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NEXT GENERATION BROADBAND ACCESS

The UK has comparatively high coverage and take-up of broadband access, but several other countries have begun to deploy 'next generation' infrastructure to support faster access. This POSTnote examines next generation access (NGA) technologies, demand for them and deployments worldwide. It looks at the debate over who should invest in NGA and when, and considers policy issues such as international competitiveness and geographical variations.

Broadband in the UK

Broadband refers to always-on access to data (including the internet) at a speed, or bandwidth, greater than dial-up modems (Box 1). Homes and businesses receive broadband services through the 'access network' that connects them to their local telecoms exchange or cable television hub. There are two major access networks for broadband in the UK: BT's copper telephone network and Virgin Media's cable television network (Box 2).

Consumer broadband was first offered in the UK over both access networks in 1999. Initially, the UK fell behind other developed countries in coverage and take-up. However, after a variety of schemes to increase demand and competition, more than 99% of BT's exchanges are now enabled for broadband. Just over half of households have a broadband connection, putting the UK 11th of the 30 Organisation for Economic Co-operation and Development countries in broadband penetration.[1] In 2005, Ofcom, the communications regulator, came to an agreement with BT that saw BT open up its copper access network to competitors. Many exchanges are now 'unbundled', allowing competitors to install their own equipment and take over the copper wires that connect to customers. Alternatively, competitors can buy a wholesale service to connect to customers using BT's equipment.

Problems with current broadband

Recent surveys have shown that many customers are not receiving the speeds advertised by broadband providers. There have also been problems with reliability, and some service providers have been criticised for limiting the bandwidth available to heavy users. There are around 100,000 homes and businesses whose local exchange is not broadband-enabled and surveys indicate that even outside these areas, some users in so-called 'not-spots' cannot receive a reliable service.[2]

At the same time, several countries have begun deploying next generation access infrastructure, which often uses optical fibre rather than copper wires (Box 2). NGA does not refer to an exact bandwidth (though it would be well in excess of what is currently available in the UK), but to a range of improved characteristics for the user including speed, consistency and reliability of service (Box 1).

Box 1. Broadband characteristics

Broadband access is usually described by its speed or *bandwidth*. This is the amount of data (in bits[3]) that can be transferred per second either to the user (download) or from the user (upload). A typical email is thousands of bits (kilobits, or kb), a music file several million bits (megabits, or Mb) and a film several billion bits (gigabits, or Gb).

A dial-up modem connection has a bandwidth of up to 56 kilobits per second (56kbps), while the average download speed of broadband connections in the UK today is around 3Mbps, 60 times faster. NGA would be around 10 or more times faster again. The broadband access generally offered in the UK is *asymmetric*, meaning that the bandwidth for downloads is far greater than that for uploads. NGA would offer more symmetric bandwidth.

The bandwidth advertised by service providers is often shared between several users, meaning the actual speed experienced may fall at peak times. Some forms of NGA offer a guaranteed bandwidth that is not shared with others.

Demand for NGA

It is difficult to quantify the demand for NGA and its potential benefits. Its proponents argue that new services will arise once the infrastructure to deliver them is in place, just as many applications of current broadband were not predicted in advance. However, some possibilities have been identified.

Box 2. Broadband access technologies

Copper

The copper telephone network was not designed for broadband, but the development of digital subscriber line (DSL) technology in the 1990s allowed copper wires to transfer data while simultaneously being used for voice calls. Technological improvements have increased DSL's maximum download speed to 24Mbps (ADSL2+). However, bandwidth depends strongly on the length of the copper wire, so users far from exchanges will not get these 'headline speeds'. The latest technology, VDSL, offers speeds of over 100 Mbps but only over distances much shorter than the typical link from exchange to customer (see below).

Cable

The cable network, now mostly owned by Virgin Media, uses a mixture of optical fibre and coaxial cables. The network reaches just over half of UK homes (with no plans for extension), and accounts for about a quarter of the UK's broadband connections. Virgin Media currently offers packages with download speeds of 2Mbps, 4Mbps and 20Mbps. The bandwidth of cable broadband does not decrease significantly with distance, but, as with copper, bandwidth is shared by several users.

Optical fibre

It is generally agreed that the most future-proof option for broadband access is laying new optical fibre cables. These are glass fibres that use light to transmit a signal with a symmetric speed of 100Mbps or more. Optical fibres are already used for the backbone networks of telecoms companies, but extending them into the access network is costly. There are two major options for fibre deployment:

- fibre to the home (FTTH), where each customer has a fibre coming into the home, providing very high bandwidth and reliability; and
- fibre to the cabinet (FTTC), where fibre runs from the exchange to street cabinets ('green boxes') but existing copper (probably using VDSL) is used for the final link into the premises. This is cheaper to deploy than FTTH, but new equipment must be installed in street cabinets, increasing maintenance and power costs and potentially reducing reliability.

Wireless

Wireless allows broadband access without the need for a cable into the home. New wireless technologies such as WiMax offer high bandwidths over a range of several miles. In Milton Keynes, an area with relatively slow DSL, one company has set up a city-wide WiMax network offering downloads up to 2Mbps. Wireless cannot deliver bandwidths as great as fibre and uses valuable radio spectrum,[4] but it is much cheaper to cover an area with wireless than to deploy fibre, so wireless is likely to play a role in less densely populated areas.

Mobile

Industry analysts predict that mobile access to the internet will become increasingly popular. Existing 3G mobile technology supports downloads of up to 2Mbps, and technologies in development such as 3.5G and 4G will increase this significantly. As with wireless these technologies will require additional radio spectrum. Some spectrum will be auctioned by Ofcom later in 2008.

Consumer services

There is growing demand for high-definition television (HDTV) programmes. These are broadcast on satellite and cable, but there are questions over how much radio spectrum will be available for them on digital terrestrial TV (Freeview). NGA would allow a household to watch multiple HDTV programmes on demand via its broadband connection. There is also increasing demand for faster upload speeds to share photos, videos and other 'user-generated content'. Fast uploads also speed up peer-to-peer file sharing. This is often associated with illegal sharing of music and video files, but there are also legal services such as the BBC iPlayer. The Broadband Stakeholder Group (BSG), an industry-government forum, estimated that by 2012 the most data-hungry households could require 23Mbps download and 14Mbps upload, well in excess of current broadband.[5]

Business services

Most large businesses pay for dedicated broadband access, usually by optical fibre. Small businesses, which often rely on the same broadband access as home consumers, thus stand to benefit more from NGA. However, large businesses still have an interest in it, because it would allow them to offer new services to customers and enhance the possibilities for teleworking. Business applications that would benefit from NGA (particularly from faster uploads) include video-conferencing and moving data storage and security off-site to be managed by specialist service providers. The Communications Management Association (CMA), which represents corporate users of telecoms, is conducting a survey of its members to establish their demand for NGA.

Social and economic benefits

Proponents of NGA argue that it will have social and economic benefits for the UK as a whole, above the private value to consumers and businesses. One impact may be on inward investment decisions. A survey of senior executives in 2007 rated quality of telecoms as the third most important factor in company location.[6] Commonly cited examples of social benefits are remote health and e-learning services. The BSG aims to complete a study on the social and economic value of NGA to the UK by April 2008.

Deployment of NGA

United Kingdom

New build sites

The cost of providing optical fibre access to new developments is little different from copper, as both require the same underground ducting. BT is piloting the use of fibre to the home in a development of 10,000 homes in Ebbsfleet, Kent, where it will offer a range of packages up to a maximum download speed of 100Mbps. 250,000 new houses are built in the UK each year, so houses built between now and 2015 will make up around 10% of the housing stock by that time. BT has stated its aspiration to install fibre to many of these sites as standard, but points out that current regulation requires it to install copper. Ofcom will consult on NGA in new-build sites later this year.

Box 3. South Yorkshire Digital Region

In South Yorkshire, a consortium of four local authorities and the regional development agency, with additional private and EU funding, plan to connect 600,000 homes and small businesses in the region with an optical fibre network. The project would deploy fibre to street cabinets, using the existing copper for the final link into homes. In 2007, Thales Communications won a competitive tender to install and run the network, and Digital Region hopes to get formal approval from all its partners by July 2008.

Digital Region will not itself provide services, but will lease capacity on its network to any service provider. Digital Region argues that communications infrastructure is vital for regional competitiveness, and that waiting for private investment could mean South Yorkshire falling behind other regions in the UK and across Europe. It also plans the network to be ubiquitous across the region (possibly using wireless for the most remote areas), in contrast to a commercial network which Digital Region says would serve urban consumers long before rural.

Existing sites

In 2007, Virgin Media trialled a 50Mbps download service over its cable network in Kent, and recently announced that it will offer the service to 70% of its customers by the end of 2008. This is expected to raise the pressure on other telecoms companies to increase bandwidth. BT is rolling out up to 24Mbps ADSL2+ technology (already offered by some competitors) to its exchanges but expects only around half of its customers to achieve a download speed over 8Mbps due to line lengths. Uploads will still be much slower.

These upgrades do not need new cables. To offer higher bandwidths, it is likely that fibre will have to be deployed at least as far as street cabinets. It is much more expensive to deploy fibre in existing sites than new-build. Around 70% of the cost is civil engineering such as digging up roads. One estimate puts the cost of running fibre to 90% of the UK's homes at £10bn.[7] No major telecoms companies have announced plans to deploy fibre to existing sites, though one company is deploying it through sewers to reduce the installation cost. There are some planned public-sector fibre deployments, the largest being Digital Region in South Yorkshire (Box 3).

Worldwide

Several countries around the world have progressed faster with NGA than the UK (Box 4). In its September 2007 consultation on NGA,[8] Ofcom pointed out several factors that could have caused its earlier take-up in other countries and argued that there may be an advantage to the UK in not moving early, as it can learn from other countries' experiences. Others argue that this time has now passed and does not justify waiting longer.

The investment debate

Both the costs and the benefits of NGA are uncertain, though the costs of deployment will be many times higher than current broadband. Some players argue that it is too early to make a decision on whether to invest, while others say that NGA is inevitable and that the UK cannot afford to fall further behind.

Box 4. NGA around the world

Europe

Several European countries have city-wide NGA deployments. In Paris, a company has deployed fibre in sewers. In the Netherlands and Sweden there are several public-private partnerships in municipal schemes. Sweden has half a million fibre to the home connections. Deutsche Telekom offers fibre to the cabinet in several German cities.

US

In the US, the poor quality of existing DSL services (due to long copper lines) and strong competition from cable operators have encouraged telecoms companies to invest in NGA. Verizon offers fibre to the home in several cities on the east coast and AT&T is rolling out a fibre to the cabinet network. There are also some public sector deployments.

Asia

In Japan and South Korea, central government has made fibre deployment part of its national technology plan and invested several £bn. Due to the high population density and greater proportion of overhead cables, it is relatively cheap to deploy fibre in these countries. Around a third of broadband connections in Korea and Japan are fibre.

Arguments for deferring deployment

The major telecoms companies argue that they do not yet see a business case to invest in NGA outside of new-build sites. They argue that:

- there is limited evidence of demand for NGA, and most customers do not use all the bandwidth already available to them. The UK has a strong satellite and cable pay-TV market, reducing the attractiveness of selling TV via broadband;
- technical innovations could allow more to be delivered with current broadband; for example, improvements in the core network (such as BT's £10bn 21st Century Network project),[9] improved compression of data and local storage of popular content;
- consumers are not prepared to pay significantly more for NGA than existing broadband. In the past few years, the cost of broadband access has fallen even as bandwidth has increased, due to strong competition.

In its 2007 consultation, Ofcom supported a market-led approach to deployment of NGA, and agreed that evidence for demand is limited.

Arguments for investing now

Groups representing broadband users and some public sector organisations argue that the telecoms companies and Ofcom are being too cautious. They maintain that:

- there is a lead time of several years for deployment so the UK must act now to avoid falling further behind;
- predictions of demand have focused too narrowly on extensions of existing services (like television), while the full benefits of NGA would become apparent only once it is deployed;
- telecoms companies base their business cases on a return on investment within a few years, but once laid fibre would not need to be replaced for at least 25 years. They suggest that new investment models could be used to finance deployment over a longer term by separating the deployment of the access network from the services provided over it. An example of this approach is the town of Nuenen in the Netherlands.[10]

Box 5. Regulation of NGA

Ofcom has instituted a well-regarded regulatory regime for copper-based broadband. It now sees its challenge as removing barriers to investment in NGA whilst maintaining effective competition. In its 2007 consultation, Ofcom proposed two parallel options for competition in NGA:

- passive competition, where operators are required to open up parts of their physical infrastructure. For example, unbundling could be extended to street cabinets, allowing competitors to run fibre to the cabinet and use BT's copper to link into homes; and
- active competition, where the network operator sells a wholesale package that allows competitors to use its infrastructure to reach customers.

BT favours active competition, arguing that it removes the need to duplicate expensive infrastructure. It also says it is unlikely that there would be effective competition at unbundled street cabinets, as each cabinet serves only a few hundred customers. However, some competitors say that having active competition only would give BT too much control over the products offered and that it would be harder for competitors to innovate.

Geographical variations in access

Broadband reached urban areas first before slowly spreading to the rest of the country with the help of public sector interventions. It is likely that this 'digital divide' will be repeated for NGA, with fibre being deployed first where there are more customers. Some regional development agencies have argued that it is possible to identify areas that will be commercially unattractive and to address this now with public sector schemes. For example, NGA could be trialled in existing not-spots such as Hambleden, Bucks where BT has been asked to carry out a feasibility study for fibre access.

However, Ofcom argues that public sector investment in NGA risks wasting public money on infrastructure that the private sector would invest in anyway and that it could deter private companies from competing. Ofcom also says that it is too early to identify areas that will not be served commercially.[11] Public sector interventions must also comply with EU state aid rules.

Policy approaches

A radical, but unlikely, approach would be for the government to finance the deployment of a national fibre network to be run as a utility (though this could have negative impacts on competition). At the other extreme, the government could do nothing to encourage NGA. Between these options, suggestions from the BSG[12] and others to speed deployment of NGA include:

- raising the profile of the issue and encouraging dialogue between the main players. In November 2007, for example, the Department for Business, Enterprise and Regulatory Reform (BERR) hosted a summit on NGA;
- monitoring bandwidth demand in the UK, benchmarking the UK's broadband access against other countries and setting targets for the future;
- providing clarity to potential investors about how NGA will be regulated. Ofcom is addressing this through its work programme on NGA (Box 5) and expects to publish a follow-up to its 2007 consultation in summer 2008. The European Commission is also expected to publish a policy document on NGA in spring 2008, which will influence UK regulation;
- encouraging innovation by the public sector and exploring new investment models. The BSG is studying public sector schemes around the world to create models for effective intervention in the UK, though it favours a market-led transition;
- reducing obstacles to deploying new infrastructure, such as planning rules for digging up roads and installing street cabinets, and the tax currently levied on telecoms companies per metre of optical fibre used;
- stimulating demand for NGA by developing services such as remote health monitoring and e-learning.

In February 2008, BERR and the Treasury announced an independent review to look at potential barriers to deployment of NGA. The BSG has identified the period from April 2007 to April 2009 as a "limited window of opportunity" to implement the policies and regulation to encourage a transition to NGA in the UK.[12]

Overview

- Next generation access (NGA) is technology that allows much faster broadband than currently available.
- Major telecoms companies have not announced plans to deploy NGA in the UK except in new-build sites, claiming that there is not enough evidence for willingness to pay to justify investment.
- Several other countries have already begun to deploy NGA, leading to concern about the impact on the UK's international competitiveness.
- Uneven deployment of NGA could increase the 'digital divide' between urban and rural areas and some public sector organisations want to act now to avoid this.

Endnotes

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