An Evaluation of the Digital Britain Report

L. Sharif [*]
M. Ahmed [**]

Abstract
Purpose: *The UK government outlined its vision of the future in the "Digital Britain" report published in June 2009. The paper provides an evaluation of the report and offers professional comments with a particular focus on Universal Broadband Access and Next Generation Access (NGA) networks. The paper also provides an overview of the currently available fixed and wireless broadband access technologies in the UK and the main challenges associated with these technologies in terms of migration towards NGA networks. The UK government has often been criticized for its lack of leadership in the provision of adequate broadband access in rural areas. The paper further discusses the government stance with regard to this issue and proposes solutions that could be cost-effectively deployed to extend coverage of broadband access to rural areas. The paper also reviews some of the successful NGA deployments around the world and discusses some of the useful lessons that could be drawn from these examples. A brief summary of some of the social and economic benefits associated with universal broadband access is also provided.*
Methodology: *The study is based on a critical evaluation of the Digital Britain report published in June 2009.*
Findings: *The study evolves up with solutions that could be cost-effectively deployed to extend coverage of broadband access to rural areas of Britain. The paper concludes with a number of key recommendations to ensure that the UK is not left behind in the global digital race as a growing list of countries actively seek to adopt a universal service commitment for broadband.*
Keywords: *Digital Britain (DB); Universal Broadband Access (UBA); Next Generation Access (NGA); Universal Service Commitment; Worldwide Interoperability for Microwave Access (WiMAX); 3G; Long Term Evolution (LTE); Mobile Broadband*
Paper Type: *Review*

Introduction

There is an ever increasing desire amongst the developed nations of the world to help their citizens to actively participate in the modern digital economy and digital society. In the UK, the fulfilment of this ambition is one of the main goals of the *"Digital Britain"* report published in June 2009. This is a wide ranging report and covers a number of areas that are essential to deliver the digital Britain vision. In this paper, the main aim is to evaluate the content of the Digital Britain (DB) report and provide professional comments with particular reference

[*] *Senior Lecturer, London College of Research, U.K, l.sharif@lcrl.org.uk*
[**] *Professor of Computer Networks and Communications Engineering, College of Computer Science and Engineering, Taibah University, al-Madinah, Kingdom Saudi Arabia, mahmed@taibahu.edu.sa*

to *Universal Broadband Access* and *Next Generation Access (NGA)* networks which is discussed in section I. The remaining sections of this paper are organized in to three sections.

In section II, a brief overview of the currently available fixed and wireless broadband access technologies in the UK is given. Description of some of the roles and main challenges associated with these technologies in terms of migration towards the Next Generation Access (NGA) networks is also taken into account.

Critics have often commented that there is a lack of vision and leadership from the UK government with regard to the provision of adequate broadband access in rural areas. In section III, the government's position with regards to delivery of Universal Broadband Access, especially for the rural parts of the UK is reviewed. Solutions that could be cost-effectively deployed to extend coverage of broadband access to rural areas is also proposed in this section. A number of countries around the world have successfully deployed NGA technologies as part of their national IT strategies. Review of some of these examples to see if there are any useful lessons for the UK will also be considered.

Today, broadband has become an essential commodity like water and electricity **(Carter, 2009)**. Governments around the world have recognized the huge benefits associated with Universal Broadband Access. In section IV, a brief summary of some of the social and economic benefits associated with universal broadband access is discussed.

Section I: Broadband Access in the UK

The communication sector is one of the three largest sectors of the UK economy **(Carter, 2009)**. The advent of the internet has revolutionized modern communications. In the UK, residential and commercial broadband services are provided through the access network which connects customers to their local exchange or cable television network **(Parliamentary Office of Science and Technology, 2008)**. In terms of fixed broadband access, there are two major access networks in the UK: *BT's copper telephone network* and *Virgin Media's cable television network*.

- **Asymmetric Digital Subscriber Line (ADSL)**

Although BT's copper network was originally designed for telephony, the development of digital subscriber line (DSL) technology has allowed this network to support simultaneous transfer of voice and data **(The history of BTs copper telephone network, 2009)**. More recent technological breakthroughs have allowed for download speeds of 24Mbps (using ADSL2+). However, this bandwidth is asymmetrical and users that are further away from their local exchange tend to experience lower speeds.

- **Cable**

In the UK, most of the cable network is owned by Virgin Media. Although the original cable network was based on coaxial cables, the current Virgin Media network uses a mixture of optical fibre and coaxial cables **(Caio, 2008)**. Current broadband packages offered by Virgin Media deliver download speeds of 10Mbps, 20Mbps and more recently 50Mbps. Although cable broadband is also a shared technology, it is less prone to deterioration in bandwidth with increased distances.

- **Wireless**

In the UK broadband is also provided through wireless and mobile technologies. These technologies have an important role to play in rural and remote areas of the country. *WiMAX* is a particularly attractive technology for such areas since it does not rely on any fixed infrastructure and offers relatively high bandwidths over a range of several miles. One particular example is *Milton Keynes* where most people could not get speeds faster than 512 Kbps due to the local loop using thin copper wire. Broadband was delivered in the area using WiMAX technology with download speeds of up to 2Mbps **(Parliamentary Office of Science and Technology, 2008)**.

- **Mobile**

Mobile access to the internet is becoming increasingly popular. Most of the mobile operators in the UK now offer mobile broadband access. Using existing 3G technology, download speeds of up to 2Mbps are supported. However, with future developments in 4G (e.g. *LTE*) this is likely to offer much higher speed.

Section II: Broadband Technologies: Roles and Challenges

NGA is generally assumed to refer to the upgradation of the final link to the end users of broadband services to speeds much higher than those currently offered **(Caio, 2008)**. A number of countries around the world have already begun deploying fibre as part of the national NGA plan. In the UK, the debate about whether or not to invest in NGA continues to gain momentum. Some of the major telecom providers have argued that they do not see a strong business case for major investments in NGA at this stage **(Parliamentary Office of Science and Technology, 2008)**. Research also suggests that consumers are not prepared to pay more for NGA than existing broadband. A well established and strong satellite and cable pay-TV market also weakens the case for pushing TV via NGA broadband **(Parliamentary Office of Science and Technology, 2008)**.

It is believed that technical innovations could allow the existing broadband access technologies to be further exploited to deliver faster speeds. Fibre is widely regarded as the ideal technology for the delivery of NGA. Although there may be expectations in some quarters for a

complete overhaul of the existing access network infrastructure in the UK, yet a solution based completely on fibre is probably not practical due to the high cost associated with its deployment. It is more likely that NGA will be delivered through a combination of existing access technologies (based on copper, cable, wireless and mobile) coexisting with solutions based on fibre (to the home or to the cabinet) **(Carter, 2009)**.

The existing broadband access technologies have an important role to play in the delivery of NGA and there are strong indications that the market is gradually delivering further investments in NGA **(Caio, 2008)**. BT has already invested over £10 billion in its 21st Century IP Network **(Parliamentary Office of Science and Technology, 2008)** and has announced its intention to invest further £1.5 billion towards NGA deployment to cover 10 million homes **(Carter, 2009)**. Very High Bit rate DSL (VDSL) is the latest access technology based on copper and promises speeds of over 100 Mbps. BT conducted successful trials of VDSL using Fiber-to-the-Cabinet (FTTC) and recently launched a national rollout. The latest developments in Virgin Media's network utilize a FTTC solution and are expected to deliver speeds of up to 50 Mbps to around 12.5 million homes by the end of 2009. The final leg of the connection to the customer premise still uses co-axial cable **(Caio, 2008)**.

It is expected that mobile broadband will serve an estimated 15% of the rural population which is unlikely to be served through fixed connections **(Carter, 2009)**. Mobile broadband is currently delivered in the UK using the 2.1 GHz frequency band and is predominantly offered in urban areas. In rural areas, it is much more efficient and economical to deliver 3G broadband over lower frequencies (800 and 900 MHz). However, in order to deliver mobile broadband over these frequencies it is required that mobile operators agree on the re-apportioning and use of 900MHz spectrum **(Caio, 2008)**. Recent initiatives by the government are expected to bring about changes in the way spectrum is allocated to mobile operators **(Carter, 2009)**. Based on historical experience, there is a danger that the ongoing competitive, legal and regulatory controversies could take many years to resolve.

Section III: Universal Broadband Access in the UK

The DB report proposes a Universal Service Commitment in broadband access by 2012. Although this commitment is still subject to a further study of the costs and benefits, a minimum service level of 2Mbps is anticipated **(Carter, 2009)**. With regard to the funding of the Universal Service Commitment, it is expected that detailed proposals will be developed for the design and operation of a new, broadly-based scheme to decide who should contribute as well as the governance and accountability structures **(Carter, 2009)**.

With reference to universal broadband access, it is clear that there are wide-ranging proposals that still require legislation in some areas. There are still many issues that the government feels require further consultation and the formation of various administrative bodies. There is a lack of detail with regard to the funding and delivery of universal broadband access for the remote and rural areas of the country. Even with regard to the pledge to deliver a minimum speed (probably 2Mbps) across the country by 2012, the government has made it clear that before making any decision, it will need to consult its European counterparts and Ofcom to assess the ramifications of universal provision before the actual mechanisms for delivery can be determined **(Carter, 2009)**.

The government's stance has been criticized by the opposition. The DB report has also received a lukewarm response from other quarters. In particular, the Commission for Rural Communities (CRC) believes that plans for universal broadband outlined in the report are not good enough for those living in rural areas. The CRC has called for a firm commitment and a comprehensive strategy and implementation plan for rural areas.

WiMAX is widely considered to be an ideal solution for delivering broadband access to rural areas. The DB report mentions that wireless technologies have a role to play in the delivery of Universal Access (UA) commitment. However, whilst the report emphasizes the role of mobile broadband in extending coverage to rural parts of the UK, WiMAX is hardly mentioned. Critics say that the government has succumbed to pressure from the incumbent mobile operators keen to push 3G and LTE based broadband access solutions **(Schofield, 2009)**.

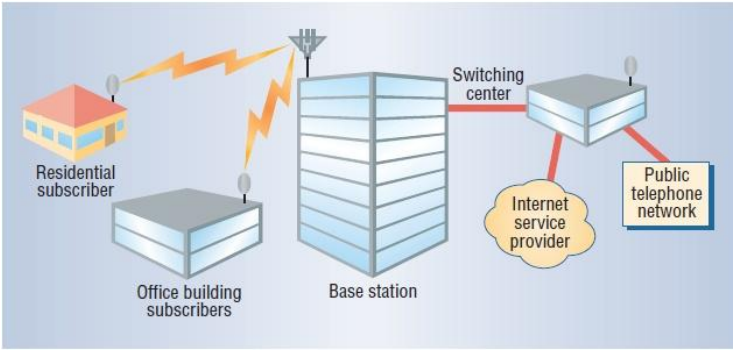
- **Broadband Access Solutions for Rural Areas**

Connecting people living in rural areas presents a major challenge. This is mainly due to the fact that rural populations are often outside the reach of existing communication infrastructure. From a service provider viewpoint, the Average Revenue Per User (ARPU) for rural areas is low so investment in deploying access technologies for such areas is not commercially viable. Fibre is commonly considered to be the ideal technology for the delivery of NGA. However, the biggest challenge in the use of fibre is the cost of deployment. Due to naturally low population density of rural areas, the cost of fibre deployment is even higher. The major cost (up to 80%) in the deployment of fibre is the civil engineering works, i.e. the physical digging of roads and pavements to lay the cables. WiMAX and 3G mobile broadband could potentially offer a solution to the problem of providing broadband access in rural areas.

- **Worldwide Interoperability for Microwave Access (WiMax) Broadband**

In rural areas wire line technologies such as DSL and cable are considerably more expensive and time consuming to deploy. Wireless technology has the potential to address this problem. In particular, WiMAX (Worldwide Interoperability for Microwave Access) which is a technology based on an evolving standard for point-to-multipoint wireless networking **(Fig. 1)**, could be cost effectively deployed to provide broadband internet access to rural areas.

Fig 1: WiMAX provides point-to-multipoint wireless networking



Source: Vaughan-Nichols, 2004

In a typical WiMAX setup, carriers could set up rooftop transceivers as base stations connected to the Internet. The base stations use WiMAX to communicate with fixed, externally mounted customer antennas **(Vaughan-Nicholas, 2004)**. WiMAX is a standard-based technology for delivering last mile wireless broadband access as an alternative to cable and DSL. It has a longer range and higher data rates than current 3G services. In the lab, WiMAX can deliver a peak data rate of around 40Mbps. However, in real world deployments, the actual data rate depends on factors such as the number of people using the network and distance from a transmitter. Average download speeds of between 3Mbps to 5Mbps are more common.

A case in point is the Cybermoor network in Alston Moor in Cumbria. Although it is one of the most sparsely populated rural areas in England, it claims to have the highest broadband penetration rate of any rural area in England. The Cybermoor network which is based on the WiMAX technology provides a fast and reliable broadband service for the local community, with plans to launch telemedicine services in the future **(Lomas, 2009)**.

- **3G Mobile Broadband**

In the UK mobile phones are generally more prevalent than PCs. The next generation of mobile phones is now developing PC functionality. Mobile

broadband using 3G is a possible solution for providing broadband access to rural areas in the UK. Although current 3G mobile broadband deployments using 2.1 GHz frequency band provide high mobility level and enable access from anywhere, the speed levels vary from 256 Kbps to 3.6 Mbps **(Prodnik & Kranjcevid, 2009)** 3G in the 2.1 GHz band is best suited for urban areas which are typically densely populated. For rural areas, such high frequency radio signals do not travel as far and thus require more sites and installations to provide better coverage **(Meyer, 2009)**. As a result, 3G mobile broadband deployments to rural areas on the 2.1 GHz frequency band would not be economically viable for most mobile operators due to the additional costs involved.

The solution would be to use 3G at the lower 800 MHz and 900 MHz bands. At these lower frequencies cell sizes are two to three times larger which enables coverage with fewer sites and over greater distances making it ideal for broadband services in rural areas. This would also result in lower costs and faster rollouts by re-using existing sites. Deploying 3G on a lower spectrum is perfectly suited to rural areas because signals will remain strong over long distances and the lower user density will easily mitigate the reduced throughput.

However, in the UK, deployment of 3G in the 900 MHz band requires regulatory approval. In the UK, *Vodafone* and *O2* occupy the 2G spectrum at 900MHz whilst spectrum at 800MHz will become available after the analog to digital switchover in the coming years **(Meyer, 2009)**. The government has proposed some initiatives in order to clarify how the required spectrum could be made available. It is expected that *Vodafone* and *O2* will have to give up some of their spectrum which is best suited to rural areas and which can then be reallocated between all the five operators **(Neate, 2009)**.

- **Long Term Evolution (LTE)**

LTE is another possible solution which has the potential to provide broadband access to rural areas. LTE is a 4th generation (4G) mobile broadband technology and considered to be the natural successor to the current 3G technology. LTE will also provide support for roaming Internet access via mobile phones and handheld devices. However, LTE technology is still in development and is not expected to be widely available until 2012.

Section IV: Lessons from other Successful Examples

Countries around the world have employed various strategies for developing NGA. It may appear quite desirable at first to emulate some of these successful models. In practice however, it is not so simple **(Caio, 2008)**. The Far Eastern countries (e.g. Japan, North Korea, etc) have achieved some of the highest rates of fibre penetration in the world.

However, this has typically involved major government investments. On the other hand US government has assured the incumbent telcos that they will not be required to share their infrastructure with competitors if they make major investments towards NGA. It would be quite impossible to replicate such models in the UK because they would breach the letter of UK or EU law and would not have a positive impact on the competitive nature of the UK market **(Caio, 2008)**.

The NGA deployment model used in some of the Nordic countries has enjoyed significant success. This has typically involved local municipal networks on an open-access basis, often funded through public – private partnerships. The local authorities often provide a leadership role and there is generally a high level of commitment from the local communities **(Caio, 2008)**. One successful example of this is *OnsNet*, a community-owned FTTH project based in the town of Neunen, Netherlands. Each household in the area pays a one-off payment of €20 for membership of the OnsNet co-operative which provides the necessary consumer aggregation and guarantees to support the investment **(Caio, 2008)**.

The open-access model adopted in the case of Neunen, in which investment is seen as part of local development instead of a national roll-out program offers useful lessons for the UK. There are signs that this model might contribute to NGA development in the UK. One particular example of this type of model being deployed in the UK is the village of Alston Moor in Cumbria. In 2002, as a result of a project started by the locals, broadband was brought to the area after BT said that it was not viable to provide even standard broadband there. The village is now set to get fibre connections after the locals themselves decided to dig the trenches for the fibre optic cables to be laid. Initially, the fibre connection is expected to deliver speeds of 20Mb with plans for speeds up to 100Mb in the future **(Village in Cumbria lays their own fibre broadband, 2009)**.

One of the recommendations made by the CRC is for the government to provide more help for such community-based broadband schemes in rural areas. The example of Alston Moor also highlights the important leadership role that local governments can play in facilitating NGA developments without necessarily providing financial support. The Alston Moor example also illustrates the very important role of local engineering and planning solutions in massively reducing the cost of universal broadband provision.

Social and Economic Benefits of Universal Broadband Access

There have been a variety of qualitative research studies conducted in the past decade along with significant amount of anecdotal evidence to highlight the wide-ranging benefits of universal broadband access. Governments around the world have begun to recognise the powerful influence and benefits that broadband offers by way of increased

economic opportunities, increases in trade and productivity, creating more job opportunities, reducing business costs, increasing efficiency, promoting research and development and attracting foreign investment.

The recent global downturn has forced many countries to look at provision of universal access to broadband as a driver of economic prosperity. The new administration in the US has announced an economic stimulus package that includes $7 billion in grants for universal broadband access. According to the chairman of the Federal Communications Commission (FCC), providing universal broadband access in the US is this century's version of building highways or extending railways **(Bleed, 2009)**. The UK government has emphasised the provision of universal broadband access as an essential prerequisite for a return to growth and increased prosperity. One study conducted by Accenture suggested that universal broadband access could contribute as much as $400 billion to GDP in Europe **(Crandall & Jackson, 2001)**.

The case for universal broadband access in the UK is a particularly strong one. Those sections of the population with broadband access already enjoy benefits such as paying bills online, internet banking, having access to competitive savings rates, access to e-government services such as online tax returns, improved social interaction and working from home. Some specific examples of the benefits of universal broadband access are as follows:

- **Healthcare**

Universal broadband access has the potential to revolutionize the delivery of health care services. Telemedicine already allows patients in remote areas of a country without access to hospitals to send information such as pulse rate, blood pressure, glucose levels, temperature, etc to medical staff who are hundreds or even thousands of miles away. Health care providers can use video conferencing technology to discuss results with patients and provide diagnosis.

- **Education**

Broadband access is now considered an essential tool for higher education. Almost all universities in the UK now have a web presence and many post course-videos and materials online, completely transforming the way teaching and learning takes place. Broadband access also makes it possible for universities to deliver courses remotely to any part of the world. In the developing world, such innovative use of the internet provides a means for levelling the usually unequal distribution of educational resources.

- **Journalism, Culture and Entertainment**

The modern internet has created new ways for ordinary citizens to produce and distribute their own works of journalism, culture and entertainment. Today's citizen is someone who no longer passively

consumes media but actively participates in it. This usually means people creating their own content in many different forms and sharing it on the web. Citizen journalism, blogs, podcasts and movie reviews are just some of the examples.

- **Civic Engagement and Participation**

The use of *YouTube* and other *video sharing websites* by ordinary citizens to submit their questions to politicians and official representatives is a good example of this. The use of the internet in this way also provides an opportunity for governments to engage with and serve their citizens in a better way and encourage participation in the political process.

Conclusion

The DB report provides wide-ranging and bold proposals. However, there is a serious lack of detail with regards to the funding and an implementation plan for Universal Broadband Access. The government has stated that it does not see a strong case for any major intervention in the delivery of NGA. This position is understandable bearing in mind the government's obligations in relation to the UK and European law. Furthermore, the competitive nature of the UK telecommunications market is probably one of its biggest strengths. Although the strategies employed in the US and Far Eastern countries have proven to be quite successful, it is best to resist any temptations to emulate such models because of their potential to undermine the competitive nature of the UK market. However, the government must do more to implement the necessary policy and regulatory framework to create stimulus and remove barriers to investment in NGA.

There are many useful lessons to learn from some of the Nordic NGA deployment examples. Although there are signs that some of these models are being adopted in the UK, the government must do more to support such projects as recommended by the CRC. In particular, with reference to providing access for rural areas, the delivery of 3G broadband over the 900 MHz frequency range has the potential to dramatically extend coverage to such areas. The government has introduced some initiatives for the reallocation of the required frequencies. However, there is a danger that the intense horse-trading over the competitive, legal and regulatory issues will create further delays in the delivery of this service.

Broadband access in the UK is now essential for participation in society and the economy. Those sections of the population with broadband access already enjoy access to information, entertainment, e-commerce, education and a host of public services. Universal Broadband Access has the potential to provide enormous economic benefits and improve the quality of life for many people. Broadband access is already a boundary

point the divide among social groups **(Carter, 2009)** and there is a danger that for some, many of these extraordinary benefits may never come to pass if access to broadband is not delivered on an open and non-discriminatory basis.

References

Bleed, J. Z. (2009). *FCC chairman pitches universal broadband Internet access as key to nation's economic success.* Retrieved June 12, 2010 from http://www.startribune.com/business/73517982.html?elr=KArks:DCiU1OiP:DiiUiacyKUzyaP37D_MDua_eyD5PcOiUr

Caio, F. (2008). Review of Barriers to Investment in Next Generation Access: Final Report. *The Next Phase of Broadband UK: Action now for long term competitiveness. Department for Business, Enterprise & Regulatory Reform.* Retrieved February 15, 2010 from http://www.berr.gov.uk/files/file47788.pdf

Carter, S. A. (2009). Digital Britain: Final Report. *Department for Culture, Media and Sport and Department for Business, Enterprise and Regulatory Reform.* Retrieved June 12, 2010 from http://www.culture.gov.uk/images/publications/digitalbritain-finalreport-jun09.pdf

Crandall, R. W., & Jackson, C. L. (2001). *The $500 Billion Opportunity: The Potential Economic Benefit of Widespread Diffusion of Broadband Internet Access.* Retrieved April 17, 2010 from http://www.att.com/public_affairs/broadband_policy/BrookingsStudy.pdf

Lomas, N. (2009). *WiMax speeds Cybermoor's rural broadband.* Retrieved September 02, 2010 from http://www.silicon.com/technology/networks/2009/03/19/wimax-speeds-cybermoors-rural-broadband-39409232/

Meyer, D. (2009). *Analyst: Reuse 2G spectrum for 3G in rural areas.* Retrieved September 16, 2010 from http://www.zdnet.co.uk/news/networking/2009/05/14/analyst-reuse-2g-spectrum-for-3g-in-rural-areas-39652100/

Neate, R. (2009). *Broadband boost for rural areas.* Retrieved December 12, 2010 from http://www.telegraph.co.uk/technology/broadband/6349671/Broadband-boost-for-rural-areas.html

Parliamentary Office of Science and Technology. (2008). Next Generation Broadband Access. *POST Number 5.* Retrieved April 17, 2010 from

www.parliament.uk/parliamentary_offices/post/pubs2008.cfm

Prodnik, V. & Kranjcevid, P. I. (2009). Broadband competitiveness. *2nd SEE ICT Forum Board Meeting & 6th MASIT Open Day Conference 18th-20thNovember, 2009, Ohrid*

Schofield, J. (2009). *Digital Britain? We haven't even got decent digital radio.* Retrieved March 02, 2010 from http://www.guardian.co.uk/technology/2009/jul/08/jack-schofield-digital-britain

The history of BTs copper telephone network. (2009). Retrieved March 15, 2010 from http://www.theiet.org/forums/forum/messageview.cfm?catid=220&threadid=32150)

Vaughan-Nicholas, S. J. (2004). Achieving wireless broadband with WiMAX. *Computer. pp.* 10-13

Village in Cumbria lays their own fibre broadband. (2009). Retrieved April 03, 2010 from ttp://www.broadbandwatchdog.co.uk/story/2009/11/24/village-in-cumbria-lays-their-own-fibre-broadband/