenda, a move towards the Internet as the chosen delivery vehicle for public services, online only services will need to be accessible by all, not least those residing and working in areas difficult to reach in terms of broadband infrastructure provision, in both coverage and speed.

Ubiquitous access to a fast, reliable broadband service for all is a laudable vision but realising such a goal presents a series of technological and commercial challenges, not least who pays and what is the lowest common denominator of service that can be feasibly provided. If Internet provision is perceived as a basic 'utility', taken to its logical conclusion a higher cost is paid by all to ensure that 'the final few' receive a service. There is a very real risk attached to improving broadband services for those who already have broadband as the gap between the 'haves and have nots' becomes even more entrenched. Addressing the digital divide and what we term a 'policy vision – practice' misalignment is fast becoming critical to the future of the rural economy.

While our Rural PAWS pilot study takes a case study approach and therefore looks in depth at a small number of users, our findings are illustrative of how improving

connectivity can have a very positive impact in terms of improved business efficiency, user adoption of digital technologies, cost savings and enhanced business revenues, and social interaction. We believe that similar benefits would be made available to more people if the Rural PAWS model was adopted in other 'difficult to reach' communities across rural areas of the UK. There are three potential avenues to explore for delivery of this type of free or near to free service: a commercial model; a public sector model; or a combination, incorporating both public and private sectors.

The most pressing issues appear to be how to engage with the most hard to reach non-Internet users, and how to ensure that they can access online public services when they have no interest or ability to be digitally connected in their own home. One way of addressing these challenges is through public provision of basic online connectivity that is open to all at no cost to the user. This raises interesting questions in the domains of public policy and use of public funds, and their relation to service providers' financial and technical models of provision which are topics of study in the on-going work of the Rural PAWS project.

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Note

1. The UK government defines SFBB as having a download speed of 24 Mbit/s or above. Other bodies, including the EU and the UK telecommunications regulator, Ofcom, define SFBB as broadband with a download speed of 30 Mbit/s or above.

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