

digital power



reform
scotland

digital power

Ben Thomson
Stuart Gibson
Nefertali Deeb

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About Reform Scotland

Reform Scotland is an independent, non-party think tank that aims to set out a better way to deliver increased economic prosperity and more effective public services based on the traditional Scottish principles of limited government, diversity and personal responsibility.

Stuart Gibson is a consultant and former Head of Telecoms & Media at Bank of Scotland with some 20 years' experience in funding a broad range of telecoms and media projects across the UK, Europe and the USA. Stuart has spent much of 2009/10 studying the Digital Britain proposals and meeting potential stakeholders in a Digital Scotland plan.

Nefertali Deeb is Reform Scotland's Researcher.

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Executive Summary

Objective

The aim of this report is to highlight the critical issues which must be addressed to ensure that Scotland's electronic communications infrastructure is fit for purpose in a digital world and is at the heart of Scotland's social, economic and cultural future.

The report first examines the current digital activity level in Scotland, in other parts of the UK, as well as in other countries and makes a range of recommendations that would position Scotland at the forefront of digital readiness and competitively-armed with an intelligent, commercial and integrated strategy. Scotland needs a plan which is much more ambitious in its attempt at inclusiveness across the country and is not just confined to the major cities.

The report looks at the level of digital infrastructure needed for anticipated use by households and businesses. It particularly takes into account Scotland's strong presence in software, digital media and the creative industries and tries to anticipate the next generation of products and services such as e-health and e-education for which digital capacity is of vital importance.

The report then sets out recommendations on how to create a Digital Scotland framework that utilises existing digital infrastructure and facilitates new infrastructure to provide the levels of digital capacity efficiently. We highlight some ideas on how these plans might be financed, despite the pressure on public and private sector capital.

The development of new and existing commercial sectors and the provision of both public and consumer services will become increasingly dependent on ensuring the correct digital infrastructure for Scotland. This will have a significant impact on economic growth across a range of sectors both 'old' and 'new' and on the provision of effective services that is at the core of Reform Scotland philosophy.

Findings

- The SNP Government has largely met the previous Labour Government's universal service objective to provide basic broadband (512Kb) to all homes in Scotland, primarily using Asymmetric Digital Subscriber Line ("ADSL") technology. ADSL is a broadband technology that enhances the capacity in the local copper phone network, but the service is limited by distance from the exchange and bandwidth sharing (contention ratio). A 512Kb service will support instant messaging, simple e-mail, online radio and very basic video applications, but not i-Player, fast internet browsing or fast music or film downloads. The speed at which the 512Kb target has been overtaken by emerging broadband capability (Neilsen's law states that average broadband speeds will double every 20 months) is an indication of how important it is to take a long-term view of Scotland's communications infrastructure needs.
- Lord Carter's Digital Economy Act 2010 committed the UK to a universal 2Mbps broadband service by the end of 2012, but the new Westminster Government has recently pushed that objective out to 2015. As a universal standard, this compares well with most other countries, and in our larger towns and cities it is already a fact, but it is the leap forward to the next target of 50/100Mbps where Scotland is in danger of lagging significantly behind other parts of the UK and many other countries. Speeds of 40Mbps or more, which will allow multiple internet connections from the same wireless hub in the home, fast music and video downloading and file and data transfer encompassing fast upload, as well as download, speeds for small businesses, is generally known as superfast broadband and is provided by Next Generation Access ("NGA") networks. (See Table 1 on page 14 for an explanation of Mbps speed and service provision).
- The Digital Economy Act 2010 sets a broad target of 50Mbps across 90 per cent of the UK by 2017, but because of Scotland's geographic and demographic profile, much of the 10 per cent not enjoying the upgraded capability will be in Scotland and some 20 per cent of Scotland's residential and business premises lie too far from the nearest exchange to have any expectation of achieving even the very modest 2Mbps 2015

target. The EU has its own universal service obligation for members and Scotland will need to do better than 2Mbps if it is to remain within the defined parameters.

- BT has announced that it is currently upgrading its infrastructure and exchanges to offer an enhanced ADSL service across much of urban Scotland with selective deployment of a Fibre to the Cabinet (“FTTC”) solution. This combination will deliver between 24-40 Mbps to some 42 per cent of premises in Scotland by Spring 2011. Importantly, however, not all of the premises within the selected areas will get a consistently faster broadband service and current plans exclude the last 40 per cent of premises in Scotland. This could have a devastating impact on suburban and rural communities in many parts of the country.
- Virgin Media and Cable & Wireless are the only real competitors to BT in terms of fixed communications infrastructure in Scotland. Virgin Media is almost wholly focused on the consumer market and has already upgraded its network to provide a 50Mbps service to approximately 40 per cent of Scottish homes with a 100Mbps upgrade likely to be available in 2011. The majority of these premises, however, like BT’s target area, are in Edinburgh and Greater Glasgow and not everyone has access to a cable network. C & W’s network incorporates the THUS network acquired in 2008 and, aside from the Pathfinder network in the Highlands and Islands and Borders of Scotland, it focuses on major city centres and edge of town business parks. 3G mobile networks provide reasonable internet access in the major conurbations, however most people obtain mobile internet access through urban WiFi hotspots, which use unlicensed spectrum. What is crucial is developing a much deeper backhaul network with many more points of presence, from which a variety of mobile and fixed line access technologies can be used to reach end users.
- The internet is increasingly the preferred transport network for information, entertainment and communication and it is important that those in poorer or remote areas, who may already suffer from social exclusion, do not become further isolated. The economic and social objective is universal access to NGA infrastructure and digital inclusion across Scotland.

- Digital connectivity is to the present day what railways and canals were to the first industrial revolution. So world-class digital connectivity won't just benefit 'creative' industries, it is also vital for 'older' industries that the Scottish Government has identified as important to Scotland's economic success such as financial services, premium food and drink and tourism.
- The Digital Britain recommendations are heavily focused on the residential market and more emphasis needs to be placed on the SME market. The Scottish Government has announced plans to investigate SME broadband access in Scotland. It is important that this study looks outside urban areas to get a true picture of current provision.
- In the more advanced digitally-aware countries such as Sweden, Finland, Norway, Canada, Australia and New Zealand, ambitious digital targets based on rich fibre platforms have already been announced in pursuit of Asian countries like South Korea and Japan, where Fibre to the Home ("FTTH") is now a common utility. In the United States, President Obama's administration has announced plans for providing 100Mbps access to 100 million premises and in the UK, Birmingham has engaged stakeholders in promoting Digital Birmingham, whilst other regions, such as Yorkshire and Wales, are building new fibre-based networks in aggressive pursuit of inward investment.
- The active role of the Scottish Government and its agencies, at present, is mostly to promote digital awareness and technological innovation, but there is no co-ordinated digital strategy or plan to ensure that large parts of Scotland do not suffer from no or very limited access to NGA capability. If Scotland is to compete with other countries and with other regions of the UK, then in an increasingly digital world, we must move quickly to develop a plan to build a fibre network across large areas of Scotland with enhanced copper, wireless and, exceptionally, satellite at the edges of the networks. This will necessitate some public subsidy and choices to be made over how our public and private capital is deployed, but much can be achieved by consolidating existing infrastructure and aggregating public sector procurement of ICT ("Information & Communications Technology") services, which we anticipate will become a major issue post the Beveridge Review.

Policy Recommendations

Establish a Digital Scotland framework and strategy: We recommend that the Scottish Government recognises that Scotland needs a plan which reflects the Digital Britain objectives, but which takes proper account of distinctly Scottish issues, such as the extensive rural landscape. The UK Government has recently announced plans for more ambitious broadband coverage and speeds and Scotland must have its own plan to ensure maximum benefit for all of its citizens.

The Digital Scotland plan should be consistent with Scottish Enterprise's commercialisation policy of helping our software, media and computer games companies and TV and film production industry to develop commercial scale through the establishment of global distribution platforms upon which content can be distributed and monetised in a digital world without selling the underlying intellectual property rights.

The Digital Scotland plan should set out targets for digital usage and literacy consistent with those set out in the UK Government's Digital Economy Act and the recent Scottish Government-backed Digital Participation Scotland Network Study.

Clear proposals and objectives for Scottish public sector involvement in a digital world are required, whether that is the move from paper to electronic databases or public sector telecoms demand aggregation to enhance the case for deeper fibre connections. The development of shared public sector ITC platforms and a new public sector ITC procurement model should be a priority for the Scottish Government and integral to the scope of the digital strategy. There are significant savings and quality of life improvements to be enjoyed from further investment in telemedicine and telecare, in which Scotland is already an international leader.

Appoint a Minister for Digital Scotland: We recommend that the Scottish Government appoint a Minister with specific and unambiguous responsibility for designing, implementing and monitoring the Digital Scotland framework and strategy. Splitting responsibility for the Scottish Digital Agenda, which we understand to be current strategy, between the Minister for Culture & External Affairs (responsibility for digital participation) and the Minister for Enterprise, Energy & Tourism (responsibility for NGA upgrade) is a compromise arrangement and Reform Scotland believes that a single Ministerial appointment with responsibility solely for the broad Scottish Digital Agenda is essential.

It would be a core remit of the Minister for Digital Scotland to engage all of our public bodies, including Local Government and OFCOM Scotland, to contribute towards a Digital Scotland plan and to create a platform for digital development which is both expansive and inclusive. The Minister should engage with the new UK Government to secure maximum central government funding for rural broadband in Scotland in line with the recent announcement by the UK Culture Secretary stating that rural and urban areas would be treated equally and that £200 million of UK-wide funding would initially be provided by the UK Government.

The Digital Scotland Minister's responsibility should include a monitoring and co-ordination role with regard to relevant existing initiatives such as Scottish Enterprise's Digital Media & Enabling Technologies division, the Scottish Digital Media Advisory Committee, Creative Scotland and related funding initiatives such as the Digital Media IP Fund.

Commitment to competitive NGA infrastructure in Scotland: We recommend that there is a commitment to the upgrading of Scotland's electronic communications infrastructure to ensure that Scotland is at the leading edge of UK regional and international NGA deployment. As a guide, we would recommend that by 2015, no community in Scotland with more than 1000 residential and business premises is more than 2 miles from a fibre backhaul network and for smaller communities, the fibre backhaul network should be no more than 20 miles away, allowing wireless connection to the backhaul network. OFCOM Scotland should work to ensure that regulation of licensed and unlicensed spectrum is adjusted to encourage optimal use in rural communities. Domestic contention ratios (bandwidth sharing) should be targeted at not more than 20:1, which would provide better quality and faster services.

The key milestones in that process are set out below:

1. Government / regulatory intervention

- *Fibre map*. There seems to be no up-to-date, publicly-available map of what Scotland's existing fibre network looks like. In order to minimise the upgrade cost by aggregating and using existing fibre as far as possible, a report should be commissioned immediately and completed by the end of 2010 on current fibre reach and ownership within Scotland.
- *Duct access and de-rating of fibre*. Further cost and competition optimisation can be achieved by opening up existing utility ducts to broadband infrastructure investment and de-rating fibre. This will improve competition in urban areas and create investment in more rural locations where high network build costs are compounded by the current rating system which penalises investment in fibre deployment by rating lit fibre on a per km basis. It is precisely in these areas where incentives will be most necessary to stimulate demand.
- *Residential initiatives*. All new green and brown belt residential planning applications in Scotland should include ducting for FTTC and FTTH investment, local authority civil engineering programmes should include complimentary fibre ducting where possible and Home Reports should set out (where broadband has been provided) the average broadband access speed for that property.

2. Network upgrade plan

An infrastructure upgrade plan needs to be developed to meet the coverage proposals outlined above. The plan should include provision for the consolidation of public networks and the aggregation of public sector procurement to reduce the cost of the programme and facilitate investment in rural provision. We need to encourage private and PPP investment, potentially limiting pure subsidy to the most remote regions where wireless is likely to be the only realistic option. An open access network model should be adopted where practical, where the active and service levels of the network are divorced from

ownership of the passive, regulated infrastructure and competitive dynamics are at work offering consumer choice at the service level at an affordable price.

It must be a top priority for the Scottish Government to ensure that at least one area of Scotland is adopted as a pilot project for NGA infrastructure deployment under the plans announced for three such pilots across the UK by the Broadband Delivery UK group. It has been reported that pilot financing could involve £5-10 million of UK government financial assistance.

3. Network upgrade costing and funding options

Funding the upgrade in infrastructure is a major consideration and we recommend a review of possible options during 2010, with a full analysis of the cost of a plan to construct the proposed multi-platform network. This analysis should look at models in other parts of the UK and other comparable countries and should include a detailed analysis of how to maximise access to UK Government and EU funding.

It is difficult, ahead of the detailed investigation of current fibre deployment and the potential for a wireless solution in more remote areas, which Reform Scotland recommends, to accurately forecast the cost of the upgrade proposal. However, our consultations suggest that, with careful planning and phasing, a great deal could be achieved within a £200 million budget. This is about 20 per cent of the likely completion cost of the Edinburgh Tram Project or 10 per cent of the cost of a new Forth Road Bridge. In the context of Scotland's physical geography, situated at the edge of Europe, we consider that the investment in establishing Scotland as a competitive force in an increasingly global electronic economy represents a compelling case for prioritisation.

Furthermore, we believe that with detailed planning of the application methodology, for example linking urban regeneration and green energy projects in remote areas, to the upgrade of communications infrastructure, it is possible that significant EU funding can be accessed (notwithstanding state aid restrictions), whilst at the same time

meeting current Scottish Government energy policy aspirations and offering an employment stimulus in areas of economic deprivation. An EU contribution to the capital cost, together with private sector investment via a broadband PPP initiative and an integrated approach to public sector ICT infrastructure consolidation and aggregation of procurement, could form the basis of a viable financial structure, but careful planning is crucial.

Conclusion

The UK, including Scotland, is one of the most digitally literate countries in the world. However, not upgrading to next generation networks as quickly as other competitor countries could seriously disadvantage our economic and cultural health. Scotland is well served in its major city centres and more affluent suburbs at the residential and the large corporate level, where the economic case is most compelling. But ignoring the poor quality of service to business and residential communities in some suburban and many rural areas is a serious derogation of social responsibility and will create a society of unequal opportunity.

What we are proposing is ministerial leadership in establishing a clear and ambitious strategy which involves much greater coordination in developing the various strands of digital policy and a phased commitment to provide high speed broadband coverage to the vast majority of premises in Scotland, many of which will not be touched by current government objectives. Reform Scotland believes that with careful planning and creative financing, we can achieve targets for our infrastructure which are comparable with other leading countries in the world and consistent with the aspirations of Scotland's residential and business sectors.

Digital infrastructure in Scotland

1.1 Geography and demography

Scotland has a population of 5.1 million, which represents approximately 9 per cent of the UK total. This population comprises 2.2 million homes and is primarily concentrated around Edinburgh and Glasgow. Scotland has a higher proportion of C2DEs (52 per cent) than the UK average of 45 per cent, and a higher proportion of people living in rural locations – at 16 per cent above the UK average of 12 per cent. ‘Rural’ areas are defined as settlements with fewer than 2,000 people and more than ten miles from a larger settlement. More than a quarter of Scotland’s population live in the four main cities of Edinburgh, Glasgow, Dundee and Aberdeen.

OFCOM Scotland published its annual survey in August 2009 which included the following information:

Six in ten households in Scotland have a broadband connection. The proportion of households in Scotland with a broadband connection increased from 53 per cent in Q1 2008 to 60 per cent in Q1 2009, compared to 68 per cent across the UK as a whole. The gap between (slower) take-up in Scotland and the (faster) UK-wide average doubled to eight percentage points. The highest take-up of broadband was in Aberdeen (72 per cent) and Edinburgh (72 per cent) and lowest in the Borders area (54 per cent) and Glasgow (39 per cent).

Some 7 per cent of households in Scotland had a mobile broadband connection at the end of 2008 – the lowest in the UK. Households in Aberdeen were more than twice as likely (15 per cent) to have a mobile broadband connection as those in Glasgow (6 per cent). Take-up in England stood at 13 per cent, Wales 11 per cent and 8 per cent in Northern Ireland. More than one in four households in Glasgow is mobile-only. With 27 per cent of households using a mobile connection for all their telephony needs, people in Glasgow were more likely to rely solely on their mobile than in any other UK city. Across Scotland as a whole, 15 per cent of households were mobile-only in Q1 2009, slightly higher than in the UK as a whole (12 per cent) and up three percentage points from Q1 2008.

In Scotland, 46 per cent of urban households and 15 per cent of rural ones were passed by Virgin Media's broadband network, each lower than the UK-wide figure (56 per cent and 22 per cent), but higher than the comparable figures for Wales and Northern Ireland.

1.2 Current generation technologies

Key Terms

Broadband: The term broadband commonly refers to high-speed internet access. Broadband service is defined as data transmission speeds exceeding at least 256 kilobits per second (Kbps), or 200,000 bits per second, in at least one direction: downstream (from the internet to the user's computer) or upstream (from the user's computer to the internet).

Data transmission: Data transmission, digital transmission, or digital communication is the physical transfer of data (a digital bit stream) over a point-to-point or point-to-multipoint transmission medium. Examples of such media are copper wires, optical fibres, wireless communication media and storage media.

Fibre-optic cable: A fibre-optic cable is made up of super-thin filaments of glass or other transparent materials that can carry beams of light. Because a fibre cable is light-based, data can be sent through it at the speed of light and optical wavelengths create increased bandwidth. Using a laser transmitter that encodes frequency signals into pulses of light, ones and zeros are sent through the cable. The receiving end of the transmission translates the light signals back into data which can be read by a computer. Because fibre-optics are based entirely on beams of light, they are less susceptible to noise and interference than other data transfer mediums such as copper wires or telephone lines and fibre is the platform of choice in network upgrade programmes around the world. There are no major studies which suggest that fibre will quickly be overtaken by another transmission medium and most experts agree that as far forward as we can see, fibre is the future-proof choice. The downside is that fibre deployment is a costly business. No-one knows the precise figures, but OFCOM estimates that to extend fibre to within half a mile of every user in Britain would cost £5 billion. Taking fibre to the door of every home in Britain might cost in the order of £25 billion and 80 per cent of that cost is simply digging the holes in the ground. There are no major plans for extensive roll out of Fibre to the Home (FTTH) by any of the UK network owners, although BT is investing in FTTH in London.

Copper: Copper wiring was first used for communication in voice-based telephone communications. To save money, the same infrastructure was used for internet data transfer. Copper phone cables were suitable for ADSL lines because the unused frequencies at which they operate were still capable of hauling large amounts of data. However, there is a limit to how much data can be transferred at one time. Copper usually transmits data at an acceptable speed at distances of two kilometres or less, but this performance is quickly diluted if the copper is in poor condition and speeds drop off dramatically beyond 2kms from the exchange.

Common broadband platforms

xDSL (the family of Digital Subscriber Line technologies): This methodology uses a combination of fibre in the core network and enhanced capacity in local copper telephone wires. BT has successfully deployed ADSL technology across most of the UK and is currently upgrading exchanges to use higher speed ADSL2+ technology with selective FTTC deployment. This uses very high capacity VDSL in urban areas where the commercial returns justify the additional investment.

Cable: Switching to new, predominantly fibre-based networks throughout the core backbone network and into cabinets in the street (“FTTC”) is widely viewed as the most economical broadband infrastructure for the future. It is the methodology used by Virgin Media, which then takes co-axial cable to the front door with traditional, copper pair wiring laid into the home. Point-to-point fibre or FTTH would enable virtually unlimited data speeds and remove bandwidth sharing issues. In the absence of a Universal Service Commitment, however, fibre rollout is gradual and is following an urban-first deployment pattern.

Wireless: Recent years have seen the rapid spread of internet access via wireless broadband using low-cost, wireless local area network cards and dongles accessing mobile networks so that PCs can transmit and receive signals using the radio spectrum. The combination of low-cost equipment, agreed technical standards and a relaxation of the rules governing unlicensed spectrum in urban areas has led to the rapid growth of Wi-Fi hotspots in hotels, airports, cafes, on trains and in other public places.

It has also enabled the growth of community-run, wireless broadband networks. But for them, the main problem is the cost of connection back to the internet – the backhaul. Here, the problem can be sheer distance, as wireless data transmissions must be in line of sight. Wireless mesh networks

are being used to deliver broadband to rural and urban areas alike, but they remain relatively sparse in the UK. Mobile broadband infrastructure should be seen as complementary to the fixed infrastructure, since once radio signals are transmitted from the mobile device to the nearest base station, they are then transmitted to the main fixed telephone network.

The Tegola wireless broadband project provides up to 20Mbps to some of the most remote communities in Scotland on and around the Knoydart peninsula using wireless within about a 20Km radius and backhaul from a nearby point of presence on Skye. As previously mentioned, it is the lack of backhaul proximity which is the major problem in rural areas. Even in cities, inadequate fibre deployment is a problem where usage patterns are voraciously eating up capacity.

WIMAX and Long Term Evolution (or 4G) are next generation wireless technologies which are so powerful they can potentially transmit as much as 40Mbps over distances of 30 miles. Development of WIMAX in the UK has been slow, due to the limited availability of spectrum and a delay in licensing it and there are questions over its effectiveness. However, the Connected Communities project in the Western Isles, which is described later, uses unregulated spectrum to provide a wide area fixed access wireless service. There are other examples of limited WIMAX roll out in the UK usually in urban areas, but there have been successive delays in the auctioning of spectrum by OFCOM as the existing mobile operators negotiate for better allocation.

Wireless will never be as good as fibre, because the laws of physics limit spectrum capacity, but wireless is an increasingly feasible option for an improved broadband service in very rural communities.

Satellite: In Reform Scotland's view, satellite should only be used in exceptional circumstances at the furthest edges of the country, which are too far away to make fibre or wireless a feasible option. The key issues are that the signal has too far to travel, the dish requires distinct line of sight and there is latency between transmission and reception. The Avanti Reach Project, sponsored by the Scottish Government to hit very poor reception areas and complete "not spots" in Scotland, has not been widely regarded as a success. As next generation applications are developed using increasingly large bandwidth, satellite will not be a reliable or efficient option and is not recommended as an NGA platform, for all but exceptional areas.

BPL: Broadband over Power Lines (BPL), uses medium and low-voltage power lines to provide broadband internet access to residential users and businesses and is considered by some as a third access technology offering potential competition to DSL telecommunication lines and cable modems. Recent trends, however, indicate that the focus of BPL technology is shifting from providing broadband connectivity to smart meter usage allowing households to reduce energy costs and allow energy companies to better manage their networks by developing a “smart grid”. Nevertheless, BPL is worth further investigation as a more mainstream platform.

Table 1: The relationship between broadband speed and service provision

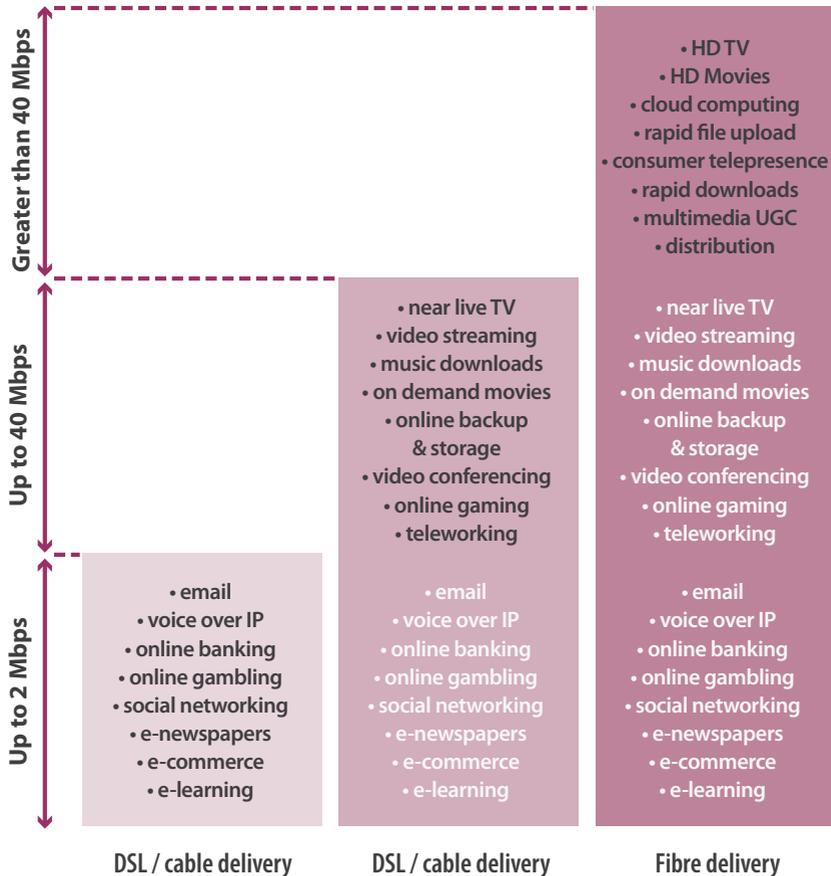


Table 1 opposite provides some insight into what we would be able to do with different levels of broadband provision. The current Scottish universal service commitment is 512Kbps, which will provide basic e-mail, instant messaging, online radio, but not much more and is out of date. At the 2012 target of 2Mbps, the range widens. iPlayer works and a music album might be downloaded in 5 minutes. At 20Mbps, if we all had dedicated access to the internet, some of the advanced services listed above would be available, but as customers are usually forced to share bandwidth, the so-called “contention ratio” (often about 50:1) limits service quality according to distance from the exchange, copper quality and the number of internet users sharing the same internet connection at the same time. At higher speeds, detailed images and good quality video can be delivered and data can be uploaded and downloaded more symmetrically and the benefits to our public sector (e.g. remote diagnosis in health) and our small and medium-sized businesses (e.g. architects sending drawings to customers) start to complement residential entertainment. But what history tells us, unequivocally, is that the higher capacity we provide, the more applications will be demanded. Moving to 50Mbps from 512Kbps creates 100x more capacity, but other countries are going much further than this modest target.

The following table gives a good snapshot of the advantages of higher speed broadband.

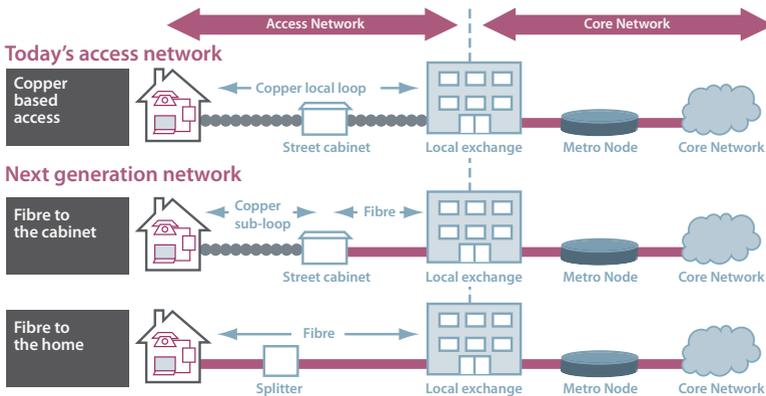
Connection Speed						
	56kbit/s	512kbit/s	2Mbit/s	8Mbit/s	16Mbit/s	24Mbit/s
Download 250kB webpage	36 seconds	4 seconds	1 second	0.3 seconds	0.9 seconds	0.1 seconds
Download 5MB music track	12 minutes	1 minute 22 seconds	21 seconds	5 seconds	3 seconds	2 seconds
Download 25MB video clip	1 hour	6 minutes 50 seconds	1 minute 45 seconds	26 seconds	13 seconds	9 seconds
Download low quality film (750MB)	31+ hours	3 hours 20 minutes	52 minutes	13 minutes 6 seconds	6 minutes 30 seconds	4 minutes 22 seconds
Download DVD quality film (4GB)	7+ days	19 hours 38 minutes	4 hours 48 minutes	1 hour 11 minutes	36 minutes	24 minutes

1.3 Urban and rural options

Urban broadband

A BT broadband connection in a city home will receive a service which varies according to its distance from the exchange, the condition of the copper wire, interference, internal wiring and the number of users on line at any one time, but may typically be in the 6-8Mbps range. This will provide decent e-mail, internet access, file and music downloads and i-player, but the service will be variable and these standards will not be maintained in many semi-rural areas. New applications will require greater speed and more symmetrical download and upload speeds. A target of 50Mbps will allow most current applications to be accessed, but our firm expectation and the lessons of IT deployment mean that with ever more bandwidth-hungry applications available, this will soon be overtaken by a requirement for much more capacity. The good thing about fibre deployment is that once the fibre is blown through the duct, increased capacity can fairly easily be added at each end and its enormous channel-carrying capacity can be transmitted over hundreds of miles.

The three major issues with broadband are reliability of the middle mile, access to services, and universal availability. The capacity of the network is strained by users' demands upon it, which will become greater as video-rich applications such as i-player become increasingly more commonplace and cloud computing offers a rich array of applications which can be downloaded. The diagram below shows how the various fibre-based NGN options differ.



Source: Lord Carter's 'Digital Britain' report

Despite BT and Virgin Media deployment plans, there are still parts of Edinburgh and Glasgow and many urban towns and villages lying just outside these cities where there are no plans for deployment of either an enhanced version of ADSL or FTTC in the foreseeable future. The question is not just over remote and rural areas, but edge of city locations as well.

Rural broadband in Scotland

In many parts of Scotland, the broadband connection remains slow and inconsistent and the current universal standard is a paltry 512Kbs, providing often unreliable internet access and e-mail. DSL 'not-spots' (no DSL service available at all) still exist for some homes connected to a small number of largely rural exchanges. Consequently, there is widespread frustration in some rural communities. BT has successfully trialled new technology at Inverness and Culloden delivering a stable broadband service over lines that were up to seven miles away from the exchanges – more than double the normal 2 to 3 mile reach for broadband. However Inverness Chamber of Commerce has warned that broadband speeds in the Highlands could see businesses lose out in the digital global economy.

Defining rural areas in terms of their distance from cities immediately highlights how central information and communications technologies (ICTs) are of vital importance. ICTs enable the transportation and exchange of voice, video and data at speeds that often make distance irrelevant. They enable people with busy lives to access and share information more effectively and at the time of their choosing. The internet is unprecedented in the flexibility of scale of communication that it can support.

Whilst some rural communities are already using broadband to strengthen social networks and access a far wider range of economic opportunities, there remain key questions around broadband reach, speed and capacity in these communities.

1.4 Investment in rural broadband

There are a number of first generation, mainly public sector-funded, digital infrastructure initiatives already running in areas of Scotland where private capital would not meet commercial return requirements. There are different distribution platforms in use and the quality of connectivity is mixed, but there

are sections of these networks which offer fibre-based backhaul and they should form part of a wider NGA upgrade plan for Scotland.

Connected Communities Broadband is an innovative project bringing broadband services to rural communities throughout the Western Isles. The project, led by Highlands & Islands Enterprise has been funded through the DTI sponsored Broadband Fund, HIE Innse Gall (Western Isles Enterprise), Comhairle nan Eilean Siar with match funding from the Highlands & Islands Special Transitional Programme. Due to the wide distribution of the population across a number of islands, more traditional methods of providing broadband are impractical and would leave those at great distances from their exchanges without a service. There is a limited fibre connection to the Western Isles and some direct fibre supplied to the public sector premises in Stornoway, but the rest of the community is fed by a backbone of primary wireless transmitters with several small wireless connections to local communities. There are still a number of communities which are not served, but the real problem for the future is that the introduction of capacity hungry services like i-player are proving very popular. The more people trying to access such a bandwidth hungry application, the slower it is delivered. In a rugged and exposed terrain, weather can disturb the wireless signal, but of much greater concern is a desperate need to increase the total fibre capacity delivered to the islands. Finding an economic solution is difficult because the population is remote and sparse, but it may be possible to combine green energy development plans with a rural broadband strategy. If a cable is laid to connect wind generated power to the grid, a high capacity fibre link should be provisioned simultaneously. That would deliver effective backhaul to the islands and go a long way towards providing the next phase of digital capability to that community. Our research suggests that many aspects of this project work well, but it has proven difficult to estimate demand and an annual funding shortfall is a risk. This is important because it reduces confidence in affordable provisioning at a time when public and private sector capital is at a premium, but through careful planning and an integrated economic plan, public sector funding and digital exclusion could both be minimised.

Pathfinder is a £70 million project to implement a high-speed broadband network across the Highlands and Islands and Scottish Borders, again largely funded by the Scottish Government. The Pathfinder North rollout is designed

to connect 800 local authority sites such as schools, libraries, social work offices and other Council buildings across the Highlands and Islands. The Pathfinder South Project aggregates the wide-area network requirements of both Councils in the South in order to deliver next-generation broadband services to schools, libraries and council offices across the region. The project sought to ensure that every primary school would have a connection of at least 4Mbps and every secondary school at least 8Mbps. The Councils' corporate (i.e. non-education, non-library) sites were also provided with connectivity under the procurement, and the network services will be used by the Councils to meet their commitments under, amongst others, the Modernising Government agenda, the Efficient Government strategy and the Community Health Planning Partnership Agenda. A seven-year contract was awarded to Thus plc, expiring in 2014.

The Pathfinder project has largely been a success, reaching almost every primary and secondary school in Scotland and its scalability should be considered as part of a larger NGA deployment plan. It is potentially an important part of the jigsaw which must be pieced together to provide rural Scotland with a superfast broadband capability as part of a Digital Scotland agenda.

In December 2008, the Scottish Government signed a £3.3 million Broadband Reach contract to deliver an affordable broadband service to those households and businesses that registered and were verified as being out of reach of any broadband technology. Following a competitive open procurement, the selected supplier was Avanti Caledonian Broadband Ltd. Avanti has utilised a mix of technologies, including satellite and wireless, to deliver a broadband solution appropriate to the location and density. The main phase of this Broadband Reach Project was completed in May 2009. There have been around 2,100 broadband installations, which represents a take-up level of over 50 per cent for those households and businesses which registered demand. Over 3,800 premises spread across numerous areas in Scotland are included in this contract, but it is a service which has been criticised. It is too slow, unavailable where satellite provision cannot reach and is too expensive.

2 Digital Scotland framework

2.1 The digital economy in Scotland

Many countries, including the UK, believe that Next Generation Access (NGA) will deliver similar benefits to those enjoyed as a result of the roll out of current generation - higher productivity, greater innovation, increased access to new markets and greater consumer choice. NGA will also enable more efficient and effective delivery of public services. Telehealth and telecare services, such as remote diagnosis using high definition video conferencing and monitoring long term health conditions in the home, substantially reduce the cost of residential and nursing home provision. This could save hundreds of millions in public spending in Scotland alone.

In economic terms, the rapid development and adoption of new digital communications technologies is fuelling massive global demand for media and entertainment. The convergence of technologies with new distribution channels creates an unprecedented opportunity for the development of new content, services and platforms in fast growing global markets whose value is measured in trillions of dollars.

For Scotland, these markets offer massive potential. Our global reputation for creativity and innovation has been strengthened by media brands such as Harry Potter, Trainspotting and Grand Theft Auto. The first five instalments of the Harry Potter franchise grossed £2.7 billion in global box office sales (more than Star Wars and James Bond) and Grand Theft Auto IV achieved over \$500 million in sales in its first week. According to the Scottish Digital Media Advisory Committee ("SDMAC"), the digital media sector employs 42,000 people in Scotland, with estimated revenues of £3.16 billion, and is typically high value, with strong productivity. Scottish games companies, many of them based in Dundee, provide more than 700 high quality jobs and turnover of more than £20 million a year.

Addressing the gap between creative development and commercial realisation is a critical issue for Scotland's creative economy. In a recent publication SDMAC stated that "we wish to achieve nothing short of a step-change in the performance, reputation and profile of Scotland's digital media industries,

to double the industry in three years and build an international reputation for digital innovation....our vision is to create a high growth, world class cluster of content, platform and technology providers, developing and distributing innovative digital content and technologies to global markets.”

A vibrant digital media sector needs a diverse mix of companies, large and small, creating and distributing content and technology across multiple platforms to international markets. Most obviously, the convergence of digital technologies has greatly expanded the range of channels and devices through which consumers can now access content, including digital television platforms, broadband internet, mobile phones, games consoles and handheld devices. While much of this is not new, most of these technologies and devices have now reached or passed tipping points in consumer adoption that make them commercial, mass- market propositions.

A Digital Scotland plan must recognize that consumers now have more choice and more control over how, when and where they access media content. They are active users rather than passive consumers, and this shift has created opportunities for new services, as demonstrated by the very rapid growth in social networking and user-generated content. In turn, this is challenging existing business models in established sectors such as broadcasting and print media. Online advertising spending in the UK has overtaken television expenditure for the first time.

Unlike other sectors where scale is a pre-requisite, digital media in its most creative and innovative form can emerge from bedroom programmers, recent graduates or micro start-ups. Scotland will always need the ignition of fresh ideas, innovative small teams and new entrants. With the benefit of better connectivity, there is no reason why people in rural parts of Scotland should not play a major role.

With better connectivity, our SME community will be able to expand their target markets by showcasing their products with high definition and detailed graphics, as well as enjoying greater stability of service and better upstream transmission of complex data and large files. As new applications emerge, it will be increasingly crucial for Scotland’s SMEs to have superfast broadband capacity if they are to survive and prosper in local, national and international markets which are increasingly dependent on electronic transaction capability.

Creative Scotland

Creative Scotland is the name of the new strategic body tasked with leading the funding and development of the arts, creative and screen industries across Scotland. The new organisation will take over the functions and resources of Scottish Screen and the Scottish Arts Council. The Creative Scotland agenda includes public and private sector co-operation to promote success in the broad creative industries and includes input from Scottish Enterprise, HIE, Scottish Local Government, The Scottish Funding Council and Skills Development Scotland. There are funding options already available for digital media, for example through the Scottish Enterprise / Creative Scotland managed Digital Media IP Fund. A Digital Scotland plan will promote the creative talent which Scotland undoubtedly possesses and identify development opportunities whether that is in skills, training and education or funding or strategic development advice, for example in addressing the multi-platform distribution options available in a digital world.

Broadcasting

Broadcasting is a whole topic for consideration in its own right, so we only touch on its relevance to a Digital Scotland plan. The UK is experiencing an unprecedented shift in the broadcasting landscape that opens up significant new opportunities for both broadcasters and production companies across the UK. The companies most likely to take advantage of these changes will be those that are able to respond best to rapidly changing demand. This involves investing in digital business and combining on-line content with new commercial initiatives. We will increasingly see online city sites and ultra local TV, which will improve local news coverage and awareness of local services. However, a helpful initiative would be to encourage increased broadband access to traditionally terrestrial broadcast output, which doesn't adequately reach some of our most remote communities.

Public services

Reform Scotland believes that engaging our public services in the digital revolution is critical to improving the quality of output and making them more efficient – in other words providing better value for money. And that means looking at electronic data collection and sharing resources, common IT platforms and connectivity between police forces, health boards, universities and colleges, social services and other public sector services, whether provided by central government, public agencies or local authorities.

Figure 1: Public services and social inclusion through broadband

	Description	Example initiatives
Improved Healthcare	Tele-medicine offers the opportunity to bridge the gap between healthcare services in rural and urban areas	A tele-pathology system developed in Japan allows pathologists using high-definition video and remote-controlled microscopes to examine tissue samples from patients living in rural areas
Better Education	E-learning and online video tutorials can be a powerful tool to improve educational services in rural areas	Korea, Rep. developed the Education Broadcast Service (EBS) to help children in rural areas better prepare for a national aptitude test through access to free video tutorials
Employment Opportunities	High-speed broadband enables tele-working in rural areas and creates rural entrepreneurs	The US government is active in promoting tele-working for the federal government in order to promote employment in rural areas as well as reduce traffic congestion
Access to government services	Broadband allows residents and businesses in rural areas to have access to e-government services	The Rural eGov project of the European Union aims to study the needs of small and medium-sized enterprises (SMEs) in rural areas for government and public services and offer policy recommendations to EU governments

Source: Booz & Company database, 2009.

Telehealth & telecare

The Scottish Government, principally through the Scottish Telecare Centre in Aberdeen and the Health and Social Care Joint Improvement Team, has made excellent progress in using IT and telecoms technology to develop more efficient healthcare with potentially massive savings in public sector care programmes. Further investment will enhance the geographical and qualitative reach of these services.

Telehealth is the delivery of health-related services and information via telecommunications technologies. Clinical uses include transmission of medical images for diagnosis, groups or individuals exchanging health services or education, transmission of medical data for diagnosis or disease management, good health promotion and emergency health advice using video as opposed to pure voice communication.

Telecare is about helping more people in Scotland live at home for longer, with safety and security, by promoting the use of a range of health and fitness monitors in the home which are connected to call centres with access

to medical and nursing intervention. Today, tens of thousands of mainly elderly people, often with different levels of dementia or long-term illnesses, are receiving telehealth and telecare services across Scotland. Examples of monitors include fall monitors, movement detectors, heat extreme, gas and electrical sensors, door alerts, as well as heart and blood pressure monitors.

In addition to the benefits to the individuals concerned, the financial benefits of developing these services are clear. In the case of telecare, keeping people at home rather than building more residential and nursing homes, could save hundreds of millions of pounds or allow these savings to be diverted towards more acute health and social care problems. To exploit these major improvements in healthcare and the potential for major savings in public healthcare spending, we need to have a better quality wired and wireless infrastructure and telehealth and telecare considerations need to be important aspects of our digital plan.

Education

Higher education feeds innovation, supports new company start-ups and has a wider upgrading influence on the digital media industries and Scotland has world class provision in this field. Yet again, Scotland has global innovators in a sector that is also driving change. The University of Edinburgh's Department of Informatics delivers more world-leading research in computing science and informatics than anywhere else in the UK – 69 per cent more than its nearest competitor. In Dundee, the University of Abertay was the first in the world to offer degree courses in computer games development, and Glasgow School of Art is home to the second largest art and design research community in the UK, with graduates working in the highest quartile of achievement in industrial design, product enhancement and contemporary art and design.

In education, Pathfinder should have allowed all schools across the regions to connect to GLOW, the £37 million national schools intranet, which was supposed to transform the way education is delivered in Scotland with internet access, distance learning and video conferencing. However, GLOW has recently been described by teachers as clunky, not user-friendly, inconsistent and unavailable to vast swathes of the country.

JANET is the network dedicated to the needs of education and research in the UK. It connects UK universities, FE Colleges, Research Councils, Specialist Colleges and Adult and Community Learning providers. It also provides connections between the Regional Broadband Consortia to facilitate the initiative for a national schools' network. The range of activities facilitated by JANET allows individuals and organisations to push back the traditional boundaries of teaching, learning and research methods. For example, JANET's videoconferencing and video streaming capabilities are being used to deliver lectures to remote groups of students. For researchers, the high capacity of the JANET backbone allows the linking of large data storage and high performance computing facilities at a national and international level.

It is clear that Scotland has a range of fibre networks, however, there is no central map or co-ordination of policy development focused on identifying how best to knit the patchwork together and upgrade it so that it is fit for 21st century purpose. Reform Scotland believes that it is essential that Scotland develops its own Digital Scotland plan to resolve this major economic and cultural policy void.

2.2 Digital awareness, skills & training

Scotland's ability to fulfil its economic potential is critically dependent on having enough people with the right skills to develop and apply the new technologies.

Skillset is the sector skills council for creative media in Scotland and seeks to continually revise its strategy recognising advances in digital technology, content and distribution in Scotland. Skillset has established a Skillset Academy Network of Excellence in Creative Media Education and Training and, in 2009, concluded discussions with the Scottish Funding Council to secure £5.8 million of investment in this network over the next five years. It is the intention of Creative Scotland to bring together Skills Development Scotland, the Scottish Funding Council and other digital media training councils to develop a specific and relevant remit to ensure that key skills shortages and training are identified and to co-ordinate activities across agencies under a policy statement agreed with the Scottish Government.

The Scottish Government has appointed a digital inclusion executive and his focus is largely on social exclusion, predominantly in poorer urban areas, also dealing with age and rural exclusion. Discussions with the government on digital inclusion and exclusion suggest that more needs to be done to define and deal with these problems in the context of a broad Digital Scotland plan, but the Digital Literacy Scotland Network recently produced a very helpful analysis of the current position in Scotland.

Social exclusion from digital engagement is important, but it should not be defined as a purely urban problem, measured, for example, by low broadband adoption in parts of Glasgow. The wider reality is that it is very often the product of poor electronic infrastructure in rural and remote areas. We should be wary of government trumpeting of local digital participation successes as a cheap alternative to a more complex, holistic solution involving structural infrastructure improvements and harder choices on spending priorities.

2.3 The case for Next Generation Access

The OECD's statistics on broadband in OECD countries find that the number of broadband subscribers in the OECD countries reached 271 million by June 2009, an increase of 10 per cent from June 2008. Nearly one in ten subscribers in OECD countries currently accesses the internet over a primarily fibre network. In Japan and Korea, most people do, and Fibre to the Home (FTTH) is growing fast in Sweden, Denmark and Norway.

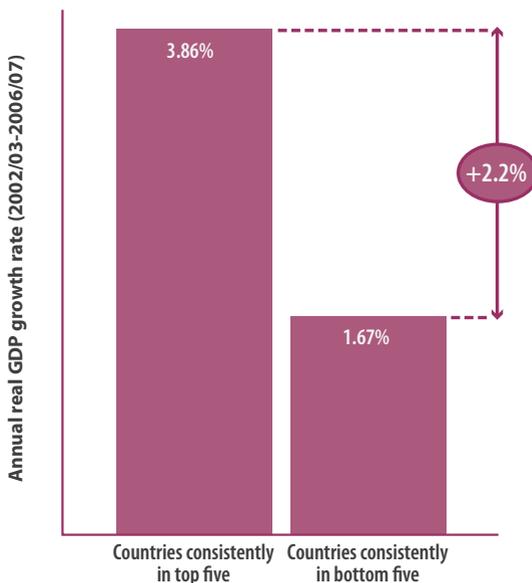
This upgrade is important because high-speed broadband networks are increasingly seen as a fundamental infrastructure for the economy, like roads, water and electricity. Telecommunications firms have been investing heavily to upgrade older copper networks to fibre to accommodate the increasing need for broadband.

The economic crisis has threatened to halt this investment just as consumers and businesses are using more internet bandwidth. According to the OECD, government investment could be justified based on even small direct benefits in just four key sectors of the economy - electricity, health, education and transportation.

If Scotland is to be a global leader in the development of digitally-based applications, content and services, we need leading edge networks over which to develop and distribute them. The pattern over the past 25 years has been the arrival of more advanced fixed and mobile networks at roughly 8-10 year intervals. Now is the time for Scotland to be investing in the next generation of fixed and mobile networks. This will need a 21st century blend of competitive market forces, independent regulation and careful government intervention.

For governments, the pursuit of the new generation requires prompt action and support for renewal. This is particularly important during periods of economic difficulty. A recent report by the Information, Technology and Innovation Foundation (ITIF) points to the multiplier effect of investment in digital infrastructure on jobs, productivity, competitiveness and quality of life, as well as the immediate impact on jobs of investment through engineering and construction. ITIF suggests that in the UK a £15 billion investment in ICT infrastructure would generate 700,000 jobs, of which 360,000 would be in small businesses.

The following table shows how the top five countries in broadband adoption have increased real GDP much faster than countries in the bottom five.



Ubiquitous bandwidth enables the transformation of public services. Rural schools become wireless ISPs and increasingly draw together services on one site. A network of second offices has sprung up next to schools, enabling workers to benefit from high bandwidth and, for many, proximity to their children. From these hubs, people can access online consultations with doctors, social workers and employment advisors. A project like the Inland Revenue tax return online capability is an excellent example of how the public sector can become more IT efficient by using electronic communications to replace the traditional paper-chase.

Reform Scotland believes that competitive business potential should be at the heart of a Digital Scotland plan and that we must be creative in how we maximise capacity and reach. We can learn from several other UK regions and similar countries where governments are prioritising the building of high quality infrastructure and simultaneously, highlighting NGA as a driver of regional and inward investment. This network will need to be fit for purpose over at least the next 10 years and planned and integrated more strategically than has been done in the past.

3 Digital development in the UK

The case studies below showcase the innovation and development that nations and regions throughout the UK have achieved in bringing broadband to even their most rural communities:

3.1 Wales

Wales was considered to be behind in broadband development, so the Welsh Assembly decided to upgrade internet access and extend coverage in order to increase productivity and business performance. Fibrespeed Wales is a collaboration between the Welsh Assembly Government and Geo Networks Ltd, a fibre-networking business. The project was conceived in order to construct a new, world class optical fibre network, starting in North Wales, and then to deliver services to the market using the “open access” networking model where the goal is to maximize the use of the infrastructure – not restrict access to one company and keep prices high. Fibrespeed sells exclusively to service providers in the communications industry at prices comparable with the most competitive parts of the UK. It operates the open access network that is bringing affordable high speed communications services to businesses across North Wales, through a network of over 320km of optical fibre cabling connecting Holyhead in Anglesey through the North Wales corridor down to Wrexham and up to the UK’s fibre backbone hub in Manchester.

The partners have committed £30 million of investment over 15 years with additional European Structural funding. The Welsh Assembly Government has estimated that the net economic benefits of Fibrespeed across north Wales could deliver an increase in Gross Value Added (GVA) of up to £29 million per annum for each of the next 10 years. The WA has predicted tangible benefits come from increased foreign direct investment, new firm creation, increased firm productivity, formation of new industry clusters, promotion of new ways of working/collaborating (including private/public sector collaboration) and encouraging innovation through research, development and commercialisation

of new products and services.¹ Whilst Scotland stalls on telecoms policy, the WA is already working on the next phase of Fibrespeed which will drive NGA further and deeper into Wales.

3.2 South Yorkshire digital region

This is the world's largest single EU-funded municipal project and it went live in April 2009. The project has been driven by a partnership between Yorkshire Forward, Sheffield Council, Barnsley Council, Rotherham Council and Doncaster Council and has attracted over £90 million of funding from the European Union, the partners and the private sector and is the first of its type in the UK. Construction began in June 2009 and is expected to take three years. It will cover the city, towns and villages of Sheffield, Doncaster, Barnsley and Rotherham and serve a population of over 1.3 million citizens, 546,000 homes and 40,000 businesses. Plans include an estimated 2,500 new jobs over 3 years, rising to 4,700 new jobs over 10 years.²

3.3 Digital Birmingham

Digital Birmingham is a city initiative to make Birmingham a major digital city by 2010. Initially set up by Birmingham Council and BT, the partnership now comprises of over 30 organisations, including the BBC, three universities, Microsoft, and Birmingham Chamber of Commerce. Digital Birmingham is involved in over 20 different projects, including a city-wide connectivity strategy, local digital TV and intelligent transport.³

One of the important things which Birmingham and other UK regions are doing is establishing a brand for digital development and promotion as a modern, IT literate, connected broadband community. Digital Scotland is potentially a great brand, reflective of the inventive, innovative and entrepreneurial people who built our country. It is a great opportunity for inward investment and export-led growth.

1 Fibrespeed Website

European Commission report from Jack Straw Note: In official document to the EC, the specific costs were blocked out due to "professional secrecy".
Welsh AsseMbpSly: Fibrespeed

2 Digital Region website

South Yorkshire Digital Region website

3 <http://www.digitalbirmingham.co.uk/projects>

3.4 Cumbria

Cybermoor Ltd provides broadband and web portal services to the community of Alston Moor. Cybermoor presently provides a low-cost broadband connection for the users in Alston Moor, many of whom cannot obtain a connection any other way either due to their location or their personal finances. Historically, the business has been based on a significant level of grant funding from central government, but a commercial business will continue to be developed as the company moves forward. This will focus on a mix of delivering services to local communities and high level consultancy to larger organisations.

3.5 Cornwall

Broadband now covers 99 per cent of Cornwall and the Isles of Scilly thanks in large part to a not-for-profit project led by Cornwall Development Company: Actnow. The project aimed to boost economic growth and social inclusion in Cornwall through the internet. It launched 'the Big Hunt' to get the remaining Cornish businesses and self employed people connected to broadband and actnowflex to promote flexible working hours and better productivity. The project helped well over 10,000 businesses, farms and voluntary organisations. All Cornish exchanges have been upgraded to the latest service – maxDSL – which offers download connection speeds of up to 8Mbps and will adapt the speed to the maximum the line can sustain. The typical speed is around 4Mbps depending on the proximity to the local exchange.

4. Lessons from other countries

4.1 New Zealand

New Zealand's domestic and international telephone systems are rated as excellent and the country has approximately 3 million internet users in a country of 4.2 million people. The regulatory environment for telecommunication companies is considered to be free and open with few barriers to entry. While New Zealand has good levels of broadband availability, the country does have low levels of broadband uptake.⁴ This is partly due to the high data transmission cost – 85 per cent of New Zealand's internet traffic is to international destinations.

Implementation of super-fast broadband: The government is committed to providing access to super-fast broadband to 75 per cent of New Zealanders within 10 years with priority given to businesses, schools, and health services.⁵ To this end, it has pledged to invest NZ\$1.5 billion in fibre companies in order to achieve this target, which would be at least matched by the private sector. This money will be managed by a state-owned investment company called Crown Fibre Holdings whose inaugural board was announced on 29 October 2009. The government views this investment as crucial to New Zealand's economic competitiveness in the 'knowledge economy', especially compared to other OECD nations.

The government called for submissions to consider how to support access to structures and services in order to facilitate the roll out of super-fast broadband. The initial fibre roll out will now cover the 33 largest towns and cities across the country. Discussions are already underway between the government and New Zealand's telecommunications firms in order to form 'Local Fibre Companies' to manage state investment through their local networks. This is the preferred model for the government, which rebuffed attempts by New Zealand's largest telecom companies to create a single, nationwide network.

4 http://www.med.govt.nz/templates/MultipageDocumentPage_____2847.aspx#P590_107043

5 <http://www.beehive.govt.nz/release/ultra-fast+broadband+investment+proposal+finalised>

4.2 Sweden

Sweden has a very advanced telecommunications infrastructure, a result of it being among the first nations in the world to deregulate its industry. It has very high levels of fixed line, mobile, and broadband penetration, and ranks third in Europe in terms of internet user penetration. 89 per cent of Swedes have the internet in their homes.

The International Telecommunications Union recently ranked Sweden top in the world in their Information and Communications Technologies (ICT) Development Index.⁶ The OECD predicts Sweden will retain this leadership status for years to come as current economic conditions make it harder for other nations to upgrade their systems.⁷ The country is also first in rankings done by the Economist Intelligence Unit, World Economic Forum, and the EU's Broadband Performance Index. Sweden's top advertised broadband speed of 100 Mbps puts it behind only Finland (110 Mbps) and Japan (1 Gbps) according to OECD figures.

Implementation of super-fast broadband: The Swedish Government's Globalisation Council's report *Beyond the Crisis* highlighted the fact that digital infrastructure is crucial to growth and the government has responded recently by promising to bring super-fast broadband – speeds up to 100 Mbps – to 90 per cent of homes in Sweden by 2020, with 40 per cent access achieved by 2015.⁸ Similar to New Zealand, the government believes the best route to achieving this goal is through the private sector and the government's 'task is to establish good market conditions and eliminate obstacles to development'. The report recommends a review of broadband access in the country in 2012 when new adjustments to the strategy can be made.

Case Study – Stokab

Stokab is an NGA open access network in Stockholm, which was established in 1994. It is a profitable, commercially-run enterprise owned by the Stockholm Council, but funded privately. It simply provides customers with dark fibre capacity and data hosting facilities. Its customers are 90 service providers with their own customers which include local hospitals, schools, councils and local

6 http://www.itu.int/newsroom/press_releases/2009/07.html

7 <http://browse.oecdbookshop.org/oecd/pdfs/browseit/9309031E.PDF>

8 <http://www.sweden.gov.se/content/1/c6/13/49/80/112394be.pdf>

businesses, which in turn service their clients with a range of products using the Stokab network. Property developers provide fibre to new developments which can offer high speed broadband and media-rich content services to residential consumers.

4.3 Finland

As with its Scandinavian counterparts, Finland has a very modern and advanced telecommunications infrastructure. In twenty years, the number of telecommunications subscriptions in the country has quadrupled with great increases being seen in mobile and broadband subscriptions, but with a decline in fixed-line subscriptions. In 2007, there were 1.5 million broadband subscriptions and broadband was available through a fixed network to 96.1 per cent of Finns.

Implementation of super-fast broadband: The Finnish Government has been actively involved in mapping out a broadband strategy for the country. The first action plan was agreed by the government in January 2004, followed by a more specific resolution outlining the objectives of a broadband strategy in February of 2005. A 2007 review of their national broadband strategy indicated success in many areas, and in 2008 the government released a plan advocating making broadband available to everyone in the country. This report states that it is the ambition of the government to make super-fast broadband (those connections supporting 100 Mbps) available to most citizens by 2015, and to provide average speeds of at least 1 Mbps universally by the end of 2010. The report recommends the government offer subsidies to private sector telecommunications companies in order to achieve this goal. In late 2009, the government passed a law declaring a legal right of all Finns to have access to a broadband connection of at least 1 Mbps. This was the first such law in the world and goes into effect in July of this year.

4.4 Ireland

Ireland's telecommunications infrastructure is advanced, though somewhat lagging behind these other nations. Broadband penetration, for instance, has stalled since 2006, but it still boasts 90 per cent DSL broadband coverage, on a par with Norway, and 34 per cent cable broadband coverage.

Implementation of super-fast broadband: In 2008, Communications Minister Eamon Ryan declared Ireland would not only achieve universal broadband coverage by 2012, but super-fast broadband access in every school by the end of 2010. Ireland wants to see the private sector take the lead in achieving these goals with targeted public sector involvement where necessary. Ireland has attempted to implement a universal coverage target of at least 1 Mbps, but it was based on a less-than-successful attempt to use mobile to provide broadband in conjunction with the operator “3” to provide access to the areas of Ireland that do not enjoy regular broadband service.⁹ A more relevant project involved building Metropolitan Area Networks in several Irish cities. These were individually- owned by local authorities and offered to operators under concession on an open access basis. They were then linked up using backhaul provided by the Electricity Supply Board. This is the kind of initiative worth examining in a Scottish context. The goal is that by 2012 Ireland should have broadband speeds that meet or exceed speeds found in other regions and cities. A broadband taskforce will be formed in the future in order to evaluate the development of broadband in Ireland and ensure it is consistent with economic objectives.

4.5 USA

The FCC just released a report entitled the National Broadband Plan which was published in March 2010 after Congress directed the agency to come up with a plan and detailed strategy in early 2009.¹⁰ The plan is fourfold:

- Design policies that ensure robust competition
- Ensure efficient allocation and use of government-owned and government-influenced assets
- Create incentives for universal availability and adoption of broadband
- Update policies, set standards, align incentives to maximise use for national priorities

9 <http://www.dcenr.gov.ie/NR/rdonlyres/F9B1D956-358D-4870-AA99-DD25A4417F59/0/NextGenerationBroadbandPaperGatewaytoaKnowledgeIreland.pdf>

10 <http://download.broadband.gov/plan/national-broadband-plan.pdf>

The plan has six long-term goals to be accomplished over the next 10 years

- At least 100 million Americans should have affordable access to download speeds of at least 100 Mbps, and upload speeds of at least 50 Mbps (every household should have access to least 4 Mbps download, and 1 Mbps upload speeds by 2020, one of the most aggressive targets in the world).
- The US should lead the world in mobile innovation, with the fastest and most extensive networks.
- Every American should have affordable access to reliable broadband service and the means to subscribe to such service if they choose.
- Every American community should have access to at least 1 Gbps broadband in order to anchor services such as schools, hospitals, and government.
- Every first responder should have access to nationwide, interoperable, wireless public safety network.
- Americans should use their broadband connections to monitor and track real-time energy consumption.

The FCC expects the National Broadband Plan to be revenue neutral as it is only looking for ways to improve government efficiency and stimulate private sector activity in broadband. The economic stimulus bill that President Obama signed into law last year included \$7.2 billion for broadband. \$4.7 billion of this will be disbursed by the Commerce Department, with the remaining \$2.5 billion given to the Department of Agriculture to specifically facilitate rural broadband penetration.

5. The way forward in Scotland

5.1 Digital Scotland framework and strategy

As a necessary first step to enabling universal broadband access, governments need to establish a consistent, coherent, and shared national broadband vision, embedded in a national broadband policy. This policy must not only put forward a national aim for the speed and coverage of the broadband infrastructure, but also provide guidance on how regulators, operators and application and content providers will work together in achieving that aim.

Reform Scotland wants to see the setting up of a cross party committee plus OFCOM Scotland plus relevant private sector experts guided by a respected chair, in place by the end of 2010, tasked with conceiving a phased Digital Scotland plan, ambitious, joined up, researched, costed and jointly resourced by the private and public sector to deliver world class connectivity and competitive service. The aspiration is universal access to high speed broadband and a network upgrade with fibre at its heart and wireless and satellite at the edges, where that makes sense. The short term aim is to develop a plan and a phased investment strategy and to start that process immediately.

There are those who believe that we only get one shot at public sector subsidy and we should go all out for 100Mbps and prioritise the capital requirement. What we certainly need is a minimum of 50Mbps across the vast majority of Scotland, but first we need to establish what our current fibre network looks like and the Scottish Government must assume the task of establishing that starting point as a priority. All of the networks owners, public and private, must be required to share that information. Only then can we work out what needs to be done, how best to do it, how much it will cost and how the funding can be raised.

And we must not be parochial in investigating how funding is sourced and structured in other regions of the UK and in other countries. The perfect funding model for NGA infrastructure does not yet exist, but we can learn from the experience of others and, if that means an international analysis of the options, that is what we must do.

Reform Scotland recommends that the Scottish Government appoint a Minister with specific responsibility for designing, implementing and monitoring the Digital Scotland framework and strategy.

5.2 Broadband investment inhibitors

There are three key inhibitors which are preventing governments and the private sector from collaborating to ensure adequate investment in national broadband infrastructure: the sheer magnitude of the investment, revenue prospects and regulatory uncertainty.

The sector's adherence to legacy policies, regulations, and business models is limiting timely and adequate investment in necessary infrastructure. Governments and private-sector operators must prepare to accept a fundamentally new set of principles and business models. Their acceptance will be imperative to breaking the deadlock that inhibits investment and secure access to broadband.

Investments in national broadband infrastructure are significant, front-loaded, and irreversible. As a result, investors are cautious, tempted to hold back on investments until they have sufficient clarity about their ability to make an adequate return on their investments. Uncertainty surrounding future broadband revenue streams and regulatory obligations are making it difficult for operators to gauge the level of investment risk.

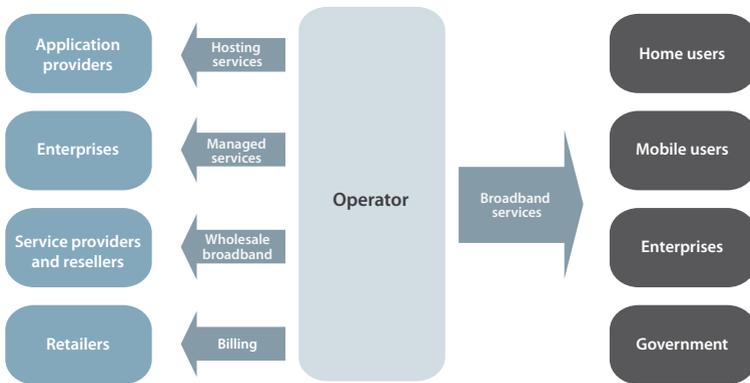
Governments must elevate broadband from merely another regulatory concern to a top issue on the national strategic agenda. This outlook on broadband will prompt policymakers to take a long-term view and develop consensus among all stakeholders, removing narrow vision short-term revenue and profitability pressures.

The emergence of powerful application and service providers is another key factor driving uncertainties around future broadband revenue streams for investors. These providers compete with operators for telecommunications service revenues and stand to profit from broadband—yet they do not have to build the network.

5.3 Open access networks

Open access networks are up and running in many different countries in the world. The principle involves separation of the design and ownership of the network from the provision of the service. The high and relatively fixed costs of deployment can lead to new aggregations of investors and new competitive models at different levels in the value chain, for instance in the provision of ducts and poles to different network providers, something which the incoming UK government is likely to force upon BT and possibly Virgin Media.

Figure 1: Public services and social inclusion through broadband



Source: Booz & Company database, 2009.

Rather than simply subsidise the incumbent to invest in FTTC beyond city centres, it is preferable to adopt a horizontal business model approach which separates the layers of traditional service delivery and establishes three different plays which allow risk to be more appropriately tied to rewards and ensure investment sustainability. This open access approach will not work on a uniform basis across the whole country, but should be investigated and deployed as a preferred strategy wherever possible. It works as follows:

An infrastructure business, Passiveco, focuses on deploying passive infrastructure and leveraging economies of scale, essentially functioning like an infrastructure utility business - similar to gas and water utilities. It is likely to be a natural monopoly and will probably be regulated. It could be financed as a long term utility play. Investors would not take demand based risk, but

would receive a modest, long term return, based on the counterparty risk of the Activeco tenants, whose covenants might be enhanced by Scottish Government intervention in order to reduce the cost of capital.

In the middle layer, Activecos would lease infrastructure from PassiveCo and add intelligent elements to provide differentiated services to both application providers and end users. Activecos would compete on their ability to provide high-quality network and enablement services to application and content providers as well as end users. These businesses would operate in a competitive market, with regulations on service levels, quality, and pricing.

The top layer would have a number of Servicecos operating in an extremely competitive and lightly regulated market consisting of multiple application and content providers. Serviceco businesses would compete on their ability to develop deep market and customer understanding, deploy advanced marketing techniques and innovate continuously.

There are a number of different revenues streams that should be considered when developing the business case. In addition to the subscription and usage fees paid by consumers, there are additional flows of revenue associated with NGA such as interconnect revenues from other operators for incoming traffic (balanced by out-payments for outgoing traffic), wholesale agreements with other service providers to carry their services and/or for the retail of their services (ranging from voice to TV) and advertising, including allowing advertisers to target audiences with intelligent profiling of on-line behaviour

As stated in the Caio report, the evidence points towards the need for a new form of cooperation and coordination among competitors to accelerate the definition of new rules, to secure interoperability and to lower the risk of the investment. It also highlights the need for a regulatory/policy environment that maximises opportunities so that the burden of investment can be shared across a broader range of players.

5.4 The Scottish dimension

The key barrier to upgrading Scotland's infrastructure and providing universal access to high speed broadband is a lack of funding and we have to expect that both the public and private sectors will continue to have limited access to

capital into the foreseeable future. Whilst the private sector will continue to self finance NGA investment in Scotland in urban centres of dense residential and commercial population where the economics work and return hurdles can be met, the reality for local councils and Scottish and UK government is going to be a battle to maintain front line services in the face of reductions in spending power. We suspect that NGA infrastructure spend is perceived as desirable, but unaffordable, and there is a reluctance on the part of the Scottish Government to make any significant commitment to high speed broadband, when it may have limited vote winning potential and when responsibility for telecoms is conveniently reserved to Westminster.

This is not good enough. It is surely essential that Scotland, sitting on the edge of Europe, its manufacturing capacity and industrial base in decline and the future premised on a knowledge based economy, must prioritise a high speed broadband network, capable of supporting economic activity in the electronic age and competing effectively in a digital world. Perhaps we should look to South Korea at this time. It was one of the nations hardest hit by the Asian financial crisis in the late 1980s but rather than deny technology progress, it turned disaster into an opportunity and now it has one of the most sophisticated broadband networks anywhere in the world. Broadband is the infrastructure of the knowledge economy and it is crucial in meeting social, economic and scientific goals. The EU has recently set out ambitious broadband goals for Europe as a matter of urgency and Scotland needs to be in the vanguard of that initiative.

5.5 Private sector funding activity

BT Scotland is concentrating its resources and deploying its capital primarily in Edinburgh and Glasgow and Virgin Media is doing broadly the same thing. If you live or work in these city centres or in nearby leafy communities, high speed broadband, at a price, will be available to you. However, that might not be the case just a few miles down the road in suburban areas, it will probably not be an option in most of our towns and certainly not in the vast majority of our villages. Virgin Media has already upgraded its Scottish network, but most of the homes cabled are the same ones which will get the BT high speed broadband service – because that's where the population lives, where there is competition to be faced off and decent returns to be had. If the investment doesn't meet internal return hurdles, capital will be invested where it does – that way profits are being maximised and the share price will be a beneficiary.

5.6 Public sector funding activity

The Scottish Government has committed funds towards upgrade projects such as Pathfinder, Broadband Reach and Connected Communities and it has engaged with OFCOM Scotland and others in promoting digital inclusion, where some grant funding is available from the UK government, but if it is to be heard, it is probably in celebrating BT Scotland's success in winning limited group capital to provide high speed broadband in our city centres and modest ADSL upgrades in some of our towns. It is dragging its heels on telecoms and NGA policy and shows little interest in prioritising financial assistance to the sector.

It is important that the Scottish Government moves towards a clear strategy as soon as possible, but given the prospect of Scottish elections in 2011 and the squeeze on public sector funding, it remains to be seen whether there exists a willingness to commit to more than further analysis and evidence gathering. We cannot wait until after the Scottish elections in 2011 before we move forward.

The Enabling Technologies Team of Scottish Enterprise is currently commissioning research on the current utilisation of broadband by businesses, identifying any constraints the current system is placing on their growth, including an assessment of the impacts improved connectivity are expected to bring to sustainable economic growth. This is expected to inform part of the Scottish Government's evidence-base for future policy development on broadband. It is also seeking to commission an evaluation of the Pathfinder North and Pathfinder South projects. Key findings will include an assessment of the interventions and the approach taken to delivery and procurement, as well as consideration of overall value for money changes to public sector delivery.

These projects are expected to take place between May and August 2010 and they must do more than simply inform ministers and should direct civil servants and agencies on policy and lead to the positive planning and funding initiatives advanced by Reform Scotland and others. The recent Westminster elections have produced a Liberal Democratic Scottish Secretary of State whilst the Liberal Democratic MSP for Tweeddale, Ettrick and Lauderdale has produced a report advocating the Borders as a key broadband upgrade area. Let us see clear evidence of a Westminster and Holyrood co-ordinated commitment to prioritising NGA in Scotland. Maybe with that momentum, we will see re-prioritised spending on NGA, because while Scotland stalls, the rest of the UK and the world are moving ahead.

5.7 Key elements of the funding model

It is not intended that this report should set out a detailed funding model for the NGA upgrade recommended, but Reform Scotland makes the following observations and recommendations:

The Digital Scotland objective is for Scotland to be one of the most advanced broadband countries in Europe by 2015 with an infrastructure to match that aspiration. The NGA upgrade plan will be phased, but will include all urban, suburban and rural communities in Scotland. Certain remote areas will not get fibre by 2015, but they should at the very least get an interim commitment to much improved wireless or satellite. It is these areas which are most likely to need more direct government intervention.

The Scottish Government, with help from OFCOM Scotland, must quickly establish what the Scottish backhaul network map looks like.

The Digital Scotland Minister must work to ensure that local councils engage with the Scottish and UK Governments, and the private sector, in shaping a successful partnership approach.

We must facilitate the evolution of the new network through a positive approach to street works and rights of way for the new infrastructure by invoking powers to facilitate regional and local investment and network deployment, adoption of national and local public administration procurement policies to accelerate the adoption of NGA, clarity on business rates and changes to planning regulations requiring all new private and public housing developments to include FTTC/FTTH ducting proposals.

Whilst there is no overwhelming case for financial intervention in our major cities, where BT and Virgin Media are already deploying an FTTC solution, public and political pressure should be maintained to push that solution ever further into adjoining communities. Opening up access to current infrastructure providers' ducts and allowing fibre to be carried above ground on poles, will create more competition in urban areas where profits can most easily be earned.

It is harder to generate investor interest in rural areas, even if fibre is de-rated, which should be a priority and to help resolve this problem, Reform Scotland recommends that that existing public networks such as Pathfinder, NHS N3,

JANET etc should be aggregated along with public sector procurement. This will drive procurement efficiency, cost savings and cornerstone revenue generation in rural areas where residential demand volumes will be lower. In other words, the savings which are realised from public sector aggregation are reinvested in pushing out an ambitious solution as far as possible into the rest of Scotland. Better public sector ICT procurement and the development of processes and platforms for sharing services will produce dramatic economies in ICT spend.

We need to develop a detailed financial model, based as far as possible on open access principles and work towards a joint public-private sector funding solution covering the cost of a phased NGA upgrade programme. Just as public-private partnerships have become the norm in the development of vital energy and transportation infrastructure, a similar model is needed for the telecommunications sector in developing national broadband networks.

We must develop a methodology with the Scottish government which embeds NGA infrastructure in Scotland's economic framework and look at the best methodology for accessing EU funding. It is therefore important to consider state aid implications and establish market failure conclusions and intervention arguments with a view to targeting specific funding pots. One option might be to add broadband funding to urban regeneration and other remote regional development proposals consistent with the EU Lisbon statement and the Scottish Economic Framework strategy. It may be possible to access a combination of European Regional Development Fund and European Social Fund money and if that can be achieved, then an application for significant additional leveraged European Investment Bank funding might also be successful. What is essential is that we examine EU funding options, changes to regional development funding policy and relevant application methodology as a matter of urgency.

The Reform Scotland proposal is to move quickly to consider the options, use existing infrastructure, where possible, to lower the cost, examine wireless alternatives and access private, UK Government and EU funding in order to reduce the Scottish Government contribution to what is really necessary to deliver a universal high speed broadband service as quickly and efficiently as possible.

6. Conclusion

The UK, including Scotland, is one of the most digitally literate countries in the world. However, not upgrading to next generation networks as quickly as other competitor countries could seriously disadvantage our economic and cultural health. Scotland is well served in its major city centres and more affluent suburbs at the residential and the large corporate level, where the economic case is most compelling. But ignoring the poor quality of service to business and residential communities in some suburban and many rural areas is a serious derogation of social responsibility and will create a society of unequal opportunity.

What we are proposing is ministerial leadership in establishing a clear and ambitious strategy, which involves much greater coordination in developing the various strands of digital policy and a phased commitment to provide high speed broadband coverage to the vast majority of premises in Scotland, many of which will not be touched by current government objectives. Reform Scotland believes that with careful planning and creative financing, we can achieve targets for our infrastructure which are comparable with other leading countries in the world and consistent with the aspirations of Scotland's residential and business sectors.

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