# The Next Phase of Broadband UK: Action now for long term competitiveness

## Review of Barriers to Investment in Next Generation Access

## Final Report

Francesco Caio

September 2008

# Contents

# Foreword

Broadband, until a few years ago a minor interest confined to the tech-literate, is today a domestic essential for millions across the UK. It has in a short space of time come to rival technologies established for a century as a vital component in the country's communication, entertainment, and cultural life, and a crucial enabler of economic activity.

The government is proud to have helped foster development of broadband in the UK. In ten years, we have gone from no broadband connections to being one of the world leaders in coverage, with high up-take and consumer choice. These factors are not coincidental. The development of a competitive market in broadband has been the cornerstone of the Government's strategy.

We now stand at the edge of another rapid development in communications technology. Next Generation Access (NGA) marks a major change in the services people can enjoy. It also brings to smaller businesses the promise of high-speed connections previously only available to their much larger competitors.

The government is committed to securing for the UK a world-class communications infrastructure, and allowing people and businesses to derive the maximum results. We know that the transition to NGA will involve large investments and an element of risk. But the prize is great.

For those reasons, we were determined to ensure we had the right strategy to help the private sector develop a new competitive market in next generation services. That is why we commissioned Francesco Caio to report on the barriers to investment, and the steps we can take to remove them.

We are pleased today to be able to welcome his report and his recommendations. The evidence in his report will provide an excellent analytical base from which the Government can work.


**Shriti Vadera**
Parliamentary Under Secretary of State
for Business and Competitiveness
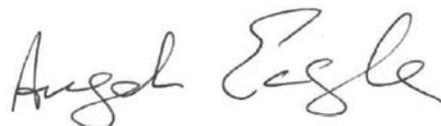
**Angela Eagle**
Exchequer Secretary
to the Treasury

# Introduction

> *"People tend to overestimate what can be done in one year and underestimate what can be done in ten years"*, J. Licklider, Libraries of the Future, MIT Press 1965.

The focus of this review is the development of Next Generation Access (NGA) in the UK. For industry participants – telecom operators, broadcasters, technology vendors, media companies – this is very much a live issue. These players are very interested in, and knowledgeable about, NGA and have proved eager to contribute to this review. Their future depends, increasingly, on the role they will play in the development of this new infrastructure and on the rules that will govern their access to it.

For the Government, too, the prospective gains and value of NGA, in economic terms and in delivery of public services, make it a vital subject.

NGA is, however, a dry subject for most. For the general public the technical and regulatory issues surrounding the development of faster broadband are of marginal interest at best. Network architecture, interconnect protocols and equivalence of input are all vital for industry players and regulators, but hold no significance for the vast majority of end users, and nor should they. The effect of all these things, however, in terms of the services that are eventually paid for and delivered, is of great relevance to the average household.

The last ten years provide good evidence of how deeply the telecom and broadcasting markets have changed in the UK, and how processes like this review have contributed to the development of dynamic retail markets and rapid take-up of services that are now part of our daily life.

In 1998:

- mobile telephony penetration was at 16%; voice and text messaging were the only available services;

- the debate about digital television was only just starting; terrestrial television was offering five channels; satellite television penetration was 10%, with cable penetration smaller again; and

- penetration of dial up internet in the UK was 9%, below the European average.

In 2008:

- broadband has become the standard for internet access; competition between providers has delivered increasing speed at declining prices; penetration is among the highest in Europe with 58% of households, or some 80% of those households with a PC subscribing to broadband;

- digital television has reached coverage of more than 87% of the population and is well on its way to universal availability; consumers have a choice of more than 80 terrestrial channels; and

- mobile telephony has almost universal penetration, with 86% of all adults owning at least one mobile telephone and a growing number of consumers using mobile devices to access internet based services.

The evolution of technology, business, and society have undoubtedly contributed to this transformation. But, so too, have the regulatory and policy initiatives that have enabled competition, investments and innovation. Commitment to competition has led to investment and innovation, driving the progress of the UK market. Landmark initiatives include:

- the award of new radio spectrum;

- the Communications Act and the creation of Ofcom;

- the definition of the switch-over plan for digital television; and

- the Strategic Review of Telecoms in 2005 and the functional separation of BT's access network.

These steps forward, not always of obvious relevance for the general public, have led to a dynamic retail market that is now offering choice and innovation to consumers across several technological platforms. The next ten years can bring a similar and even more exciting transformation.

The development of NGA is not just an upgrade of a digital infrastructure that makes a user's web browsing speedier, although this on its own will be welcome to many. NGA arrives at a time when basic popular services, such as voice telephony, radio and television broadcasting are extending their reach from existing fixed and wireless networks to the Internet. At the same time, the continued development of new digital devices is making it possible for consumers to use a growing range of web based services without any interaction with a PC.

In this next phase of online life, access to the internet will extend beyond existing PC 'literate' users: it will be embedded in new, broadband enabled versions of familiar devices. These devices – such as radio, TV sets and mobile handsets – will be user-friendly and central to everyday life of most households. Their functionality is also likely to evolve to support the delivery of a broader set of services.

This will not happen everywhere at once, and will not be the norm this year or next. One of the key findings of this review is that it is a mistake to believe the UK must have an NGA infrastructure tomorrow or suffer as a result. We should not overestimate what technology will deliver in one year.

But we cannot afford to underestimate its impact over the next ten years. Over that time:

● broadband will become an essential digital utility for the country; and

● an extensive upgrade of the access infrastructure will be necessary

Now is the time to set the scene for this transformation and give the country the best opportunity to capitalise.

Because of all this, this review should be of relevance to the public and will hopefully be part of the process that will enable a transformation in the UK's communications infrastructure.

# Executive Summary

## Context and key issues

Broadband has become an essential platform for communication and access to information, knowledge and services across the world. Penetration of broadband has grown rapidly in the UK and the country today has one of the highest penetration rates in the world. The physical infrastructure that delivers broadband in the UK is a combination of existing copper and cable TV networks.

In recent years NGA networks based on fibre have began to be deployed in other countries. In some cases, namely Korea, Japan and Singapore, new access networks have grown to represent the standard platform for internet use. In the UK, fibre access is still limited to large to mid-sized businesses, with hardly any deployment of fibre for connecting homes.

The debate on NGA has recently stepped up driven by the launch of new services (primarily video) and the continued growth in traffic over the internet.

It is against this background that, in February of this year, the UK Government decided to launch an independent review. The terms of reference of the review are reported in Annex A. These specific issues have helped shape the activity of the review and are discussed in the main report.

In presenting the review's conclusions and recommendations, however, it is useful to group them around the critical themes that have emerged in the review team's work, and the continued and constructive dialogue the team has had with government departments, Ofcom and other key stakeholders.

These themes can be summarised in three main questions:

1) *Is the delay in the development of NGA translating to a competitive disadvantage for UK businesses and UK citizens?*

2) *Will the market deliver an investment in NGA on its own, or should the Government intervene now through subsidies or a structural change in regulation to get the roll-out of NGA started?*

3) *Is there a role for the Government to play in the development of NGA infrastructure and, if so, what type of initiatives ought it to pursue?*

## Approach and methodology

The future of broadband – its economics, its technological development and its impact on telecommunications, media, business and society at large – is a vast, very complex and widely researched topic. A large number of task forces, projects, forums and think-tanks are at present investigating these issues. Within government itself, other initiatives in this area are currently being undertaken.

It is against this background that it was decided early in the project not to embark on new primary research on the economics of, or demand curves for, NGA but rather to draw on existing data and facts, and spend most of the available time in engaging with the relevant constituencies to get their views on the main issues, uncertainties and opportunities. We have particularly interacted with Ofcom, the Broadband Stakeholder Group, the main service providers and major broadcasters. We have also received valuable input from a wide range of constituencies, from technology vendors to bodies representing end-users. A list of organisations consulted is contained in Annex B.

Our objectives in doing so were: to develop a shared, fact-based view of the competitive situation of broadband infrastructure in the UK and the available options for its developments; to remove prejudices and myths about fibre deployment and its impact; and to identify a pragmatic way forward to develop a competitive up-to-date infrastructure.

This process has helped us cover a wide range of issues in a relatively short period of time. We hope it has played some part in moving the debate forward over the last few months. It has certainly given us strong evidence of key stakeholders' readiness and desire to engage in a constructive process to equip the country with a competitive NGA infrastructure.

We have benefited enormously from the constructive response that we have received from our interlocutors, and are grateful to them all.

## Summary of conclusions

Joseph Licklider, one of the founding fathers of computer-based communications, said in 1965 that there is often a risk of overestimating the impact of innovation in the short term, and underestimating it in the long term. This could, in the extreme, be the conclusion of our review. There is no need for immediate major government intervention in the short term to accommodate traffic growth, but in the next five to ten years NGA will become a critical infrastructure and, as such, the Government should actively support and monitor its development.

## IN THE SHORT TERM, THE CASE FOR A MAJOR GOVERNMENT INTERVENTION IS WEAK …

The high costs of NGA, and high expectations of what it can deliver, tend to raise expectations in some quarters that the Government should make a major intervention – such as a large subsidy or structural change to regulation – to support the market. However, it is the conclusion of this review that the case for such a major intervention is weak at best. There are three principal reasons for this.

First, broadband penetration is now at about 60% (placing the UK at 5th in the OECD); coverage of DSL has reached 99.6%; average headline speed has gone from 3.6Mb to 5.9Mb; strong competition has delivered value and choice. This has, in turn, led to the creation of one of the most developed internet economies in the world: online advertising has now reached 18.9% of total advertising spend; online retail is the largest in Europe accounting for 15% of total retail. Review of other countries indicates that drivers for their investment in NGA thus far differ widely and are not necessarily comparable with the UK. Also, there is little evidence that higher penetration of fibre has led to a material changes in uses.

Second, there are strong indications the market is delivering investment in NGA. Virgin Media continues the deployment of high speed services on its network and is on course to make up to 50 Mb/s available to around 12.5 million homes by 2009. BT has announced its intention invest £1.5 billion in an NGA deployment covering 10 million homes. Other service providers are evaluating ways to upgrade their access networks from DSL to fibre. Additionally local initiatives, including some innovative investment models, are gaining momentum in various regions and cities.

Third, although demand for bandwidth and internet traffic continues to exhibit strong growth, there is little evidence that, in the short term, UK consumers will experience a detriment due to the lack of an extensive NGA network. Some consumers, particularly at peak times, experience a reduced level of service, suggesting stress on the network, but this is more likely evidence of a bottleneck in the backhaul, rather than access.

## … BUT GOVERNMENT SHOULD ACT NOW TO SUPPORT INVESTMENT IN NGA

This first conclusion, however, should not lead to complacency. In the mid- to long term, Broadband/NGA will become a critical digital utility, essential to the competitiveness of any country and to the quality of life of its citizens. The UK will be no exception and, if anything, it will be even more dependent on this infrastructure than other economies. Here, high-quality broadband will be essential for the continued development of sectors that in recent years have elevated the UK to a position of global leadership, such as the creative industries,

financial services, software and gaming. Equally importantly, broadband will be central to critical processes of information and innovation in education and health services.

Because of this, the Government and Ofcom, as the two principal entities involved in determining the efficient and effective deployment of NGA, need to play an active leadership role in shaping broadband policies.

This does not translate into subsidies or structural changes in regulation, but rather a set of initiatives that could support and inform the activity of regulators and industry players in their journey to NGA. The government should seek to remove obstacles that could potentially delay or compromise the development of the new network.

## Recommendations

We have identified four areas where the government should consider specific initiatives to support and facilitate the deployment of NGA.

**1) Set out a framework for delivery of NGA**

The development of NGA is a challenging task for the whole industry and will build on the involvement of a large number of stakeholders. Building on the progress in the last six months, it is now a good time for the government to set out in some detail a framework for the delivery of NGA. Such a framework would provide an up-to-date reference point for all relevant parties and help them in the implementation work that is about to begin. Whilst it will be for the Government and Ofcom to finalise the specifics, it is this report's recommendation that the framework should recognise, among other points, that:

● NGA, defined as fast high-quality access, will be delivered through a combination of digital technologies which will coexist in different parts of the country: fibre (to the home or to the cabinet), cable, wireless and copper.

● Adoption of open network models and access to ducts and fibre of new and existing networks can create a competitive wholesale market and encourage investment in new services.

● NGA will most probably result from a combination of national and local networks. Local developments are welcome and are to be encouraged provided they comply to access standards of interoperability and open access

**2) Launch specific initiatives that do not distort the market, but provide some further momentum to the deployment of NGA**

This report has identified ten initiatives that should be explored further to facilitate the progress of the UK towards NGA. They are grouped in three clusters based on their expected primary impact on the industry: create the stimulus for the upgrade of access infrastructure; facilitate the implementation of NGA by removing uncertainties and lowering the cost of build out; and create the conditions to favour the development of new investment models.

*Create stimulus for the upgrade of access infrastructure.* This would include:

- **Accelerating the release of radio spectrum to favour the development of new wireless broadband services.** Ofcom already has a programme of spectrum release, refarming and liberalisation, and there are two bands suitable for wireless internet services which should be made available in the near future – more than 300MHz of suitable spectrum is planned for release. However, the auction of these bands is being delayed by litigation with current licence holders and reform of EU directives. Ofcom should seek a route to release available spectrum to the market as quickly as possible, while the Government should support this effort, including by seeking early resolution of deliberations in Europe over the GSM directive.

- **Mandating transparency on traffic management policies for network capacity.** Ofcom should require internet service providers should tell their customers how they manage traffic on their network. This would make consumers aware of the 'true' bandwidth they were receiving, and could lead to differentiation of services in which consumers value bandwidth and are willing to pay for them. This might then create stimulus for further investment in network upgrade.

- **Supporting the introduction of an agreed specification for newly built homes.** The Government has a target of up to 240,000 new homes to be built per year up to 2020. It would be a missed opportunity not to equip them with NGA. The government should drive forward an agreed specification generated by the construction and communications sector to raise awareness of NGA in the minds of the construction industry and help NGA connectivity begin to emerge as a valuation criterion for homes.

*Facilitate the implementation of NGA by removing uncertainties and lowering the cost of build out.* Government and Ofcom should, in their respective roles, remove uncertainties and facilitate deployment of NGA.

- **Regulation – Ofcom to identify a specific implementation path.** As Ofcom's consultation on NGA, launched in 2007, comes to a close, a number of issues have emerged that need resolution. These range from the interconnect regime in IP networks, to the date of switch-over from copper to NGA, to the nature of passive remedies and wholesale products, to the future of the USO and requirements to provide 999 access. In the next phase of work, Ofcom, as it did in the case of the Telecoms Strategic Review, needs to take a leadership role and drive the industry towards timely resolution of these issues. This will be a difficult task, but one that is essential to defining an actionable impelmentation plan.

  This is likely to require significant time and effort and, a least for a period, an even more intensive interaction with industry players either to encourage bilateral agreement or lead multi-party negotiations. But at this juncture, this task will prove essential and the Government should strongly back Ofcom in carrying it out.

- **Lowering build out costs.** Civil works account for up to 80% of the investment in NGA. The potential savings if the cost of those works can be reduced are material. According to the Broadband Stakeholder Group, a roll-out of Fibre-to-the-Home to 80% of the population could cost up to £16 billion, of which more than £12 billion will be the civil engineering cost – in other words saving only 10% of the civils cost could mean £1 billion. The Government should undertake two initiatives to achieve that reduction.

  One is pursuing better coordination of streetworks to share the cost of road openings between utilities. There are some 1.2 million streetworks per year. The Government has made some progress in better coordinating them through a combination of legislation and joint working with the utilities. There is though scope to do a lot more and reduce costs for all. The Government should use the existing regulatory framework to ensure coordination of works is the norm, but be prepared to take further steps if results are not forthcoming.

  The other initiative to reduce rollout costs is by relaxing constraints on overhead deployment of fibre cables. Unlike other countries, operators deploying fibre in the UK are required to bury the lines except where they already own poles. Figures supplied by Cisco suggest the cost for rollout in eight major English cities could be reduced from £1,200 to £400 per home passed.

  The Government should therefore amend the planning laws so that overhead deployment can take place where necessary, subject to local consultation and certain constraints in sensitive areas. For rural areas in particular, overhead deployment can make the case for investment much stronger. While there will be issues around the environmental impact of such installations, those in the countryside who want better broadband provision will need to balance the impact of new poles against the benefits of improved services.

  Additionally, Ofcom should move ahead with work to address barriers to alternative ducting methods such as the use of sewers.

- **Providing updated and detailed guidance on the approach to applying business rates to fibre**. Uncertainty over the liability faced by owners and occupiers of fibre networks could add a further brake on investment. The Valuation Office Agency should provide updated guidance in the light of both recent litigation and the anticipated growth in NGA networks.

*Create the conditions to favour the development of new investment models.* The construction of a new access network creates the opportunity to adopt new business and investment models and, in particular, local open access networks. There are more than 300 such schemes across Europe, and Sweden, with a quarter of its broadband provided by fibre, has 200. Some of these are funded by householders providing a high up-front installation fee, sometimes funded from additional borrowing on their mortgage, recognising the potential impact of the new infrastructure on the value of the home.

Such networks warrant attention since they can play an important part in the overall broadband picture, and there are several examples in the UK. Such developments might though be threatened by fragmentation if their technical standards are different and they therefore present a barrier to service providers to utilise their infrastructure. There are two relevant recommendations.

- **Establishing standards for local NGA developments.** In order to maximise the opportunities for scale deployment, local access networks across the country can organise to standardise technical requirements and present a coherent front to service providers. The Government should ask the Community Broadband Network to organise such a development.

- **Directing Government support towards open access networks.** Where local or regional authorities are investing in broadband, the Government should amend its guidance so that central government support is conditional on the scheme complying with the open access standard. Where they are privately funded, Ofcom should consider the introduction of a 'must carry, must connect' rule, whereby local access networks cannot unreasonably refuse to carry a service provider, and service providers cannot reasonably refuse to make their service available through the local network, provided this complies with the open access standard.

### 3) Establish a structured, permanent benchmarking process to monitor the development of NGA in the UK and in relation to other Countries

The initiatives outlined above will further encourage investment in NGA. Their implementation will not be quick or easy, and there are still risks of delay and market failure. To ensure momentum is maintained, the Government should signal their leadership by naming a senior figure to monitor delivery, and Ofcom should consider a parallel process. The Government should additionally establish an ongoing process for identifying barriers to deployment and rapidly addressing them.

It should further institute an annual NGA event to draw together detailed international benchmarking by Ofcom, industry insight and analysis from the Broadband Stakeholder Group, and wider views to form an overall assessment of progress in the UK. This process would help provide a continued stimulus to all stakeholders by reviewing progress against plans on all key aspects of NGA development: regulation, demand, and network roll-out. It would also allow the Government to build a robust fact base to determine if further action is needed to expedite the upgrade of the broadband infrastructure. This would represent the necessary input to the fourth recommendation.

**4) Invest time and resources to identify remedies to adopt in case the market fails to deliver the required NGA investments**

The Government ought to be working, along with Ofcom, to identify the remedies that would be needed in the unlikely event of market failure and prolonged delay in the development of NGA. This report does not highlight any specific initiative but only the broad circumstances in which, some time from now, the government ought to consider their adoption.

## Structure of the document

This document is structured in four parts:

- **Part 1** where the report reviews in summary some key facts about NGA and highlights the challenges and opportunities that characterise its deployment.

- **Part 2** where, based on evidence on the UK market, comparisons with the international situation and short-term expected evolution, the report concludes that *the case for public intervention now is weak at best*.

- **Part 3** where, due to the growing importance of broadband to society and the challenges still associated to its deployment, the report recommends that the *Government should, with Ofcom, take a leadership role on the deployment of NGA*.

- **Part 4,** in which the report formulates specific recommendations for short, mid and long term initiatives that the government could undertake to *remove obstacles and facilitate the development of a competitive NGA infrastructure* in the UK.

Further facts, data and supporting materials are provided in the annexes.

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The UK has a unique opportunity to develop NGA infrastructure in an innovative and effective way:

- by taking full advantage of the flexibility that new technology and business models offer;

- whilst preserving the commitment to competition and an independent regulator that has delivered, thus far, one of the most competitive and vibrant broadband, telecom and media environments in the world.

This review is intended to contribute to such development.

# Part 1: Deploying Next Generation Access: challenges and opportunities

## Definition and scope in this review

The term Next Generation Access is used to cover a range of different technologies. When we discuss NGA we generally mean the upgrade of the final link to end users of broadband services to speeds well in excess of those offered by existing technologies. Most often, the term is used to refer to the upgrade from copper to fibre, but can apply to other technologies such as certain wireless standards.

The first part of this review is intended to give a brief definition of some key terminology, provide a summary overview of the economics of NGA roll-out, and outline the main challenges and opportunities that should be considered when discussing NGA strategies.

## 1.1 Terminology and basic facts: a very short primer

NGA is a large, technically complex subject. The objective in this report is not to explain the detailed technical and economic aspects of NGA, but rather to highlight ways in which policies and regulation can be used to favour investments in its development. However, because this review should be of interest to a readership beyond the core of technical experts, it is useful to review quickly some basic facts and terminology in order to define a shared baseline for the recommendations later in the report.

In simple terms fibre access networks can be described in terms of three variables:

1) **Nature of their components**. An *active* component of a broadband network is usually a piece of electrically-powered switching equipment which manages signal distribution and directs signals to specific customers (via copper, fibre or wireless). A *passive* component of the network refers to physical infrastructure needed to carry the signal to different points of the network. That includes ducts, fibre, chambers, copper links (see below).

2) **Extent of fibre reach.** There are two main categories.

● Fibre-to-the-home (FTTH) in which fibre extends from the core network to the premises, has no theoretical limit in terms of speeds but is generally talked about in terms of 100 Mb/s.

● Fibre-to-the-cabinet (FTTC), in which fibre connections only reach street cabinets and copper provides the connection from the street cabinet to the home. Such connections can deliver around 24-50 Mb/s, and are significantly cheaper to install than FTTH. FTTC could in some circumstances be a first step towards an eventual FTTH rollout. FTTC allows for unbundling at the cabinet (i.e. competition based on different operators having access to the passive part of the network, in this case the final copper connection).

3) **Network configuration and design.** FTTH networks have two main types of configuration:

● point-to-point (P2P), in which a single dedicated fibre runs from each home to the exchange; and

● Passive Optical Network (PON, the most common variant of which is GPON) in which bandwidth is shared between users in a series of thinning pipes, and directed via optical splitters.

Broadly speaking, the costs of these different FTTH architectures are comparable, but point-to-point is considered around 15% more expensive than PON. FTTH/P2P can often provide for unbundling at the exchange, while technical trials for unbundling of GPON have been reported but have yet to be commercially deployed in scale.

**Figure 1 Access Network designs**
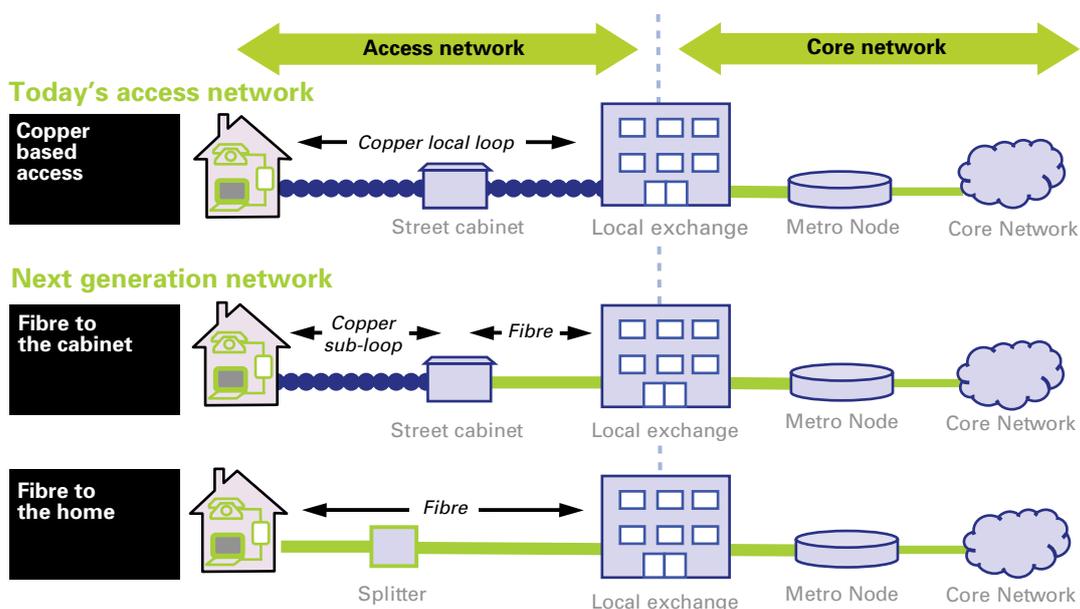


Source: Ofcom

## Benefits

The main features of an NGA service compared to current generation broadband are:

● faster and more reliable download speeds;

● a greater degree of symmetry between the down- and up-links for the end user;

● lower latency.

It is however important to highlight that the full potential of any variant of fibre access is only delivered if other components of the network (servers, routers, core network, backhaul) are adequately sized.

## Economics

Alongside this review, the Government asked the Broadband Stakeholder Group (BSG) to investigate the cost of NGA deployment. The review received further analysis from Cisco, focussing on the cost of deployment in some of the largest English cities. Additional data has been provided by operators during the course of the review.

In this and the following sections, the review focusses on high level summaries of data and the implications. There is a great deal of in-depth material on this subject, some of which is referenced in the bibliography.

The following figure indicates the cost of FTTC and FTTH in different markets.

**Figure 2 Cost of deployment in different markets**
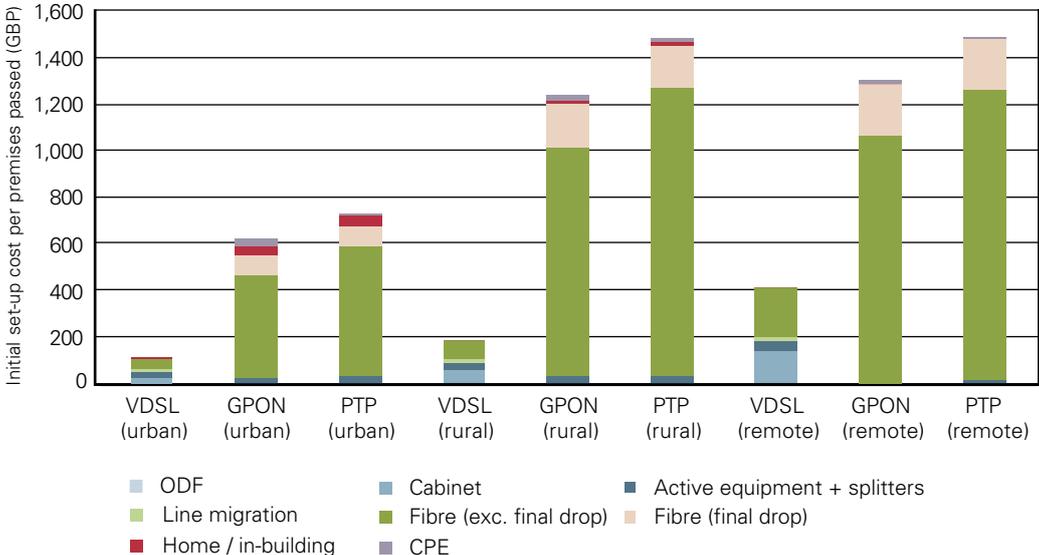


Source: Analysys Mason for BSG

## 1.2  Deploying NGA nationwide: key challenges

The development of NGA and, in particular, of fibre-based access networks, poses a series of challenges:

**Large investment.** The BSG report indicates that the costs of deploying fibre access using FTTH/P2P (i.e. a single fibre to each home) on a national basis is almost £29 billion. A GPON configuration (in which a fibre connection is shared between several homes) would cost around £24.5 billion. If fibre was deployed only to street cabinets (FTTC), the cost would be around £5 billion. FTTC would though deliver a lower level of performance.

The BSG report found that there are pros and cons to an FTTC network as a first step to an eventual FTTH rollout. Whilst only a small proportion of the investment costs for both FTTH and FTTC are the same (£2.1bn – only 9% of BSG's estimated FTTH roll-out), initial deployment of FTTC may help to drive innovation and develop the applications requiring even more bandwidth that only FTTH can deliver. Importantly though, FTTC first does not preclude FTTH at a later date.

Irrespective of the technological design, the investments needed for a scale roll-out are very significant and substantially higher than were those for roll out of first generation broadband which estimates place between £1.5bn – £2bn broadband.

**Very high costs in low density areas.** Where customer connections are densely contained within one area (i.e. in cities) the cost is substantially lower than where customers are more dispersed. The investment curve shows a steady incremental increase for the cost of roll-out to around 60%, after which each incremental step carries an accelerating cost.

The BSG study found that the cumulative cost of roll-out began to accelerate at a point when around 60% of homes had been covered.

**Figure 3 Deployment costs of each technology split by area: A(Urban), B(Rural), C(Remote)** – (the corresponding population coverage for FTTC/FTTH is shown in brackets)
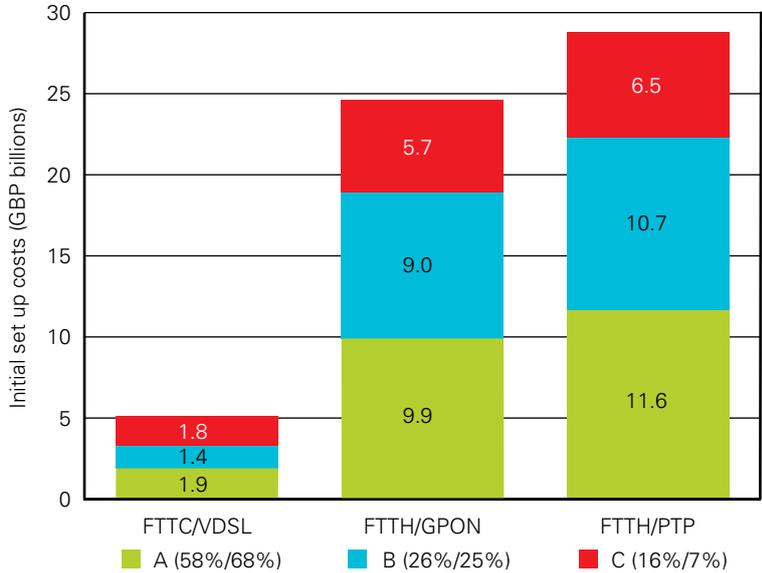


Source: Analysys Mason for BSG

**Figure 4 Cumulative cost of roll-out**
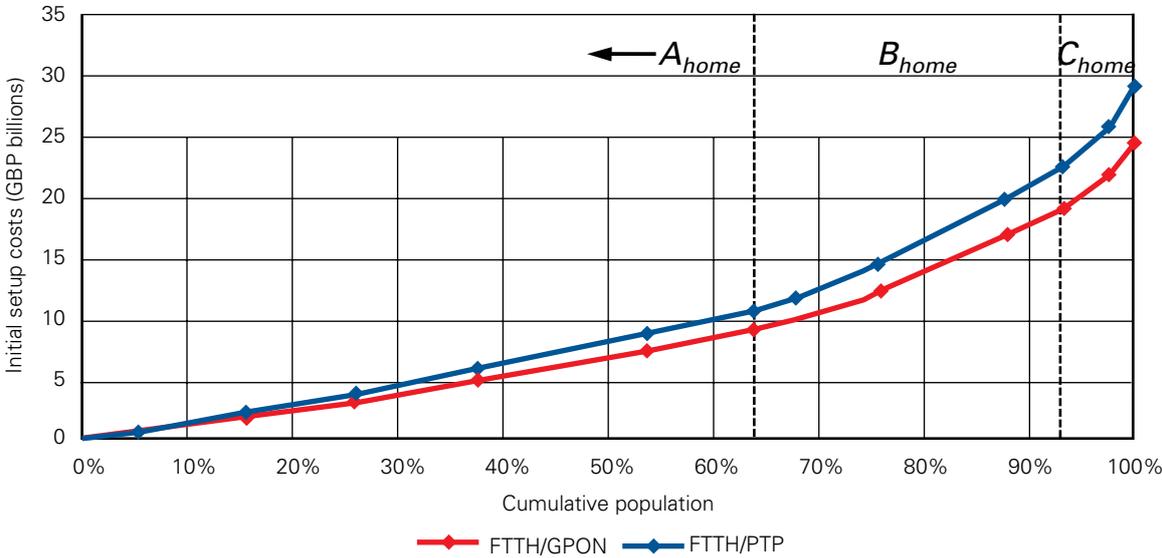


Source: Analysys & Mason for BSG

**Unproven case for driving higher revenues.** There is little evidence of a substantial pent-up demand for higher bandwidth at higher prices. UK consumers have become used to declining prices and growing bandwidth. There is some evidence of consumers in other countries continuing to prefer low prices for lower speeds, where the choice is available. For example, France Telecom had, up to July 2008, only 14,000 fibre subscribers out of a possible 344,000 connectable homes.

Additionally, in the UK there are few applications for which fibre is needed. Satellite, Cable, and Digital Terrestrial TV offer a wide range of TV channels making the attraction of IPTV delivered by fibre relatively low in comparison to other countries.

## New regulatory challenges

The deployment of NGA poses completely new challenges for which it is difficult to identify ready-made standard solutions. Throughout the review it has become evident that industry, regulator, and government are on a learning curve, and this is not surprising:

- this is the first time in a generation that a major upgrade of the fixed-access network infrastructure is in prospect;

- whereas historical major fixed-access network investments have been done in a state monopoly context, this time the new network needs to be funded in the context of an open market, satisfying return expectations of private investors, with amortisation only on a share of the market;

- it is the first time when telecoms regulators are called on to oversee the creation of a new strategic asset rather than regulate the access to existing 'scarce' resources such as the copper network in the case of local- loop unbundling, or radio spectrum in the case of GSM;

- the technical structure of the new network is not being dictated by a rigid, predetermined standard, but needs to be designed in parallel to the definition of new architectures and rules of interconnection;

- roll-out will be a long process, meaning that industry and regulator will have to agree on a migration path from old to new, and on a long period of coexistence of different networks;

- experience in other countries provides useful inputs but no template for a successful roll-out. With NGA influenced by many variables, each country seems to have developed its own path, which is usually not replicable.

## The temptation to take a step backwards

These economic factors bring with them implications for the likely evolution of the industry and infrastructure:

1) there is limited scope for infrastructure competition at the level of physical network – there might be extended areas where only one fibre- access network can be economically justified;

2) coverage will be driven by density and will be a function of specific technology choice – although the extent of the economic region of coverage is difficult to predict, it is likely that large areas of the country might not offer an economic return for the investment for some time.

Against this background, the debate around the regulatory framework tends to include suggestions that it would be difficult to deploy NGA in a competitive market-led environment and that investment can only be attracted in the context of state subsidies or closed networks.

The recommendation of this review is that this notion should be resisted. While regulation will need to recognise the higher risk of this development, policy makers should avoid these temptations. They should instead acknowledge that we are in new territory and proactively tackle the uncertainties, taking advantage of new opportunities.

## 1.3  Deploying NGA: opportunities

While the uncertainties and fluidity around NGA pose a challenge to all stakeholders, they create unprecedented opportunities for flexibility in delivery. Whereas previous investments have represented the upgrade of networks by monolithic, vertically-integrated fixed operators, the government can expect to see the shift to NGA to be much more diverse.

In particular, the government's strategy ought to reflect the following principles:

**Initiatives aimed at reducing the civil engineering cost can better the business case and facilitate fibre deployment**. The deployment of a new greenfield access network is primarily a civil engineering task. There has been a broad agreement across those bodies consulted during the review that the civils component accounts for 50-80% of the roll-out cost. According to the BSG study, the cost of laying new fibre (including the cost of the fibre, duct, and all installation costs) accounts for approximately 42% of the total cost of a national deployment of FTTC, with the cost of installing new cabinets a further 30% of the total. For an FTTH/GPON network, the proportion of total costs taken up in street works is 75%, and for an FTTH/PTP network the proportion is almost 80%. Whereas costs can usually be limited through innovation, technical changes or learning, this is an area of cost over which the telecoms industry can have little impact.

Other countries have sought to bring the civils bill down in several ways and one is through coordination of streetworks. To illustrate the potential gains if the cost of civil works could be reduced, the BSG report estimates the cost of roll-out to 80% of the population on a FTTH/P2P basis to be around £16bn. If civils account for 60% of this, and the civils bill could be reduced by 10%, this would represent a saving of nearly £1bn.

In the UK, utilities are already encouraged to coordinate plans such that their disruption is minimised and they can share some of the costs. This model has been in operation for several years and has achieved some limited success, although figures for the extent of coordination seem elusive. An enhanced framework was put in place by regulations which came into effect in spring 2008. It is too soon to determine their effect.

**Decisions on network design have an impact on the degree of infrastructure-based competition.** Although the high cost of market entry through investment reduces the feasibility of competing infrastructures in many areas, there is nevertheless the possibility to favour higher or lower degrees of infrastructure-based competition through the adoption of alternative network topologies.

Figure 5 below reports the design choices of the main NGA plans across a number of countries. With the exception of The Netherlands and Slovenia, all European national incumbents have thus far opted for a PON design, whilst local networks and new entrants have tended to choose P2P.

**Figure 5 Design choices by country**

| Incumbent | Technology |
|---|---|
| BT (UK) | GPON |
| France Telecom (France) | GPON |
| KPN (Netherlands) | E-P2P |
| Sonera (Finland) | GPON |
| Telecom Italia (Italy) | GPON |
| Telefonica (Spain) | GPON |
| Telekom Solvenije (Slovenia) | E-P2P |
| Telenor (Norway) | GPON |
| Telia (Sweden) | GPON and E-P2P |
| Deutsche Telekom | FTTN |
| Swisscom | FTTN |
| Belgacom | FTTN |

Source: Informa Telecoms & Media

**Wireless is likely to have a growing role in the provision of high-speed broadband.** Over the last 10 years mobile networks have made substantial progress in the cost-effective delivery of data services. In particular, the advent of 3G and more recently the High Speed Packet Access (HSPA) standard, combined with the declining cost of powerful digital devices, has led to a rapid growth of mobile internet traffic.

The speed and bandwidth that mobile networks offer today is similar to the performance of DSL (1st generation fixed network broadband) three to four years ago. Radio technology is expected to continue its progress and to deliver in three to five years speeds that can be materially higher than current access networks and, as such, can be regarded as integral part of the NGA infrastructure. Recent announcements regarding developments in new technologies such as Long Term Evolution (LTE) confirm that trend.

**NGA can be funded through different investment models, and deployed using alternative techniques.** Adoption of the internet standard is bringing greater possibilities to separate the design of the network from the provision of a service. This can be a major change for the model of delivery. Moreover, 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 provision of duct to different network providers.

This flexibility is built around the layered architecture with which Internet Protocol (IP) networks operate. In very simple terms, an NGA network can be thought of as three layers:

| Services | e.g. voice, broadband, TV |
|----------|---------------------------|
| **Active** | transport and switching of traffic. |
| **Passive** | dark fibre, ducts, etc. |

This model creates the possibility to develop local 'open access' infrastructures designed to offer a wide range of services by providers, as indicated by recent developments in Europe and the US. Such networks can include a public sector involvement, and Figure 6 below shows some of the forms this might take.

**Figure 6 Private/public sector partnership models**

| Services | Services | Services | Services |
|----------|----------|----------|----------|
| **Active** | **Active** | **Active** | **Active** |
| **Passive** | **Passive** | **Passive** | **Passive** |
| Local Government owns and operates the network. It also operates as a service-provider using the network (although not necessarily the only one). | Local Government owns the network and resells the dark fibre and/or capacity to service providers. It does not directly provide services (but may operate for its own needs). | Local Government owns the passive layer. A private company operates the active layer and resells dark fibre and/or capacity to service providers. | A private company owns and operates the network wholly, but also resells dark fibre or capacity. They may also act as a service provider, but not necessarily the only one. |

| | |
|---|---|
| <span style="color:#8a9ac0">▮</span> | private |
| <span style="color:#1a2a5e">▮</span> | public |

Source: Yankee Group

It is important to appreciate the different drivers of the economics of different 'layers' in these new networks. At the level of physical access, i.e. the passive and active layers, take-up rate rather than scale of network makes the business plan. To address this, small networks have managed to reach breakeven relatively fast through the use of 'preregistration', investing only when it was clear that at least 45-50% of the local community would connect to the new network.

This suggests that the development of NGA is not necessarily confined to the plans of existing large, fixed players. Of course, the major players will perform an essential role, but the NGA development strategy for the UK can and should rely on a wider group of competitors and technologies.

**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 three additional flows of revenue associated with NGA:

a) *interconnect revenues from other operators for incoming traffic (balanced by outpayments for outgoing traffic);*

b) *wholesale agreements with other service providers to carry their services and/or for the retail of their services (in NGA the services can range from voice to IPTV); and*

c) *advertising, possibly including allowing advertisers to target audiences with intelligent profiling of on-line behaviour.*

All of these are to a greater or lesser degree influenced by regulation. In a world of open networks and new business models, these flows are relevant to the viability of the investment case.

## Summary

While the business case for a competitive national deployment of fibre-based access network remains challenging, there are a number of factors that Government and regulators should consider to lower cost and enhance the prospects of NGA deployment.

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.

# Part 2: Assessing the case for public intervention at this time

The first issue the review has addressed is whether government needs to intervene now to get the market started, either through subsidy or a change in the regulatory basis. The circumstances in which such a move would be justified would be if: (a) a structural competitive gap was emerging between the UK and other countries; (b) the market was not likely to deliver, and (c) consumers were losing out.

**The evidence gathered through the process indicates that the case for any major public intervention at this time is weak at best.**

Our conclusion is based on three main points, expanded in more detail in the next pages.

- **First,** proper comparison of the UK with other countries does not highlight a structural gap. UK consumers and businesses benefit from a competitive broadband industry and a rich choice of digital communications and entertainment platforms. Headline comparisons with the leading economies elsewhere can be misleading and lead to unnecessarily alarmist conclusions.

- **Second,** there are strong indications the market will deliver substantial investment in NGA in the next 12 to 18 months. Virgin Media is upgrading its network; BT has announced an intention to deploy fibre. There is a range of other local initiatives, and mobile networks are now credible competitors in broadband. This all adds up to an environment in which fibre roll-out is likely to accelerate.

- **Third,** although demands on the network are growing as data consumption goes up, there is only limited evidence of service degradation, and these are generally related to capacity in backhaul rather than access networks. In the short term, there are ways to enhance capacity and delivery of most popular 'bandwidth-hungry' services such as catch-up video, without a full scale investment in NGA, let alone forms of subsidy to achieve it.

There is an equally important conclusion emerging from this part of the review: the government ought to recognise and build on the substantial achievements to date. In particular, it should acknowledge that its commitment to open competition and independent regulation has, since 2003, delivered choice,

innovation and a high rate of take-up. Preserving this commitment as the country moves to the next phase should be regarded as one of the key objectives of any NGA strategy.

## 2.1 The UK broadband market and network in the international context

### 2.1.1 A WORD OF CAUTION ON INTERNATIONAL COMPARISONS

In a number of countries across the world NGA has been, is being, or is due to be deployed to the extent that, by the first quarter of 2008, fibre accounted for 11% of all broadband connections. This is leading to some anxiety about the possibility of the UK being 'left behind' with a second-class broadband infrastructure.

Statistics on take-up of NGA from the OECD are often quoted and have fed the concerns that some hold regarding the lack of deployment of NGA in the UK. An example illustration is below.

**Figure 7 Percentage of fibre connections in total broadband subscriptions, December 2007**



NB: Australia, Canada, Finland, Germany, Greece, Luxembourg, Mexico, New Zealand, Poland, Portugal, Turkey, Ireland, Belgium, Hungary, France, Austria, Switzerland, and Spain have reported less than 1% fibre connections and are not represented on the chart
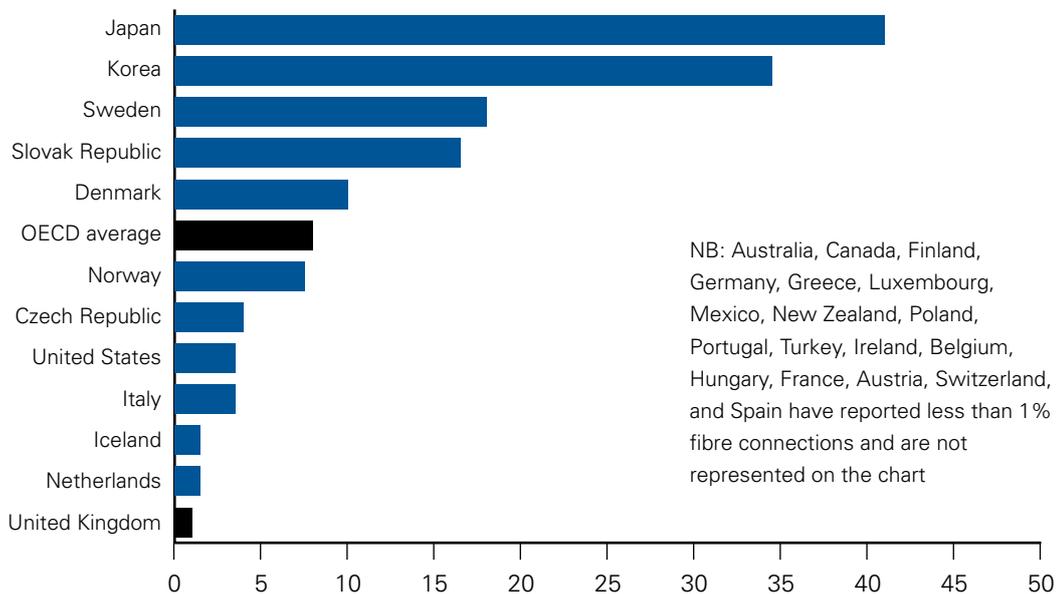
Source: OECD

However, there are several reasons why we might view these figures with caution. First, there are some questions over the robustness of this indicator. The focus on FTTH, for instance, could ignore many NGA developments such as Virgin Media's planned roll-out which, as we will see, plays a key role in the UK. Secondly, it is a partial view. The OECD itself presents penetration as only one indicator in a suite of factors: usage, coverage, prices, and services and speeds.

In other words, although much focus is on the simple number of fibre connections, the health of a country's broadband infrastructure is assessed by a wider range of factors. Indeed the often-cited chart above is one of 145 pieces of analysis carried out by the OECD. Some of these present the UK in a much better light: the average UK subscription price is one of the lowest (i.e. the fifth cheapest of 29 countries) ; the proportion of UK households with PC use is high, at 11th; in DSL coverage it ranks 5th; and so on.

Additionally, the perception of gaps opening up between the UK and competitor countries is often greater than the reality. It is worth noting that numerous announcements have been made regarding intentions to deploy, but in many markets actual deployment is still in the early stages. Figure 8 below highlights deployment intentions and actual deployments by operators across various markets (but excludes the recent BT announcement).

## Figure 8 Planned and achieved NGA deployments

| Country | | | | | | | | | | | | | | | | | Note: AT&T is present 36 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Technology | FTTHB | FTTC | FTTC | FFTH | FTTC | FTTC | FFTC | FTTC | FTTH | FFTC | | FTTC/H | FTTH/B | FTTH/B | FTTH | FTTH | Cable | out of 50 states. Verizon has presence 28 out of 50 |
| Target Coverage | 4% | 9% | 16% | 26% | 40% | 61% | 80% | 90% | 90% | 100% | | 0.4% | 2% | 4% | 17% | 38% | 47.5% | states. Virgin coverage is 50% of the UK. Illiad |
| Target year | 2008 | 2010 | 2010 | 2010 | 2009 | 2008 | 2010 | 2010 | 2011 | 2010 | | n/a | 2009 | 2009 | 2009 | 2013 | 2009 | target coverage extends |
| Coverage so far | 0.6% | n/a | 8% | 7% | 21% | 59% | 75% | n/a | 84% | 7% | | n/a | 0.9% | 0.5% | 2% | n/a | n/a | to 70% of Paris. |

Source: Ofcom

Even where coverage has reached a reasonable level, take-up of NGA-type services can lag. Starhub in Singapore and KT in Korea have both reported that the majority of customers on their NGA networks remain on 'lite' packages (4 – 10 Mb/s), while in Italy the availability since 2004 of a fit-for-purpose Local Loop Unbundling (LLU) product has seen Fastweb's business expansion based increasingly on selling LLU-based DSL services rather than fibre. Of its circa 1 million customers, only around a quarter are believed to be using fibre-based products.

## 2.1.2  THE UK ENJOYS A COMPETITIVE INFRASTRUCTURE

Looking beyond the headlines, therefore, the facts show the UK in a strong position. Consumers and businesses in the UK benefit from a competitive broadband industry and a rich choice of digital communications and entertainment platforms.

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1    At PPP in US Dollars.

## Competitive broadband market

After a relatively slow start, the UK enjoyed a rapid growth in broadband penetration between 2003 and 2007. Spurred by an initial growth in cable broadband, the rise in DSL penetration over that period was the highest in any comparable country. There are now over 16 million broadband lines in the UK. Given current trends, Point Topic estimate that the UK will have over 21 million connections by 2012.

As take-up has increased across the UK, so has broadband coverage. The UK is now among the world leaders in broadband coverage, with 99.6% of homes connected to an ADSL-enabled exchange (5,564 exchanges are DSL-enabled from a total of 5,592). Within this footprint, some homes are situated a distance from the exchange, meaning service is slower, but the point remains that coverage is close to universal. This places the UK at 5th in the OECD.

The average UK subscription price is 5th cheapest in the OECD; the proportion of UK households with PC use is high, at 11th.

## Choice of platforms

Consumers also benefit from one of the widest ranges of competing digital platforms for communications and entertainment. The UK has high levels of digital TV take-up through satellite, cable, and digital terrestrial television. At the end of the first quarter of 2008, some 87% of UK households had digital TV service and nearly 50% took some form of pay TV. Added to this are digital radio and data services available over digital mobile networks.

**Figure 9 Proportion of main sets connected to Multichannel TV (%)**
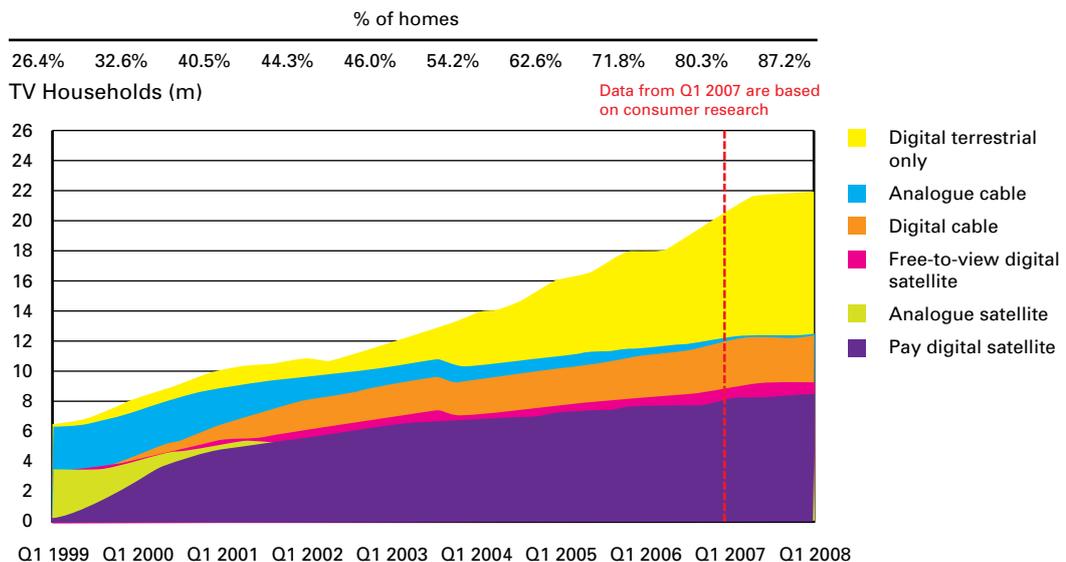


Source: Ofcom

## Key public sector establishments are connected

Although the focus of this review is on the development of broadband for homes and businesses, it is worth remembering that key public sector establishments in the form of schools, hospitals or GP surgeries are already virtually all provided with an adequate level of connectivity including, in some cases, through fibre or other forms of NGA.

### Figure 10 Level of connectivity for schools

|            | ADSL  | 2-10 Mb | 10-100 Mb | 100+ Mb | Total   |
|------------|-------|---------|-----------|---------|---------|
| **Secondary** | 0.85% | 28.4%   | 61.63%    | 8.94%   | **99.82%** |
| **Primary**   | 4.09% | 64.54%  | 30.6%     | 0.13%   | **99.36**  |

Source: BECTA

***Fibre is available for large businesses.***

Most large businesses in the UK have access. Providers such as BT, Cable & Wireless, Colt and Global Crossing have fibre-based networks providing services to large businesses and other big organisations. BT report that over 120,000 large customers have access to fibre-to-the-premises connectivity.

## The UK is among the leading internet economies

UK consumers of broadband are the most active users of the internet in Europe, and are among the biggest contributors to the online economy. UK users spend an average of 34.4 hours online per month, at home or work, compared to an average of 24 hours in Europe and 31.4 hours in the US.

### Figure 11 Hours online per user per month
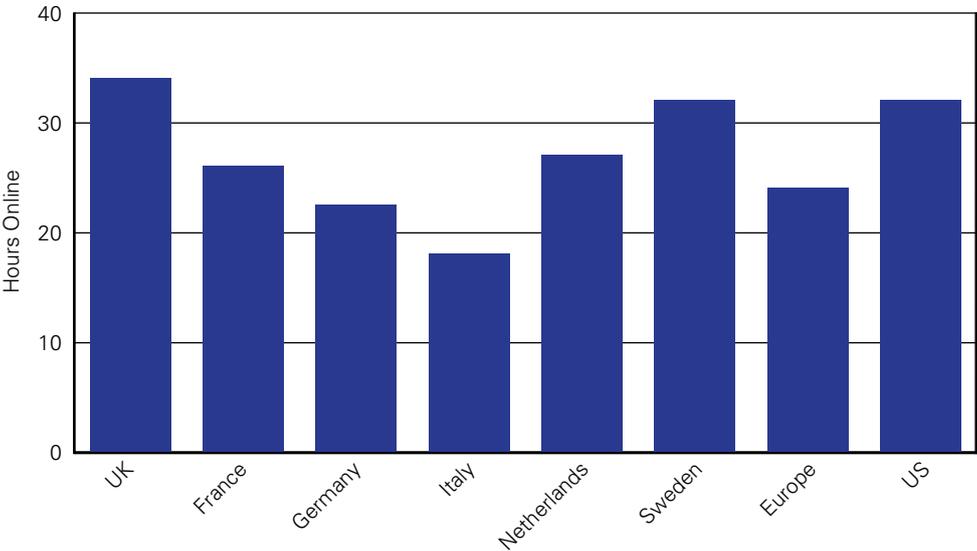


Source: ComScore data

The UK has the largest online retail market in Europe[2], with sales worth £46.6bn in 2007, comprising 15% of overall retail sales.

The UK also has the highest level of internet advertising per head in the G7, and internet advertising spend in the UK (at 18.9% of all advertising) makes up a far higher proportion of total advertising spend compared to other G7 countries (the US for example is 13%). Consumers are using more online services as part of their everyday lives; according to APACS, for example, 21 million UK consumers currently use online banking.

**Figure 12 Internet advertising spend as share of total advertising**
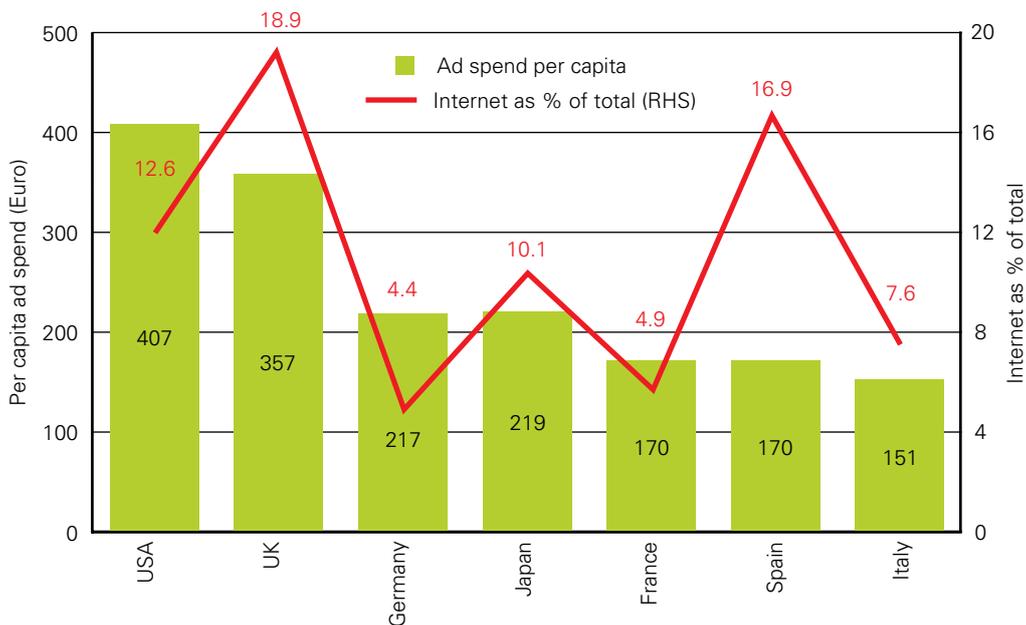


Source: World Advertising Trends 2007, WARC, reported by Ofcom

## 2.1.3  THERE IS LITTLE EVIDENCE THE UK IS YET MISSING OUT

There is some limited evidence that the presence of NGA is changing how people use the internet. Analysis of the most visited websites across countries, shows no correlation between NGA penetration and the sort of content people consume.

There is some evidence that the volume and mix of data is affected by NGA. Research carried out by Ventura estimated that fibred homes generated three times more traffic, both inbound and outbound, than ADSL subscribers.

The study estimated that 81% of the traffic in Sweden (where fibre penetration is high) was peer-to-peer sharing of large files, with many users downloading large files during the day for the evening's entertainment. Whilst the volume of traffic was significantly higher when compared to ADSL, ADSL subscribers

2    IMRG research, cited by Enders Analysis

were still accessing similar types of content, but through different methods of distribution.[3]

While this does not suggest that next generation broadband is not beneficial to an economy, it does highlight that it is difficult to conclude that the UK is <u>currently</u> disadvantaged by the lack of NGA. This review has certainly found no application essential to public welfare that is being delivered by NGA that cannot be delivered over conventional networks.

There has been little study of the overall additional economic value that next generation broadband provides over current generation broadband. This does not suggest however that NGA will bring no benefit to the economy. Earlier this year, the BSG published a report on the economic and social value of next generation broadband[4] that set out a framework for understanding how value would accrue across the economy.

The report identified three ways in which NGA would create value: (a) saving time doing existing things; (b) doing more of existing things; and (c) doing new things; and suggested where in the economy future value might occur. The report concluded that the benefits of widespread NGA deployment were likely to be significant and would, over time, exceed the costs of deployment.

### 2.1.4 WHAT THE UK CAN LEARN FROM AROUND THE WORLD

Annex G provides a detailed description of NGA developments in seven countries. In this paragraph the report focuses on the main development 'models', and on the aspects that are relevant to the UK.

There are various strategies for developing NGA. Generally speaking, four main models can be identified: (a) the Far Eastern model; (b) the Nordic model; (c) the US model; and (d) the French model.

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3   Peer-to-peer use of course brings its own challenges and potential negative economic impact where it is associated with illegal copyright breach.

4   http://www.broadbanduk.org/content/view/287/

| Model | Features | Comments |
|---|---|---|
| **The Far Eastern Model**<br><br>**(37% of all broadband connections are fibre[5])** | Major government expenditure, either through direct subsidy, tax breaks or provision of infrastructure (although exact details of government involvement can prove elusive).<br><br>High density of population with multi-dwelling units the norm. | Large cost to government: EU rules on state aid make major subsidies very difficult.<br><br>Limited evidence to date of transformational effect of major fibre roll-out on economy. |
| **The Nordic Model**<br><br>**(7% of all broadband connections are fibre)** | Local municipal networks on an open-access basis, sometimes public/privately funded (often involving utility companies), sometimes rolled out on a preregister basis to assess demand. There are over 300 of these across Europe[6]. In Sweden alone there are 200 such projects. | This requires limited, if any, public funding – the local authority role can be limited to one of leadership. The degree of commitment required from householders is often quite high and this model is unproven in the UK. There are signs though that it might contribute to NGA development in the UK. |
| **The US Model**<br><br>**(3% of all broadband connections are fibre)** | Regulatory forbearance, to assure incumbents that the value of their investment will not be compromised by a requirement to provide access to competitors. | The attempt to adopt a similar approach in Germany has been challenged by the European Commission. |
| **The French Model**<br><br>**(less than 1% of all broadband connections are fibre)** | Roll-out driven by competition with innovative new entrants, with regulatory involvement to settle issues such as in-building wiring. For now coverage limited to high density areas | Potentially relevant for the UK (particularly in high density areas), this could prove a good example of how competition, clarity of rules (e.g. in building wiring) and lower cost of civil works helps development of NGA. |

5    All fibre connection figures from OECD

6    www.fiberevolution.com

Just as when considering OECD league tables we must exercise some caution, so must we when examining these models. Whatever we might think about the desirability of emulating some of the countries with significant fibre penetration, their strategies do not necessarily translate well to implementation here in the UK. The sort of intervention practised abroad would, if applied here, often breach the letter of UK or EU law, or the spirit of government and Ofcom policy. In particular, while not all forms of state support are ruled out by the framework of EU law, many non-European models would prove very problematic to reproduce. Additionally, the models employed abroad might not be a good match for the competitive structure of the UK market.

Where the market is not delivering, there might be grounds for considering forms of subsidy or forbearance. But, in the UK, a case for such policies cannot be made with any real conviction. Given the existing competitive infrastructure, proven results of a commitment to competition and – as we will see – signs of new investment, there are reasons to expect the UK market to deliver without the sort of major intervention seen overseas.

This is not to say that we cannot learn legitimate lessons from how roll-out has occurred in other countries, or even adapt them for implementation in this country. In particular, the open-access model, in which investment is seen as part of local development rather than a national roll-out, points the way to a possible pattern for the UK with multiple investors and heterogeneous developments. This is the case in major cities as well as more rural areas – for example in Amsterdam, where a citywide deployment of 450,000 premises is planned on a public/private basis, and Stockholm, where a publicly owned FTTH network is being extended across the city.

**Box 1 OnsNet, a successful localised NGA project**

OnsNet is a community-owned FTTH project based in the town of Neunen, Netherlands. Each household pays €20 as a one-off payment for membership of the OnsNet co-operative. The network covers the entire town of 7500 households, and has been operational since 2005. The cost of connection was €2100 per house (although this decreased to approximately €1500 in later developments), with a government subsidy accounting for approximately €800 per house. The remainder was funded through by Reggefiber, the infrastructure provider. Consumer aggregation via the OnsNet co-operative provided the necessary guarantees to support the investment.

In its first year, 97% of the town subscribed to one or more of the services, with the government subsidy enabling OnsNet to offer the first year free to subscribers. Subsequently, subscription rates remained at over 80%, with triple play services costing €39.39 a month. Currently, 5500 people receive high-speed internet services, 6000 people use telephony services and 5000 people subscribe to television through OnsNet.

Neunen is a test-bed for bandwidth intensive public services. Phillips is trialling several e-health applications, plus Achmea (a major health insurance company), and Rabbobank (a major banking company) are also trialling services.

The success of the project has led to others being established in the Netherlands, in the Eindhoven and Brabant regions.

## 2.2  NGA in the UK: recent developments and likely evolution

The second reason for concluding the case for public intervention now is weak is represented by the increasing likelihood of competitors investing in NGA.

During 2008 there has been a number of developments which indicate that the market is likely to deliver NGA investment in this country in the next few years. Virgin Media is upgrading its network and BT has announced their intention to deploy fibre. There is a range of other local initiatives, and mobile networks have accelerated the launch of wireless broadband services – and, in some cases, extended their presence in fixed broadband. This adds up to an environment in which roll-out is likely to accelerate.

### 2.2.1  INCUMBENTS ARE ANNOUNCING INVESTMENT

*Virgin Media is leading the way*

Virgin Media announced in November 2007 plans to offer a new 50 Mb/s cable broadband service to 70% of its customer base by the end of 2008, rising to 95%

in 2009 (Virgin Media's cable network covers slightly more than 50% of homes, some 12.5 million households). The service is in some respects analogous to a fibre-to-the-cabinet solution, and leaves potential for an upgrade in future. Indeed, in July 2008, Virgin CTO announced the intention to provide 200 Mb/s by 2012.

**Box 2 Virgin Media's technology model**

Virgin's roll-out follows technology trials that took place in Kent in two phases during 2007.

During the trial Virgin used pre-DOCSIS 3.0 equipment, as the full standbard had not yet been certified. Certifications are taking place now and will continue throughout 2008. CableLabs is awarding three types of certifications:

- **Bronze:** the equipment is compliant only to the part of the standard about downstream bandwidth increase;
- **Silver:** compliant to downstream and upstream requirements;
- **Full:** downstream, upstream, encryption and security elements.

All vendors of DOCSIS 3.0 equipment are expected to progressively increase their level of certification to a full implementation of the standard.

Virgin's initial deployment will focus on leveraging the 'bronze' capabilities of DOCSIS 3.0 which will provide a substantial downstream bandwidth increase to its existing range of asymmetric service tiers.

A new phase of the trials in Kent has also commenced in order to test some of the other important capabilities in the full DOCSIS 3.0 standard, including much higher upstream bandwidths and IP version 6.0.

Virgin is using spare RF channels to support the DOCSIS 3.0 expansion which is also fully backwards compatible with the existing DOCSIS 1.0-based services. As a result, the DOCSIS 3.0 investment will provide both the capabilities for the new 50/1.5 Mb service, as well as capacity expansion for the existing DOCSIS 1.0 services.

Virgin's network is divided into levels with fibre deployed to 37k 'level 3' street cabinets which are typically within 500m of customers' homes. The Broadband services are then connected to each home using Co-axial cable via around 555k 'level 4' distribution cabinets.

Virgin currently offer up to 20 Mb unlimited data usage for £29 a month.

### *1 oz threat > 1 lb opportunity?*

Discussions with the main broadband service providers confirm that there is great awareness of Virgin Media's ongoing upgrade and an appreciation of the competitive threat it might represent. This is, at the moment, the most visible aspect of the competitive dynamics that are at work in the UK and of their impact on the deployment of NGA.

As we have seen, it is difficult to prove that faster broadband can help providers extract a substantial premium and generate a higher average revenue per user (ARPU). This makes investors, particularly in the case of new entrants, nervous about investing in major fibre upgrades.

But the picture is very different for operators who might face an erosion in revenues and margins resulting from their customers migrating to a faster network. In the UK market, Virgin Media is acting as a powerful catalyst of decision-making on investment in fibre by other competitors.

### *BT has announced its intention to invest in NGA*

BT's stated position prior to this year had been that the only NGA deployments that it envisaged undertaking were in new builds. But, in July 2008, it announced plans to invest £1.5 billion over five years, of which £1 billion was incremental to that already planned, on an NGA network that will deliver download speeds up to 40 Mb/s to 10 million homes (i.e. about 40% of the UK total) by 2012.

BT said that the deployment would involve a mix of fibre-to-the-home (FTTH) and fibre-to-the-cabinet (FTTC), and that the geographic spread of the investment would be determined in part by the level of assistance BT gets from local and regional authorities. Details remain to be established and, crucially, investment hinges on certain regulatory decisions, particularly around the rate of return on capital and rules on network access for BT's competitors. It is, therefore, too early to estimate how and when the announcement will translate into a mass deployment, but it represents a step change in BT's attitude towards investment in fibre.

### *Other broadband providers are also evaluating their options in NGA*

At the moment none of the other major broadband providers has announced firm plans to invest in NGA. Most cite the lack of a compelling business case: there is limited indication of consumer willingness to pay a high enough premium to cover the investment in NGA infrastructure.

However, a number of operators have held preliminary discussions with Openreach to begin defining an upgrade of their access networks from DSL to fibre (primarily FTTC). Sky is trialling – on a limited scale – an FTTC architecture using sub-loop unbundling.

Operators have also voiced their concern about the lack of a suitable 'industrially-designed' offer for sub-loop unbundling which would allow alternative operators to roll out FTTC networks.

Whilst this is one of the key issues that industry participants will have to resolve with Ofcom and Openreach, it seems apparent that growing 'tensions' in this area should be regarded as a further indication of the industry getting closer to the definition and launch of an NGA plan.

### Mobile is offering an alternative to fixed lines

The growth and success of mobile internet services provides another stimulus to the market. The sales of 'dongles', which offer wireless connectivity to a laptop, have reached more than 30,000 per month with a number of attractive price propositions for download limits of 1, 3 or 7 Gb, at speeds advertised up to 7.2 Mb/s[8], delivering a typical speed of around 1.3 Mb/s. Some 15% of new broadband subscriptions are for mobile, and this is thought to be contributing to drive the increase in the number of landline-free households (now 13%).

While the speeds offered by mobile operators do not really resemble NGA services at present, there exists the potential for upgrades to their networks as the standards and technology evolve. For the time being, it is possible to imagine the dongle being largely complementary to the fixed-line market. However, with growth in broadband subscriptions slowing and a greater share of new additions being mobile, fixed operators might start to feel a threat of declining growth in customer base and consider investment in NGA as a possible response.

### 2.2.2 DEVELOPMENTS ARE HAPPENING AT A LOCAL LEVEL

In addition to these plans by national incumbents, there are a number of more local developments, including a mix of public and private initiatives, and different examples of innovative roll-out.

### New housing developments are getting NGA

In new housing developments, there is a growing understanding that NGA is to be part of the infrastructure expected of modern homes. Developers are increasingly seeking different ways to demand and deliver NGA in a way that does not rely on the plans of incumbent telcos.

Ebbsfleet, a development which will see 10,000 new homes connected with fibre by BT in partnership with Land Securities, represents the first example of BT delivering NGA. The project should serve as a testing ground for the technology and consumer reactions.

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8    Vodafone and Orange advertised maximum speeds, August 2008.

There are though other developments where new homes are being built with NGA, such as the Titanic Quarter in Belfast, and the Olympic Village, Greenwich Peninsula, Wembley Park and Elephant & Castle redevelopments in London. Importantly, developers are innovating in the means by which their NGA is provided, including plans to build their own networks and have them run on an open-access basis.

The example of the Titanic Quarter is an excellent illustration of this.

### Box 3 The Titanic Quarter development

Titanic Quarter is the large-scale privately funded regeneration of the former shipyard on Queen's Island, Belfast. The Queen's Island area already houses the Northern Ireland Science Park with global companies including Citi and Microsoft.

Plans include a financial services centre, a metropolitan college for 17,000 students, major tourist attractions, new campuses for Creative Media and Connected Health, and eventually up to 15,000 homes.

The two key design requirements for the Titanic Quarter access network are future-proofing and competitive innovation.

The chosen design is therefore a fully open-access and carrier-neutral fibre-to-the-home network modelled on the well-proven independent local networks already in use in countries such as Sweden. Utilising the new freedoms of fibre, each occupant will be able to use their connection to handle several concurrent services of different types (voice telephony, internet access, IPTV etc.) from many different, concurrent, service providers.

The operational management of the Titanic Quarter access network is independent of any communications/service provider and connectivity is sold only on a wholesale basis. Take up will be 100%, with all occupants of the estate (whether business or residential) purchasing their choice of services directly from the interconnected Service Providers and their retail channel partners.

### The public sector is supporting some developments

There are several schemes at various stages of development in which public bodies across the country are supporting NGA deployment. Some of the main ones are:

**Manchester –** Fibre-to-the-Building (FTTB) pilot to 1,000 homes, with probably extension to 5,000 later;

**Digital Region (South Yorkshire) –** FTTC project providing every home and business in the region with NGA;

**Gateshead –** the Baltic Business Quarter will see the redevelopment of 21 hectares of urban landscape with a fibre enabled business site;

**Bournemouth –** fibre City project from H2O networks providing fibre-to-the-premises to up to 85,000 homes and businesses;

**Glasgow –** 700 new and existing properties fibre-to-the-home project commencing in 2008;

**Walsall –** community aggregation project for new development;

**Alston Cybermoor –** planned fibre-access project;

**Cornwall –** a public sector project plans to bring NGA to the whole of Cornwall.

The development of local NGA schemes in other countries has made this an attractive option for various parts of the UK, and there is today interest from several Regional Development Agencies (RDAs) and local authorities in fostering NGA in their area.

There is a range of models by which the public sector can intervene to support NGA. Some of these are analysed in the BSG's publication *Models for efficient and effective public sector intervention in next generation broadband access networks*, which identified a set of critical success factors for public-sector supported schemes. As public sector projects of different sorts emerge, it is likely that they will contribute to a groundswell of interest in NGA and answer some of the questions about demand, use and willingness to pay. They may also offer a further stimulus to private investors.

It is worth noting, though, that a number of issues might compromise the effectiveness of some of these developments. In particular, there seems to be little coordination of the various projects. This may lead to the adoption of different network architectures and basic processes (such as provisioning and billing), making it difficult for service providers to deliver their offer through these networks.

### Companies are experimenting with new roll-out models

The other sign of investment is through innovative roll-out methods – primarily utilising the sewer network to run fibre through. In France, we have seen how this sort of deployment (which has the advantage of low costs and rapid deployment, but of course depends on suitable chambers and agreement with the water company) can deliver for consumers and act as a spur to the market.

H2O announced in June 2008 that it would be providing fibre access through the sewer network to 85,000 homes in Bournemouth, and has made further announcements about its plans for Dundee. It believes that this deployment

method could lead to cost savings of up to 70-80% compared with traditional methods of network build. If successful in its initial roll-out phase, H2O plans to extend this to many other UK cities.

## 2.3 Considerations on short-term evolution of demand on the network: access vs core/backhaul

Although demands on the network are growing as data consumption increases, evidence of service degradation remains limited, and these seem to be related to capacity in backhaul rather than in access networks. In the short term, there are ways to enhance capacity and delivery of most popular 'bandwidth hungry' services such as catch-up video without a full-scale investment in NGA, let alone one subsidised by the Government.

**CONSUMER DEMAND IS GROWING**

Increased usage, combined with more bandwidth-hungry applications, has meant that demands on the broadband network have been on an upward trend for a number of years.[8] The level of typical consumption of content, measured by the amount of data downloaded per household, has continued to rise dramatically since the introduction of broadband, and this can be attributed in particular to the growth in peer-to-peer traffic and video.

**Figure 13 Actual and predicted demand for bandwidth, by content type**
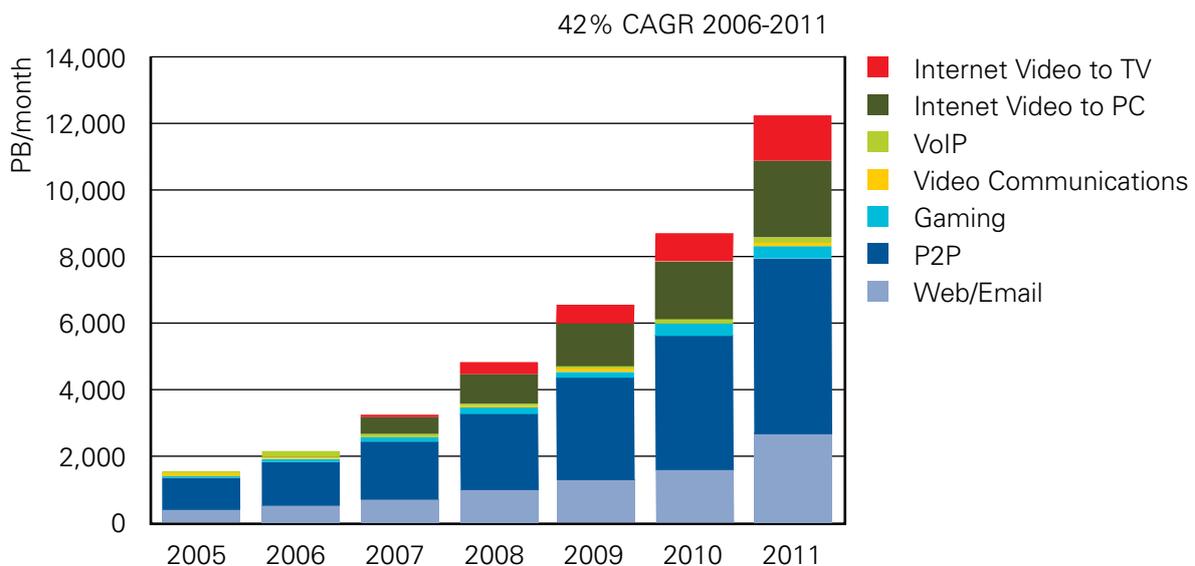


Source: Cisco

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8    Evidence of this trend is widely available, such as data from Internet exchanges (see www.linx.net; www.ams-ix.net).

## IN THE SHORT TERM, BOTTLENECKS ARE MORE LIKELY IN THE BACKHAUL/ CORE THAN ACCESS

Although demand for bandwidth and internet traffic continues to exhibit strong growth, there is little evidence that, in the short term, UK consumers will experience a detriment due to the lack of an extensive NGA network.

The quality of service delivered to end users is a function of many factors, including the 'end-to-end' capacity available and not just sufficient capacity in the final access link. The speed and reliability with which data are delivered are dependent on at least four groups of sub-systems:

- speed and capacity of the source (servers and interconnect links into the public internet of the web site);

- throughput of the core network(s) of the carriers through which the information travels to move from the website to the ISP of the specific user;

- capacity of the ISP network including its backhaul; and

- speed and capacity in the 'last mile'.

At present, video services represent more of a challenge for the core and backhaul parts of the network, rather than the last mile.

- Today, the majority of internet-based video streaming services require a bandwidth that is well within the range of what is offered by most DSL connections (some 300 – 500 Kb/s), even taking into account the difference between 'headline' advertised speeds and the actual performance delivered.

- The core and backhaul networks of ISPs around the world were designed to support the pattern of use typical of web browsing (short burst of data flowing primarily in one direction) or continued streaming of relatively narrow band applications. They were not designed to cope with many users simultaneously accessing sustained bandwidth-hungry services.

- Traffic throttling and shaping is evidence of ISPs facing capacity constraints in their backhaul and core networks. 'Traffic throttling' is the practice by ISPs of limiting the throughput of traffic to users in order to regulate the aggregate level of demand. 'Traffic shaping' policies focus on particular types of traffic and applications which generate heavy network usage and seek to block, restrict or degrade these applications. The Samknows website published the results of a limited test of ADSL performance in August 2008[9] which suggested some use of traffic-throttling across all ISPs tested.

9    http://www.samknows.com/broadband/news/now-available-our-first-performance-monitoring-report-417.html

## INVESTMENT IN CORE AND BACKHAUL NETWORKS CAN ADDRESS CAPACITY PROBLEMS IN THE SHORT TERM

In aggregate, the cost of upgrade of backhaul is minimal compared to the investment for a major NGA development. But for some ISPs, it may represent a significant portion of their margin. However, this is not entirely straightforward: it is worth noting that Ofcom has acknowledged that competition in the backhaul market has not developed to the expected extent and it may be appropriate for Ofcom to re-assess the dynamics of this market, also in view of the launch of BT's 21st Century Network.

Broadband providers have, over the years, upgraded the capacity of their core and backhaul networks to serve growing demand for bandwidth. This will continue to happen as traffic increases. From time to time, especially when new services are launched, parts of the network can suffer from degradation of performance. Increases in the capacity of backhaul and core networks in fact happens in steps and at different times across the entire network.

## THE COPPER NETWORK IS STILL CAPABLE OF MARGINAL IMPROVEMENTS OVER THE LAST FEW YEARS

The market has responded to this customer demand by providing a set of products which provide much higher download speeds and, in some cases, greater upload speeds. Major providers now offer up to 20 Mb/s download speeds for as little as £15 per month, while niche products offering higher upload speeds exist for a small premium.[10] Actual delivery may often fall short of this, but further gains in copper speeds are not to be ruled out.

As demand rises further, there are ways in which service providers can continue to deliver more bandwidth out of the copper network through 'bonding' techniques to combine the capacity of multiple lines, various technical adjustments, and better maintenance of the physical infrastructure.

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10  O2 offers its 'Unlimited' package providing 20 Mb download speeds from £15 a month and Virgin Media offers a 20 Mb package for an introductory offer of £13.99. Sky and UK Online both offer 16 M/bit packages. Be's Pro package allows users, for a fee of £22, to enjoy higher upload bandwidths of up to 2.5 M/bits at the expense of slightly lower download speeds compared with their 'Ultimate' package, of 22 Mb. Source: http://www.broadbandchoices. co.uk/?partner=lp_sp and companies' own sites.

**Box 4 Delivering catch-up video: bandwidth vs hard disk**

*An example of competing platforms in the age of convergence*

As the telecom and media industries continue to move towards digitization, one should consider that a given service can be delivered through a variety of alternative platforms.

A point-to-point fibre network – i.e. a network with a dedicated fibre link to each home – offers the most flexible solution to deliver a very wide range of information and entertainment services.

But when considering an application such as iPlayer the economics of alternative ways of delivery should be taken into account; especially if, as the service gets increasingly popular, demand could arise to invest in network infrastructure for more capacity.

The key feature of iPlayer is catch-up TV. Consumers in the UK have the possibility of watching their preferred programmes whenever they want for 1 week after date of broadcast on the air. As in the case of catch-up radio, catch-up TV has proven very popular. Other broadcasters have launched similar services.

The focus of the debate about iPlayer has been about the internet, but catch up video can be delivered in more than way.

With Digital Terrestrial TV (DTT) enjoying 83% penetration and a £25 Personal Video Recorder (PVR) capable of storing 100+ hours of video, programmes can be distributed over the air, stored locally and watched at any time.

The recent drive by Sky to advertise its Sky+ service can be seen as a reaction to the new habits and demands of consumers increasingly growing used to catch-up TV on demand. The market might therefore meet these demands in the new term without NGA necessarily being involved. Top-up TV also offers a similar service combining DTT and PVR technology.

The majority of consumers are interested in a limited number of 'hits'. For this large segment, a hard disk could offer a more cost-effective solution than fibre for some time to come.

The scenario will therefore evolve considerably, presenting new obstacles and opportunities. Government should therefore ensure all is in place to support development of factors enabling rural coverage, such as wireless networks, local networks and high take-up, rather than finalise today specific actions to address NGA coverage in low density areas.

**SUMMARY**

We have seen that partial international comparisons can be misleading and distract from the UK's competitive infrastructure and online activity. There are lessons that can be learned from around the world where governments have adopted various strategies to support roll-out of NGA, but not all are directly applicable and their effects are not always desirable. There are signs of market investment and the kindling of a competitive environment, with developments in several guises.

There is evidence of consumer demand for applications which require greater bandwidth, and of this placing a strain on the network. There are though ways in which that demand can be met without NGA, in particular by addressing the bottleneck in backhaul, which is where the constraints generally lie, but also by further innovation in the copper network.

# Part 3: The Government's role in the longer term

The first conclusion of this review is that there is no need for major intervention now, but this should not lead to complacency.

In the mid- to long term, Broadband/NGA will become a critical digital utility, essential to the competitiveness of any country and to the quality of life of its citizens. The UK will be no exception and, if anything, it will be even more dependent on this infrastructure than other economies. Here, high-quality broadband will be essential for the continued development of sectors that in recent years have elevated the UK to a position of global leadership, such as the creative industries, financial services, software and gaming. Equally importantly, broadband will be central to critical processes of information and innovation in education and health services.

Because of this, the Government and Ofcom, as the two principal entities involved in determining the efficient and effective deployment of NGA, need to play an active leadership role in shaping broadband policies.

This does not translate into subsidies or structural changes in regulation, but in a set of initiatives that could support and inform the activity of regulators and industry players in their journey to NGA. The government should seek to remove obstacles that could potentially delay or compromise the development of the new network.

As in the case of first Generation Broadband, there is an important role that Government – and Ofcom – need to play to support a timely evolution of the broadband infrastructure.

- Broadband is increasingly central to society and business. A competitive NGA will be an important component of its evolution, and essential for the UK to retain its leadership in the online economy.

- Even more than for first generation broadband, government can create an environment that supports private investment. NGA is a new utility. Its development can be influenced by initiatives that go beyond sectoral regulation: From streetworks to legislation of online privacy.

- The NGA development plans that are underway face implementation challenges, and there is a small risk, albeit limited, that their impact on the market may not be felt for a while. The industry could overly stretch the investment in copper with only minimum ("static efficiency") improvement to the broadband quality

As the penetration of various networks evolves, it will be for the Government to identify the best path to maximum coverage.

## 3.1 Broadband as the new digital utility

Broadband has developed from being another platform for communication, to establishing itself as a key part of the economic infrastructure supporting a modern knowledge economy. Broadband take-up across the population has occurred faster than for any other communications technology, and new services and applications are constantly being developed.

The rapid adoption of internet technology as the new standard for communication and the digitisation of a growing number of devices, from telephones to radio, to TV sets, has driven a profound transformation in many industries, including telecoms, media, music and financial services.

The growth in household broadband penetration has rapidly extended this transformation to consumers who, over the last few years, have come to use the telecom network not just as instrument of communication, but as a permanent source of news, entertainment and services.

**Through this convergence broadband has 'de facto' become already an essential digital utility for many households and businesses**

| From | Through | To |
| --- | --- | --- |
| Fixed and mobile telephany | | One Integrated IP Network |
| Data networks | | |
| Radio | Internet Standard | |
| Terrestrial TV broadcast | | Connecting a wide range of Digital Services |
| Music via radio or physical recordings | | |
| Film in cinemas or physical recordings | Digitization | Delivering a growing bredth of services and transactions |
| Printed media | | |
| Retail | | |
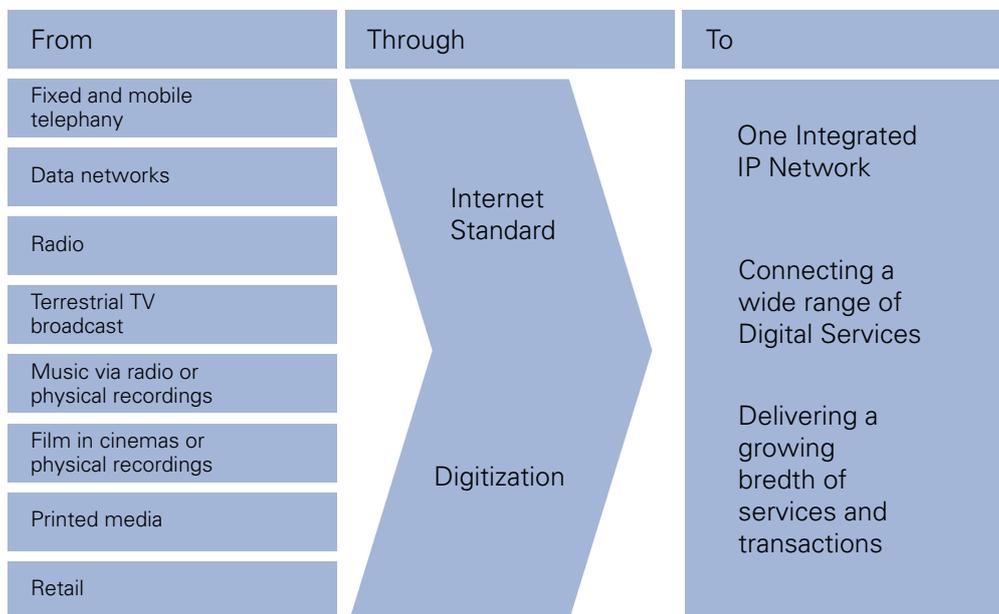
A growing proportion of GDP is being affected by the availability and quality of the broadband infrastructure. Its impact is now being felt in a growing number of sectors.

Businesses are taking advantage of this improved connectivity. New services are coming online all the time from a variety of industries, from entertainment, to finance, to retail, to public services, and we have seen previously that the UK is among the leading internet economies. Broadband has become a key part of everyday life, for consumers and citizens, businesses and public authorities.

NGA is likely to have a significant impact on the economy and society. The BSG report on the economic and social value of NGA identified a range of areas where value might accrue to the economy and society, and this highlights the possible transformative effect NGA could have.

In this context the quality of networks and services is becoming a key factor in attracting investment and business. Countries, regions and cities will all utilise their digital infrastructure to compete for investment.

## Need for NGA in the mid term

Growth in volume of traffic, new applications and more users are likely to require a migration to NGA in the mid term:

- the demand on internet bandwidth has grown rapidly. YouTube currently consumes as much bandwidth as the entire internet did in 2000. Cisco forecast an annual growth rate of 42% in global consumer traffic.

- new devices will increase the load on both core and access network. The extension of the IP standard to radios, TV sets, alarms, remotely-controlled systems (e.g. heating and appliances) will continue to alter the profile of use by increasing the number of devices that will simultaneously exchange *symmetric* information on the web. The declining cost of memories, LCD and processing power will lead to continued enhancement of quality of services;

- the evolution in demographics will shift toward heavier users of online services that will spend more and more time on internet-connected devices and bandwidth-hungry applications;

**Figure 14 Bandwidth requirements of different applications**
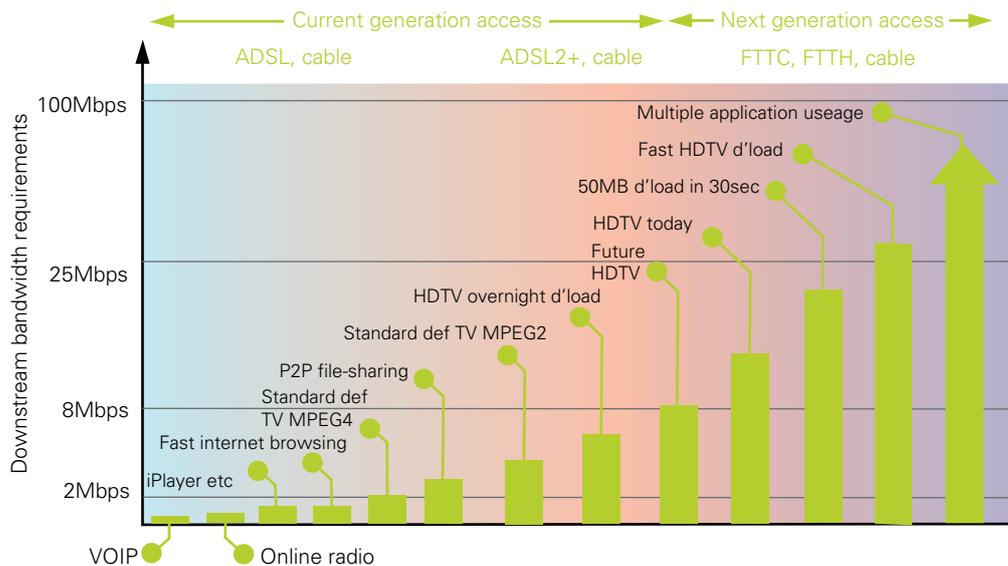


Source: Ofcom

- recent studies that have attempted to project internet capacity (core and access), such as *The Internet Singularity*, by Nemertes Research, seem to confirm that a bottleneck in access might emerge in the US over the next three to five years.

- The British Computer Society has reported that a third of all businesses think they will need speeds of up to 100 Mb/s in the future in order to run core business computing.[11]

## 3.2  Government and Ofcom have roles to play

The trends described above point to the need for an important leadership role that the Government should play with Ofcom to create the appropriate conditions for the evolution of broadband in the UK and the deployment of a competitive NGA.

**A REGULATORY ROADMAP FOR NGA**

Ofcom will lead the definition of the most suitable regulatory framework for the broadband market, but the wider regulatory picture is equally important, and here the levers of control are shared by regulator and Government.

11   http://www.computerweekly.com/Articles/2008/07/04/231347/slow-uk-broadband-to-hit-business-computing.htm

## OFCOM

In the migration to NGA, regulators face a difficult balancing act in signalling to the market their likely approach in a way that protects consumer interests and creates scope for competition, but also allows sufficient reassurances of returns. For this reason, Ofcom's strategy on network access, active and passive remedies, the future of the copper network and new business models, are all essential parts of the process. It has taken some time for the market to progress to the point where it is ready for a clear signal, but the time has been reached when it will start to demand clarity from regulatory policy.

## OFCOM AND GOVERNMENT

**Spectrum.** Ofcom's programme of spectrum release and reform of spectrum regulation needs to be thought of as a vital input to the NGA strategy, since wireless is likely to be one means of delivering NGA services. At present, the schedule for auctioning spectrum suitable for wireless data services is unclear due to the contentious issues surrounding the entitlements of mobile operators. Development of spectrum policy requires close cooperation between government and regulator, given the need for negotiation in Europe and the formal powers of direction which rest with Ministers.

**Broadcasting.** A further major strategic area is that around regulation of broadcasting services. The remit, funding, and structure of public service broadcasters will have a knock-on effect on online video availability and, thereby, potentially on consumer demand for NGA.

The regime for regulating premium content and pay-TV could also have an effect. Ofcom is currently conducting an investigation of the pay-TV market, the results of which are expected to be published before the end of 2008.

There are issues beyond sectoral regulation which the Government alone can address

There are several critical issues where the role of government can materially influence the evolution of the new network. These include:

- approach to streetworks and rights of way for the new infrastructure;

- powers of local authorities 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.

The range of other policy areas which will have a bearing on NGA development should not be underestimated. It will include:

- legislation and awareness of online privacy and safety;

- definition of processes in essential public services such as education and health care, that can build on and favour the further adoption of broadband; and

- legislation on intellectual property and copyright infringement to support the creative and high-tech industries in the digital market space.

To be clear, all of the above applies to broadband in general and not just to NGA. But these areas influence the evolution of the broadband economy and, as such, drive the rate and funding of investment in new infrastructure. Achieving these goals will require work on several fronts, and Ofcom and the Government will need to work together to achieve best results.

## 3.3 There is a limited risk of static efficiency in the market

The third reason why the Government should be vigilant and remove obstacles to investment is the risk of static efficiency. It is possible that for economic, regulatory, or technical reasons the current investment plans might not lead to a significant roll-out for some time. Given the uncertainties around the investment, a rational response by market players under some circumstances would be to continue to develop services by wringing the maximum out of the existing copper network alongside efficiencies in processes and cost cutting.

Despite their announcements of investment in NGA, it is conceivable that both Virgin Media and BT might encounter difficulties in delivering their roll-out, or find that the customer response is limited.

In turn, the limited effect felt by other ISPs in the market might mean that their incentive to invest in NGA services is reduced as well. Additionally, the threat of wireless broadband might start to fall away due to delays in spectrum allocation.

Additionally, the success of local NGA projects hinges on the success of the relationships between those providing the different parts of the value stack (passive infrastructure, active infrastructure and services). Developing functional relationships might prove challenging and threaten the success of the model, which might in turn lead to reluctance to creating further innovative models elsewhere.

## 3.4  Finding the best path to maximum coverage

The fourth reason for the Government to retain an active involvement is that there will remain a need for effective policies to achieve maximum coverage of NGA and universal access to broadband.

The Government, along with the Devolved Administrations and Regional Development Agencies, has launched a number of initiatives in this area and has a programme of work in pursuit of digital equality which will be set out later in the year.

The existing broadband access network has to date extended its reach to 5564 out of 5592 exchanges DSL-enabled. The problems of households situated several kilometres from the exchange are well known, but this level of coverage is well in excess of what was initially anticipated, and has made first generation broadband almost universally available. Although DSL roll-out largely outperformed the expectations of most, the cost of fibre will make it even more challenging for the new networks to reach a level of coverage approaching universality.

Although the focus of this review is primarily on ensuring a timely start for deployment of a competitive NGA deployment, the advent of new networks and technologies will provide new challenges and opportunities to progress towards universal coverage.

Over the next few years the government will have to address two issues:

- **Balance.** As NGA deployment gets under way, what is the extent of coverage that should be regarded as essential vs. desirable over time and can this be delivered by the market?

- **Baseline.** As broadband becomes an increasingly essential digital utility, what are effective ways to provide an adequate level of connectivity to all households?

While the economics of NGA do make questions of coverage more problematic, the NGA environment will bring with it some new opportunities to address extension of provision. NGA networks will:

- rely on wireless technology in less populated areas to a larger extent than current generation broadband; and

- result from a combination of national and local developments. These will offer local communities the possibility to fund new access networks in parallel to, or in partnership with, national developments, and could contribute to an acceleration in coverage.

In addition, over the next few years the level of penetration and adoption of broadband is likely to grow. Today a number of factors limit take up rate, among these the need to own and know how to use a PC. As new broadband-enabled devices develop, access to the internet will extend beyond domestic PCs, thus making it easier for a larger portion of the population to benefit from broadband services. This could in turn drive uptake beyond present levels and extend the areas where demand justifies new investment.

# Part 4: Recommendations

Having established therefore that there will continue to be a role for government in supporting roll-out of NGA, there are a number of initiatives the government should put in place now to foster its development. The review has identified four recommendations for Government action:

● develop a framework for delivery of future broadband, setting out how the government would like to see the market or infrastructure develop, in order to provide all parties involved with a clear sense of direction;

● carry out a set of policies which stop short of major intervention (i.e. major subsidy or a structural change in regulation) but which might lower the cost of deployment for operators and facilitate investments in NGA nationally and locally;

● establish permanent monitoring and benchmarking processes to monitor progress in the development of NGA in the UK in relation to other countries;

● invest time and resources to identify remedies that should be implemented in case of major (comparative) delays in the in deployment of NGA.

## 4.1  Defining a vision for fast broadband in the UK

The development of NGA is a challenging task for the whole industry and will build on the involvement of a large number of stakeholders. Building on the progress in the last six months, it is now a good time for the government to set out in some detail such a framework for the delivery of NGA. This would provide an up-to-date reference point for all relevant parties and help them in the implementation work that is about to begin.

Whilst it will be for the government to finalise the specifics, it is this report's recommendation that the framework should build on the following elements:

**Broadband's status –** a recognition of broadband as increasingly essential infrastructure and an enabler for economic activity, public service and society.

**Competitive Markets –** a renewed statement in favour of competitive markets in broadband, overseen by an independent regulator, in order to drive innovation, choice and value for consumers. Wide-scale intervention to be limited to circumstances where the market is demonstrably not delivering.

**Flexibility in approach –** an acknowledgement that NGA, defined as fast high-quality access, will be delivered through a combination of digital technologies which will coexist in different parts of the country: fibre, cable, wireless and copper.

**Community involvement –** a recognition that, as part of the picture, grassroots local access networks (regional and community based) can play a relevant role in the development of NGA infrastructure and act as accelerators of national coverage through the adoption of the open-access standard. In this context, the Government might encourage developments funded by public-private partnerships to the extent that they comply with interoperability and open-access standards.

**Technological neutrality –** a recognition of the growing equivalence of wired and wireless networks, as their architectures, functionalities and performance continue to converge.

**Separation of networks and services –** an acknowledgement that open network models and access to ducts and fibre of new and existing networks can create a competitive wholesale market and encourage investment in new services.

**Availability –** a statement as to what level of service the government would like to see across the country, and what its expectations are regarding the balance between 'leadership' and 'minimum service' areas.

**The public sector's role –** a commitment to sustaining the adoption of broadband and e-processes across central and local governments.

**The wider policy context –** a commitment to seeking to further the interests of a high-speed broadband market through other policy areas such as safety and security online, regulation of services, development of standards, decisions over broadcasting, etc.

## 4.2   Launching initiatives to remove obstacles and facilitate investments in NGA nationally and locally

This review has identified ten initiatives that the government can adopt now to accelerate and facilitate progress towards NGA. The list that follows is the result of our discussions with key constituencies and of a preliminary check of their feasibility. These initiatives vary in nature and cover a wide range of areas.

Each of the initiatives is a headline suggestion, with further work and study needed before final implementation. Their expected impact will vary but, taken as a group, they can contribute to an environment that is more favourable to new investment.

The recommendations fall first of all to government. Some ask them to work closely with Ofcom, and some will require action from a range of wider stakeholders. In the first instance, it will be for government to consider the recommendations and provide a lead.

The initiatives can be clustered in three broad groups:

- create direct and indirect stimulus to the market to accelerate the investment in NGA;

- facilitate the implementation of NGA by removing some of the major uncertainties and lowering the cost of the build out;

- create the conditions to favour adoption of new investment models.

Each initiative is, hopefully, likely to contribute to more than just one of these objectives but, for clarity, they have been grouped based on what is likely to be their primary impact.

### 4.2.1  CREATE STIMULUS TO INVEST

*a) Work with Ofcom to accelerate the release of radio spectrum for mobile broadband*

Wireless standards are progressing rapidly and there is a widespread view that these networks could begin to deliver high-speed broadband connectivity within the next two to three years. This will enable mobile internet providers to add further competitive pressure to fixed operators and potentially stimulate investment in fixed networks, but also to play a part in the NGA picture itself, particularly in extending coverage to less densely populated areas.

The ability of network operators to roll out enhanced wireless services depends on the availability of suitable spectrum. Ofcom's spectrum release programme provides a major opportunity for consumers to benefit from new services. There are at least two major bands of suitable spectrum scheduled for release in the near future. These are the 2.6 GHz band, which is already clear spectrum free from other uses, and the digital dividend, which is the spectrum that will be freed up by the switchover to digital TV scheduled to take place from 2008 to 2012.

However, Ofcom's programme for spectrum release is at risk of delay due to a number of factors: litigation that has been started by some of the existing mobile operators; delays in the European Parliament over liberalisation of the GSM directive, and the possibility of new Europe-wide rules on use of the digital dividend spectrum.

Existing licence holders do, of course, have every right to challenge Ofcom's decisions, and it is understandable that they should seek to protect their sizeable existing investments and strategic priorities.

But rapid resolution of these issues is likely to accelerate the deployment of mobile broadband services and, as such, would represent one of the strongest incentives to existing fixed operators to upgrade their offer through higher speed and quality of service.

The Government and Ofcom should therefore seek a route to release available spectrum to the market as quickly as possible, avoiding additional delays. This should be regarded as one of the most efficient initiatives that could be undertaken. The Government has an important role to play, for example, in seeking early resolution of changes to the GSM Directive. The Government should pursue this actively.

### b) Mandate transparency on network capacity management policies

Ofcom have already instigated action to ensure there is greater transparency over actual performance, after criticism of some of the claims made by ISPs regarding their 'up-to' speeds, which did not match those experienced by consumers. A published statement of policy by each service provider could have the further effect of turning the general lack of satisfaction over speed into a competitive force.

The objective of this would be twofold:

- it would create some pressure on ISPs to upgrade their existing capacity even though, as explained in Part 2.3, this is likely to be directed to backhaul in the short term;

- maybe more importantly, it might help providers and consumers to value (and price) differences in quality of service. Some ISPs might opt to offer lower prices, but with constraints in capacity for certain applications or in 'peak time'; others might guarantee higher capacity but charge a premium.

A clearer and more transparent communication on effective available speeds should also raise awareness regarding this aspect and favour players who undertake early investment in NGA. As such, it might act as catalyst for further investments.

In the ongoing negotiation of revisions to the EU Regulatory Framework, a power to require transparency of traffic-shaping policies is being proposed. This report recommends that the Government supports its inclusion in the revised Framework, which Ofcom could then implement in due course.

### c) Support an agreed minimum specification for new build NGA

The government has announced ambitious plans for 3 million homes to be built in the UK by 2020. This will include many major developments and therefore major opportunities for more innovation in connectivity. New-build NGA will only have a limited effect on the overall market, but could act as a testing ground for people's use of the technology, provide lessons for installation and network design, flush out regulatory issues, and build momentum for consumer demand.

There are some signs that home builders are looking to embed NGA in their plans for new developments. However, it would be a missed opportunity if all new developments over a certain size were not enabled with NGA. Discussions with developers and others suggest there is still some reluctance to include NGA in plans for new homes because it is seen as a luxury rather than an essential utility, and because the costs are expected to fall on the developer.

There already exists government guidance on duct access for new build, which is a useful start in giving a steer to home builders, but there exists an opportunity to support them in developing an agreed blueprint to provide new accommodation with a high minimum standard of connectivity. Such a specification would:

- raise awareness of NGA in the minds of the construction industry and potentially home buyers;

- facilitate the construction of homes that are wired for NGA; and

- help NGA connectivity begin to emerge as a valuation criterion for homes, which would help businesses and consumers to begin to attribute a tangible value to NGA.

Whilst the direct impact would only be felt a over long period of time, it would help raise NGA's profile and further signal the government's interest in its development.

Government and industry should therefore take forward a programme of work to introduce a Publicly Available Specification (PAS) for connectivity. This could be developed by a cross-industry group with support from the British Standards Institution.

The intention of the PAS would not be to mandate a specific technology or supplier but rather to identify a minimum standard of connectivity which could be fulfilled in a number of ways.

### 4.2.2 FACILITATE THE IMPLEMENTATION OF NGA BY REMOVING UNCERTAINTIES AND LOWERING THE COST OF THE BUILD-OUT

The Government and Ofcom should, in their respective roles, remove uncertainties and support deployment of NGA. There are three main areas to consider:

- Regulation;

- Barriers to cost-effective deployment;

- Tax/business rates.

## Regulation – Ofcom

### a) Identify a specific implementation path

As mentioned above, the transition to NGA will be a complex and difficult one. Ofcom has over the last few months completed a thorough consultation process that has produced, among other things, a list of the major criteria and principles that will inform regulation of NGA.

In the next phase of work Ofcom needs to take an active leadership role in the definition of an implementation roadmap. Ofcom has already played a similar role when, in the context of the Telecoms Strategic Review, a workable regime for competition and ways of working in the local loop was implemented. It is now time to extend that same approach to the definition of a path to NGA.

Today's task will be a more complex one, as it entails a larger number of issues to be resolved and can only, to a limited degree, rely on the experience of other countries (although evidence from The Netherlands suggests that a clear way forward can be identified with the right attitude from market players – including, of course, the incumbent – and regulator).

Based on the evidence gathered during this review it has been possible to establish a preliminary list of the issues that will have to be addressed and resolved:

- The circumstances in which a 'switch-over' might be achieved, in other words, the time at which BT might be able to withdraw its LLU product in favour of an all-NGA provision in a locality, and the process by which this would be done. This has implications both for consumers and the companies who have invested in LLU.

- Definition of appropriate passive remedies[12] and the circumstances in which they are likely to be applied, including the relevance of duct sharing, dark fibre, and sub-loop unbundling.

- Definition of wholesale products such as Active Line Access[13] and exploration of the extent to which these provide for innovation and service differentiation.

- The IP interconnect regime. As part of the shift away from a conventional system of interconnect and termination rates, there will need to be a re-examination of how the flow of data between all-IP networks is accounted for, including over wireless networks.

- Likely approach to future definition of markets and, in particular, whether there will remain a focus on national markets or a greater focus on different markets in different localities.

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12  i.e. allowing an operator access to a part of an incumbent's network without an 'active' component, so that the operator can use that infrastructure to provide its own service.

13  Ofcom has suggested that ALA could form the basis of competition and differentiation via an 'active' remedy (i.e. one in which the operator takes a product from the incumbent which provides a service over the incumbent's infrastructure).

- Definition of rules for in-building wiring. Unlike current generation access, NGA requires additional work in the home to ensure that wiring (or in-building wireless installation) is sufficient to support the services delivered by the access network.

- Adjustment of existing requirements in their application to NGA. Some existing regulatory requirements, both on BT and other providers, could unduly increase the cost of roll-out unless adjusted to reflect the technology change from the public-switched telephone network to NGA. In particular concerns have been raised over the requirement for continuous power supply for emergency calls, and certain regulatory requirements on BT to offer products to competitors.

- The future of the Universal Service Obligation (USO). The Government and Ofcom should make sure that as USO policy evolves, they avoid the dangers of either diverting resources away from NGA development, or creating perception of a hazard in the eyes of investors that if they provide a service to some areas they will be forced to do so to the entire country.

Other issues will no doubt be added. Ofcom and industry therefore have at least two distinct tasks:

*i) working through the regulations*

Ofcom has a first opportunity to outline its approach and intentions through its statement on regulation of NGA. This will, hopefully, clear up some uncertainties and signal a clear way forward on some issues. However, even with an Ofcom statement based on a thorough consultation, it is likely that the regulatory path to NGA will not be cleared without the full participation of industry.

Ofcom has a crucial role to play in this process in bringing participants together, driving forward the debate and injecting pragmatism. As in the case of the strategic review, the final outcome will need to be a comprehensive package of measures with which all sides can claim roughly equal satisfaction. While of course bound by its statutory remit, Ofcom will need to play a big part in bringing that 'deal' about.

In some instances the issues mentioned above could be resolved through a series of bilateral agreements between industry participants. But even in these circumstances Ofcom should actively monitor some aspects including:

- Timing – to minimise the risk that one or two specific agreements might delay progress for the whole industry;

- Compliance – to ensure that all agreements are consistent with the overall regulatory framework that Ofcom will define for the migration to, and competition in, NGA.

Ofcom recognises the need for this new phase and has held an initial discussion with industry players. This is to be welcomed.

*ii) establishing new ways of working*

In several discussions with BT, Openreach and all main LLU competitors, many have raised the need for an ongoing process to address the many issues that migration to NGA poses. As highlighted in the first part of this document, the industry is entering a new territory, with new technology, a new industry structure based on reduced vertical integration, and new means of providing consumers with choice and value.

This calls for a higher level of sharing and cooperation among industry participants. This should alter the dynamics of competition but would reduce the level of uncertainty and risk that is currently perceived.

This could follow the template of Ofcom's Strategic Review of Telecoms when the creation of the OTA (Office of the Adjudicator) significantly helped the industry in agreeing and implementing new processes.

## Lower cost of deployment – Government

**b) Lower cost of civil works through a better coordination of streetworks**

As described in Part 1, most of this cost of roll-out is likely to be in the civils component, i.e. the physical installation of lines and equipment.

This suggests that the greatest scope to reduce the costs of roll-out would come from any measures that could reduce the cost of streetworks. The Department for Transport has estimated some 1.2 million utility-related streetworks per year, of which around 20% are telecoms related. Other estimates suggest the total number of openings might be twice that.

These two facts point to the value (in terms of reduced cost) of shared works. Evidence gathered during this review, though, suggests that wide-scale sharing of streetworks, despite some welcome examples and recent steps to encourage better coordination, is not happening. This might be for reasons of planned works not coinciding conveniently, reticence to share plans, simple lack of adequate coordinating systems, use of new replacement technologies, or the performance of local authorities in facilitating sharing. This is a complex area, but there is scope to do much more, which might also contribute to other government objectives in minimising disruption.

The government should work with statutory undertakers and highways authorities to arrive at a solution whereby coordination of works is expected to be the norm. Primarily, this should be carried out through application of the recently-amended regulatory framework, and work with all involved to encourage them to assume a constructive attitude, but the Government should act if results are not forthcoming.

There are two reasons for this. First, roll-out of NGA will be the first major telecoms network deployment in a generation, and the regulatory framework for streetworks has not yet been tested in this regard. Second, while the regulations need time to demonstrate results, we cannot afford to wait for the next review of streetworks policy to ensure results are achieved.

Action therefore needs to be taken by three sides:

- central government should ensure all regulation is suitable and appropriate to a wide-scale roll-out of NGA;

- local government highways authorities should assume a constructive role in working with utilities to ensure forward plans are developed and opportunities for coordinating utilities work with local authority work are maximised; and

- utility companies should establish proper structures for coordination. Where large-scale replacement works are underway, such as those currently being undertaken by gas and water companies, more should be done to build on existing coordination plans such as the Advance Planning Forum being managed by the National Joint Utilities Group.

### c) Relax constraints on overhead deployment of telecoms lines

A further measure to reduce costs would be to allow overhead deployment. In other countries (notably Japan and the US), at least some of the fibre 'drop' between exchange and home is flown overhead, thus making roll-out more cost-effective. Cisco's study for the review has suggested the saving might be as much as 50%.

In the UK telecoms operators have, since liberalisation, been required by the Communications Code to place lines underground for reasons of visual amenity. However, where BT or Kingston have already deployed overhead they have been allowed to maintain these poles and lines. This is understood to amount to something like 50% of Openreach's 'final drop'.

The arguments against overhead deployment are understandable: unsightly poles and a profusion of overhead wires can detract from an area's attractiveness. For rural areas in particular, overhead deployment can make the case for investment much stronger. While there will be issues around the environmental impact of such installations, those in the countryside who want better broadband provision will need to balance the impact of new poles against the benefits of improved services. Thus, whilst some environmental lobbies would find increased overhead

deployment objectionable, there also exists a rural lobby which campaigns for equality of access across the country. This recommendation is likely to be regarded favourably by the latter, given that the business case for these areas might become more compelling through a cheaper deployment regime.

The government should therefore amend the regulations in the Communications Code to allow, subject to appropriate local consultation and sensitive siting, overhead deployment of lines where necessary to deliver high-speed broadband – subject to certain constraints in sensitive areas such as designated landscapes and Conservation Areas. In parallel, Ofcom should consider requirements on BT and Kingston to provide access to existing poles for competitive providers.

### d) Address barriers to alternative ducting methods

In some other countries, notably France, the ability of competitors to deploy fibre through the incumbent's ducts is seen as an important part in lowering costs of deployment and encouraging competition. Ofcom announced, on 16 April 2008, a survey to determine the potential availability of access to Openreach's ducts. Ofcom should ensure that the feasibility of this possibility is properly explored as a first step before considering any necessary regulatory measures.

Additionally, as we have already seen, there exist developments by which some network operators are seeking to deploy NGA through alternative ducting methods and, in particular, through the sewer network. Such methods could have an important part to play in the overall pattern of deployment for the UK. However, it is possible that there might be barriers to further adoption due to regulations (related to safety, or possibly economic regulation of the water companies) or lack of clarity over the application of those regulations.

Also in April 2008, Ofcom announced that, building on their work looking at use of BT's ducts, they would seek to explore issues related to the use of other utilities' networks. This work should be carried out in consultation with the Government, utilities and other regulators to ensure that maximum use is made of the potential for lower-cost roll-out. The government might also have a role in encouraging industry to develop and adopt new techniques for 'minimal dig' installations.

## Tax

### e) Provide clarity over application of business rates to fibre

The issue of application of non-domestic rates to NGA networks can have two distinct effects. First, it can add to the cost of deployment for owner-occupiers and act as a drag on investment, although this is arguably true of any tax on property. Evidence from rates holidays in enterprise zones suggests that rates may not have any impact on prices paid by the end user of a property. A second effect might be that the lack of clear guidance around the application of rates

to new networks or infrastructure leads to an additional layer of uncertainty for investors.

The recommendation of this review is that the government should look to address the second of these through clearer statements of principles and worked examples that can provide investors with more clarity as to their liability if they were to invest in fixed and wireless NGA networks. This could be helped by the Valuation Office Agency (VOA) providing updated and revised guidance in the light of both recent litigation and the anticipated growth of NGA networks. The industry can also take part in this process by providing the VOA with details of its new network proposals and likely development costs in a timely manner and engaging in dialogue with the VOA to discuss the valuation implications.

Additionally there have indeed been some claims that the existing rules on rating of networks (which includes the principle of a 'tone' that reduces rates burdens per Km of fibre as the number of fibres on a route increases, reflecting the decreasing marginal value of additional capacity on the route) can have a distortive effect on the market, in particular, leading to discrimination against smaller players. This is subject to ongoing litigation, and subject to the outcome of this litigation it may be appropriate for the VOA to include a further explanation of the application of this principle in their guidance.

### 4.2.3 CREATE THE CONDITIONS TO FAVOUR DEVELOPMENT OF NEW INVESTMENT MODELS

#### a) Establish a network of support for local NGA developments

The concept of local broadband initiatives has primarily been associated in this country with publicly subsidised projects aimed at deploying networks in rural areas. However, experience from other countries provides a number of models for local developments, with or without public money, also serving large conurbations.

Properly implemented, open-access networks can put the consumer in charge of the choice and blend of services. A truly open-access network sees separation of network and service, both technically and commercially, in such a way as to attract service providers and align their costs with the number of customers.

There are however a number of issues to be resolved to minimise the risk that these developments, rather than build up to a coherent national network, end up creating isolated 'islands'. A well-defined set of standards is essential: these should range from the technical aspects of interconnection and interoperability to the ones of provisioning and billing. This requires an industry-wide effort that can be justified by the potential benefits that this model has began to deliver in other countries.

An important step forward would be if local networks could present a united front in order to offer a coherent proposition to service providers with a national perspective. This would provide the beginnings of a scale market as well as a focus for commercial negotiation.

It need not take any government intervention to achieve this, but there is plainly an opportunity for an umbrella body to perform a standardising and aggregation role. The Government should support this principle as a step towards maximising the effectiveness of local networks, particularly where public money is spent. The functions of an umbrella body might be as follows:

| Umbrella function | Aggregation function |
|---|---|
| best practice sharing | product set development |
| standardisation of network design and interface | negotiation with service providers |
| representation to Ofcom, government, etc. | peering hubs |
| sourcing funding | maximisation of public value through public service delivery |

To take this forward, the Government should ask the Community Broadband Network to:

● prepare a proposal for a new umbrella body for local access network that all local networks can sign up to; and

● provide a plan for development of open access standards.

They should look to deliver this by the end of 2008.

#### b) Focus resources on open-access networks

The Government ought to consider further ways to support these developments. There is potentially some value in providing partial funding (either a small amount of capital or project management support) to field-test the concept of local networks and accelerate learning. This is where, in the first instance, central government might direct limited funds if it decides to support broadband with Exchequer money.

The Government and Ofcom have in the past expressed concern that schemes to subsidise broadband development might either waste public money, or inhibit future private sector investment, or both. They have therefore been cautious in their approach to public sector intervention and published guidance for regional and local authorities in February 2007[14]. This guidance provides a framework for local decision-makers to fully assess the wider costs of any intervention against the proposed benefits.

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14   http://www.ofcom.org.uk/media/mofaq/telecoms/pbs/dti-pbs.pdf

Such a central steer can be helpful in identifying where there is a reasonable case for public sector intervention, and structuring that support. Recognising, however, that the economics of NGA are very different, the government should update its original guidance to ensure that it remains appropriate as next-generation technologies progress. This guidance should include a statement that it is not opposed to development of NGA from heterogeneous sources – whether a countrywide investment by a single player or a multiplicity of local schemes.

The principal message should be that, when local authorities (and/or RDAs) are funding in whole or in part this type of development, in addition to complying with state-aid requirements and minimising distortion of the competitive market, the Government expects to see the scheme to comply with genuine open-access standards. The Government should make clear that this is a condition for offering its support, including resources, advice and, where appropriate, release of funds.

Where these developments are entirely funded by private money, the Government and Ofcom should explore the possibility of introducing a 'must carry, must connect' rule, whereby the local network cannot reasonably refuse to carry the service of any service provider; and service providers cannot reasonably refuse to make their service available through the local network, provided it complies with the defined open-access standard.

## 4.3  Benchmarking progress towards NGA deployment

The initiatives listed in the previous section should create better conditions for an effective, pragmatic deployment of NGA. But their implementation is demanding and requires leadership and joint working with Ofcom and other partners.

In order to support their implementation and assess if the market is delivering against its plans for NGA, the Government should use this review as the starting point for a structured process to monitor progress of NGA in the UK and benchmark it against evolution in other countries. The following paragraphs outline some elements of a possible way forward.

**APPOINT A SENIOR FIGURE FOR BROADBAND**

The Government should consider naming a designated senior figure for Broadband, who would have overall responsibility for delivery of the strategy. This would send a strong signal of commitment and provide a focal point for coordination of various activities.

Stakeholders should not need to know the internal workings of government to raise issues or point to barriers to investment. They should, though, have confidence that delivery of NGA is given appropriate priority in policy-making.

The government should instigate a process by which barriers can be identified and solutions are quickly considered.

## ESTABLISH A STRUCTURED PROCESS TO MONITOR PROGRESS

The process ought to review two main areas: progress against plans in the UK and international developments in NGA.

### *Progress against plan in the UK*

The process ought to provide an assessment of how activity is developing on three main fronts:

- **Regulatory/legislation –** to keep track of how the legal and regulatory framework is evolving; how the initiatives that the Government will decide to pursue among the ones recommended by this review are being implemented; whether main uncertainties and blockages are being removed; whether further initiatives are needed to support development.

- **Evolution of supply –** to have a regular update of how key industry players (and main projects) are progressing in the implementation of their plans and how their offer is evolving. These should include fixed operators such as BT and Virgin Media; main local projects; and mobile networks.

- **Evolution of demand –** to understand consumer demand in terms of broadband usage profiles, customer satisfaction with quality of service, evolution and take-up of devices (e.g. IP-enabled TV sets), and the take-up rate of information and entertainment applications.

### *International benchmarking*

The second area to monitor should be the evolution of NGA in other markets. As we have seen in Part 2, no single metric will give the Government a definitive answer of whether the UK is decisively falling behind in deployment of NGA. It will therefore be necessary to consider a range of deployment metrics, and derive a qualitative overall assessment of what the results are telling us.

## ATTRIBUTE ROLES TO OFCOM AND BSG

The government should involve both Ofcom and the BSG in this progress.

This report has already mentioned the need for joint working with Ofcom.

The BSG has played a vital role in bringing together industry voices, undertaking research and analysis, and advising government. The BSG's ability to move the debate on and attract attention to the issues should be fully utilised.

Each of these could play a part in a structured benchmarking and tracking process. The exact details of this would need to be subject of further discussion between the main players, but some preliminary ideas for this process might be:

- Ofcom to undertake international benchmarking according to criteria agreed with government (Annex E outlines some possible categories for benchmarking);

- BSG to publish annual stakeholder report on progress; and

- the Government to register public policy issues, identify options for solutions and drive forward action to address them.

## INSTITUTE AN ANNUAL EVENT TO DISCUSS PROGRESS WITH THE FULL RANGE OF STAKEHOLDERS AND UPDATE PRIORITIES

Over the last few months the review team has observed a keen interest from all stakeholders involved in the review to access key facts and information about the development of NGA in the UK and abroad.

This was demonstrated, among other things, by the large attendance to industry events such as the recent BSG conference on NGA and the Converge meetings at BERR.

In this context, it might be helpful to consider the introduction of an annual event hosted by the Government, whose main objective would be to share and discuss the outcome of the monitoring and benchmarking process sketched out above. This might help: (a) sustain momentum in the industry; (b) reinforce commitment to broadband NGA by Government and all involved stakeholders; and (c) define a notional annual deadline to review progress and confirm priorities.

**Box 5 A possible agenda for an NGA conference to be held in the first half of 2009**

**Regulatory:**
Definition of wholesale products
Resolution of IP interconnect regime
Copper switch-over plan
In-building wiring

**Public Policy:**
Overhead deployment
Streetworks
Business rates

**Supply:**
Progress of Virgin Media upgrade
Extent of BT roll-out
Development of wireless broadband offer
Survey of actual bandwidth delivered
Evolution of ISP marketing policies
Progress of local NGA initiatives

**Demand:**
Take-up rate of broadband by speed
Evolution of customer satisfaction
Feedback on local initiatives

## 4.4 Investing time and resources to identify a contingency plan

Again, the conclusion of this review is that the UK is in a good position and that, with the right short-term actions by government and regulator, the NGA market should begin to develop. However, as we have seen, there will remain a risk that the market does not deliver. Although this risk is not great, the government should not neglect it.

The broad scenarios under which a major intervention might seem appropriate are:

- **No, or extremely limited roll-out of NGA in the UK.** This scenario is the least likely. Although we cannot absolutely rule out a failure of the market to deliver, given recent developments and market pressures identified in Part 2 it is very likely that in five years' time a substantial proportion of the UK will be covered by NGA deployment, particularly if the government and Ofcom take the right steps now.

- **Roll-out stalling at a limited proportion of homes in the UK.** A more likely scenario is that roll-out stalls at the major urban areas, covering 40-50% of the country. Again, if government and Ofcom take the right steps now, they can increase the attractiveness of investment beyond these core areas, but there will remain a danger that NGA will not be available to up to half of the country. If the Government assesses that this has a negative effect on economic development or public service delivery, it might feel that action is needed in order to broaden availability.

- **Changes to the broadband market in such a way that usage is negatively affected.** If investment is achieved in such a way that competition is affected and consumers suffer a detriment (such as higher prices with reduced choice of suppliers, leading to lower take-up or a decline in online economic activity), there might be need for a change in strategy to correct the balance.

At this stage the review does not recommend any specific initiative that should be adopted in case of market failure, but rather that Government work with Ofcom to develop appropriate contingency plans.

It is important to avoid the prospect of the market waiting for an intervention and, thereby, delaying investment by signalling a strategy is in preparation. That said, the high costs of a government intervention, and the value of what it would seek to achieve, mean that this is too important a policy discussion to postpone until it is too late. The government therefore should invest time now in planning outline strategies for intervention in the event that future benchmarking shows the UK is falling behind its competitors.

It is important in the coming years that thinking goes on to determine the right course. It should not be left to another independent review in 2012 to provide a new strategy.

# Annex A: Terms of reference

The key areas the review will consider will be:

- To consider the possible barriers to any new models of investment, involving collaboration between telecommunications suppliers and between suppliers and content providers and identify potential solutions.

- To examine whether there are opportunities to minimise the cost of private sector investment, including whether there is a public sector role in this respect, for example related to civil works.

- To examine the framework within which investment will take place to promote a more certain investment environment.

- To clarify the treatment of new infrastructure options within the non-domestic rating system.

- To examine whether the EU and UK statutory framework has given Ofcom the necessary powers to establish a regulatory regime which would provide regulatory certainty for investors and sufficiently incentivise new investment in high speed access.

In parallel, the Government will also ask the Broadband Stakeholder Group to examine the economics of fibre deployment, specifically whether deployment of fibre-to-the-premises will be viable without a first step of deploying fibre-to-the-cabinet.

In looking at these areas, the review will consider the impact of barriers on both speed and reach of likely deployment of next generation broadband. It will also take account of the current Ofcom consultation on NGA policy, which this review is intended to complement, and the ongoing work of the Broadband Stakeholder Group following their report in April 2007. Ofcom will continue to develop their proposals for regulating next generation access under the existing regulatory framework.

# Annex B: Organisations consulted by the review team

## Government and other public sector

ActNow

BERR – Department for Business Enterprise and Regulatory Reform

BSG – Broadband Stakeholder Group

CLG – Department for Communities and Local Government

CTT – Convergence Think Tank

DCMS – Department for Culture Media and Sports

DCSF – Department for Children Schools and Families

DETI N.I. – Department of Enterprise, Trade and Investment, Northern Ireland

DIUS – Department for Innovation Universities and Skills

DfT – Department for Transport

Digital Region

Gateshead Council

HMT – Her Majesty's Treasury

Manchester Digital Development Agency

NHS Choices – Department of Health

No. 10 Downing Street

Norwich Wi-Fi

Ofcom

Ofgem

Scottish Government

South West Regional Development Agency

Transport for London

UK Statistics Authority

Valuation Office Agency

Walsall Regeneration Company

Welsh Assembly Government

Westminster Council

Yorkshire Forward

## Industry

Alcatel-Lucent

Analysys Mason Consulting

Avanti Communications

AT&T

Babelgum

BBC

Bovis LendLease

Brands2Life

British Sky Broadcasting

BT

Cable & Wireless

Carphone Warehouse

CBI

Community Broadband Network

CE Electric

Channel 4

Cisco Systems

Click & Links

Commendium

Conviction Research

DC10plus government

Deutsche Telekom

EADS Astrium

EDF Energy

Enders Analysis

Energy Networks Association

Ericsson

Fastweb

Fidelity

First Mile Networks

Five

Freedom 4

Genesis Technical System

Groupe-Intellex

H2O

Hutchison 3G

Hyperlink Communications

Idate Consulting & Research

Intellect

ITV

Kangaroo

KCOM

KPN

Joost

Land Securities

Lehman Brothers

McKinsey

JP Morgan

MTM London

NBC

National Grid

New Street Research

NJUG – The National Joint Utilities Group

Norges

Nortel

Northern Gas Networks

O2

Oakleigh Ventures

Openreach

Orange

Packetfront

PCCW (Europe)

Scottish and Southern Energy

Shareband

Southern Water

South West Water

Spectrum Value Partners

SPC Network

STL Partners

T-Mobile

Telecom Italia

Tellabs

Thames Water

Thus PLC

Tiscali

Topup TV

UKBroadband

United Utilities

Virgin Media

Vodafone

VTesse

Wales & West Utilities

Western Power Distribution

WPP Group

Yahoo

Other

## Other

ADIT Northeast

AGCOM (Italian Regulator)

All Party Group Communications, House of Commons

Prof. Martin Cave

Connect

European Commission

Prof. Andy Lipmann, MIT

Ofcom Consumer Panel

OPTA (Dutch Regulator)

# Annex C: Other NGA Initiatives

The work of the review is not intended to duplicate the significant work taking place in this area, across both Government and the EU. It is important that the review is complementary to these efforts, and informs the debate for policy makers while using the output from elsewhere to best effect.

The UK communications regulator Ofcom has recently carried out two public consultations in this area. The first examined future regulatory approaches to next generation access, focusing on five key areas: contestability, maximising potential for innovation, equivalence, reflecting risk in returns and regulatory certainty. The second focused on NGA with specific regard to new build homes. Ofcom's responses to these will form the basis of Ofcom's approach in the coming years.

The Convergence Think Tank (CTT) also has an interest in this area. The CTT was established by BERR and DCMS to examine the implications of technological development for the media and communications industries, and the consequences for both markets and consumers. The CTT has identified the deployment of, and access to, high speed networks and will form a workstream to look more closely at these issues. The results of this review will inform the CTT and provide a base from which it can carry out further study.

The Department for Communities and Local Government is leading a cross-Government team looking at reducing the digital divide, and will produce a Digital Equality Strategy. As part of this, a Digital Equality Action Plan will be published. The Action Plan aims to identify clear actions and policies that will deliver greater equality in availability of digital connectivity and services across the country. Plainly, next generation access is relevant to this work, but whereas the focus of this review is to look at initial barriers to investment, the DEAP will focus more on ensuring barriers to accessing services are addressed. The scope of the DEAP is also wider than NGA alone.

Finally, the European Commission's Telecommunications Framework Review will have a large impact in this area. The Commission, member state governments and national regulatory authorities are currently reviewing the regulatory framework for the telecoms markets, which will establish the framework in which Ofcom will be able to regulate NGA. Alongside this, the Commission is planning to publish a Recommendation on the regulation of NGA by the end of the year. This too could have a significant impact on the approach taken by national regulators.

# Annex D: The application of business rates to telecoms networks

National Non-Domestic Rates (NNDR or business rates) is a widely applied tax on the occupation of property. Since 1990 the tax base has been revalued every five years, and the rate of tax increased between revaluations in line with RPI. At revaluation the rate of tax is rebased against the updated total rateable value.

In addition to buildings, networks such as: pipelines, electricity, gas, water and railways, for example, together with associated land and plant and machinery (rateable plant and machinery is defined by Regulations) are all subject to non-domestic rates. Telecoms infrastructure is within the scope of business rates, and cables, fibre, exchanges and relevant plant and machinery has been taxed based on 'rateable value' (akin to rent payable on a set date) for many years. The unit of taxation is the 'hereditament', each of which is valued based on either the actual rent that is paid or a comparison with rents paid for equivalent properties. In the case of BT, the entire network estate is treated as one hereditament in England and one in Wales and is managed on a central list of companies and networks (mainly Utilities and Railway companies) whose properties exist across large parts of the country and therefore cannot be managed within individual local authorities.

If rental and comparable rental data sources are not available, the valuation is normally agreed based on either an assessment of receipts and expenditure (the 'R & E basis') or on the decapitalised cost (the 'Contractor's Basis'). These alternative valuation methods have been well established by case law. However, and potentially importantly in the context of the future rating of new telecoms networks, Virgin Media's cable TV networks are rated according to the number of homes passed. The current 2005 list valuations are subject to appeals, but at the time of the initial investment the valuations were based on a decapitalised cost to which were attached substantial allowances to reflect , low penetration and lack of profits during the development phase. Subsequently receipts from subscribers were used to ensure that the valuations were sustainable and reasonable.

Normally the liability for rates lies with the occupier of the hereditament, usually the tenant or owner/occupier. An important exception to this is the rating of BT's many millions of local telecoms loops that have been unbundled in recent years. In this case the owner of the local loop, BT – is liable for the rates bill by regulation as part of its overall network hereditament and recovers this cost as part of the charge made for access to the local loop. The complex issue of rating of unbundled local loops has been subject to Government consultation.

Source: VOA

# Annex E: Suggested benchmarking criteria

| Category | Quantitative metrics | Qualitative research |
|---|---|---|
| **Market context and impacts** | Size of fixed and mobile telecoms markets by revenue, revenue per fixed line/mobile subscriber, etc.<br><br>Fixed telecoms spend as a percentage of GDP, capital expenditure per line by fixed and mobile operators, and incumbent revenue per employee. | Specific research in countries where NGA has been deployed early to assess whether any improvements in these areas have occurred which can be causally linked to the availability of NGA.<br><br>Specific consideration of cutting edge public service delivery models, and the effects of NGA on these. |
| **Consumer outcomes** | Overall consumer satisfaction with current generation broadband products.<br><br>Actual, achieved broadband speeds.<br><br>Bundle/profile-based price comparisons. | Willingness to pay for NGA-enabled services. |

| Category | Quantitative metrics | Qualitative research |
|---|---|---|
| **Device, platform and application take-up** | High definition TV: Take-up of services on DSat, DigiCable, DTT (when available) and IPTV. Current generation 3G HSDPA wireless broadband. Next generation wireless broadband (e.g. LTE). ADSL2+ Docsis 3.0 cable. Fibre new build. Other NGA, such as fibre in sewers. USB-enabled DTT receiving devices and other computing devices. Wireless dongles. Take-up of specific applications and services e.g. iPlayer, online gaming. | Research on internet use. |
| **NGA experience** | NGA availability as % of households [nationally and broken down by region and if possible rural/ urban]. NGA take-up, with splits on the same basis. Marketing, pricing and offers. Consumer satisfaction. | Consumer understanding and perceptions. |
| **NGA market competitiveness** | Market shares retail and wholesale, including share of alternative infrastructure providers such as cable. Progress in developing wholesale offerings. Relative take-up of different types of wholesale offerings (e.g. sub-loop unbundling, duct access, 'bitstream-type' remedies). | |

# Annex F: Supporting evidence charts and tables

## Figure 1 UK statistics: DSL and modem take-up, 2001-2004
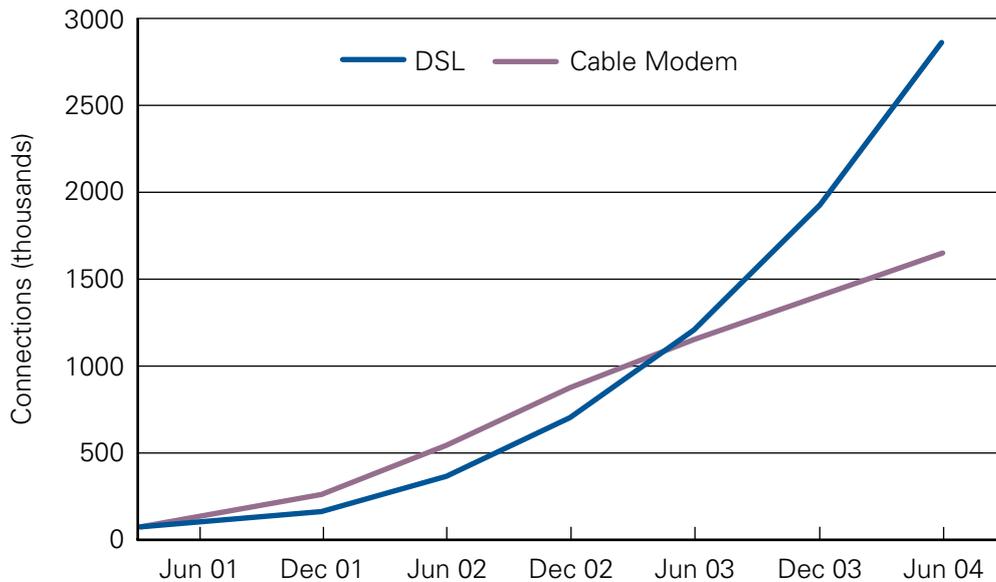


Source: Ofcom/operators

## Figure 2 Broadband penetration across the G7
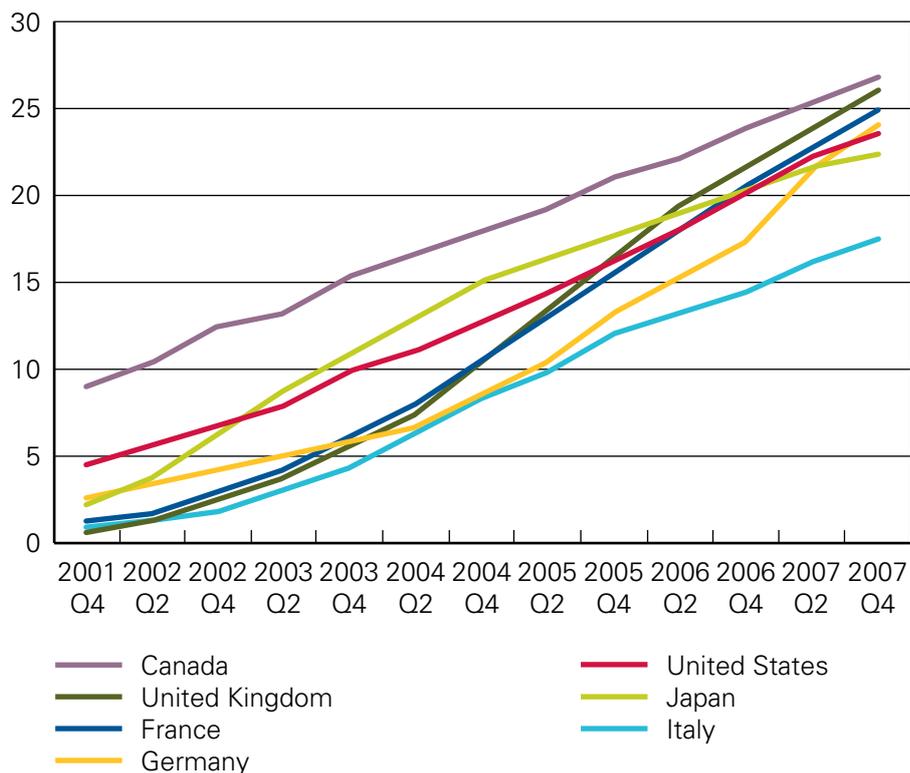


Source: OECD

## Figure 3 Broadband growth in the UK – estimate to 2012



- Total broadband
- Consumer broadband
- Business broadband
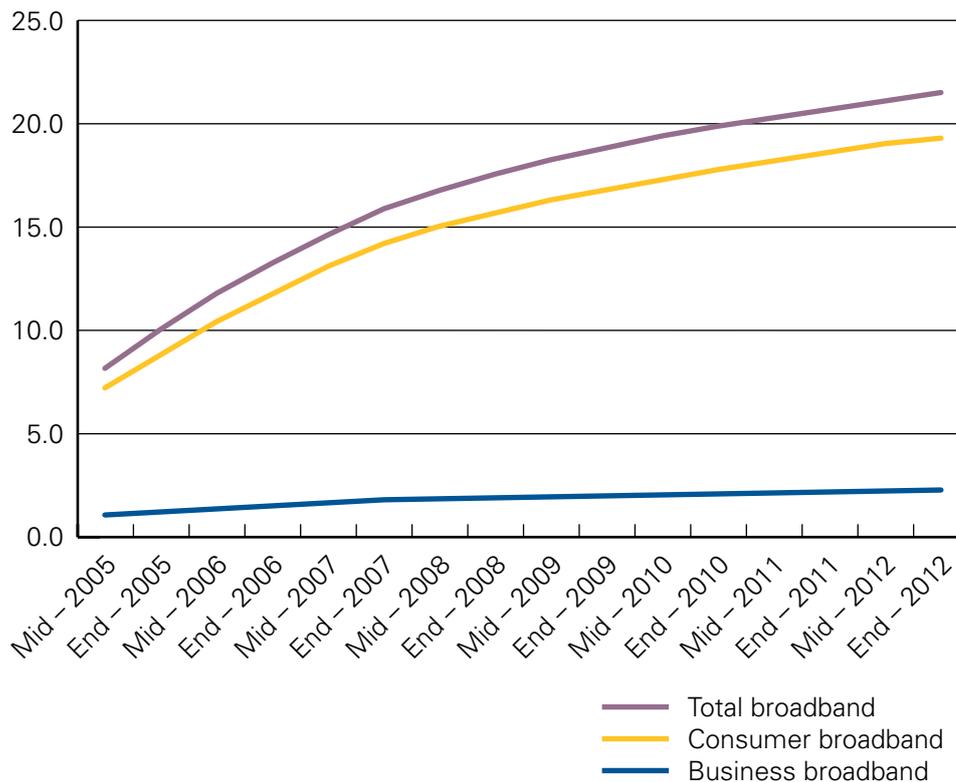
Source: Point Topic for BSG

## Figure 4 Percentage of homes covered by DSL, G7 countries
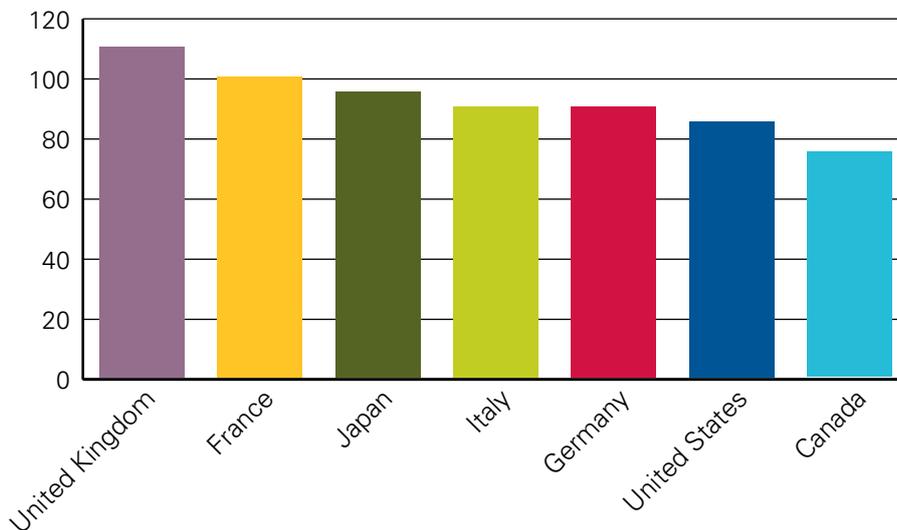


Source: OECD

## Figure 5 UK ISP market share trends
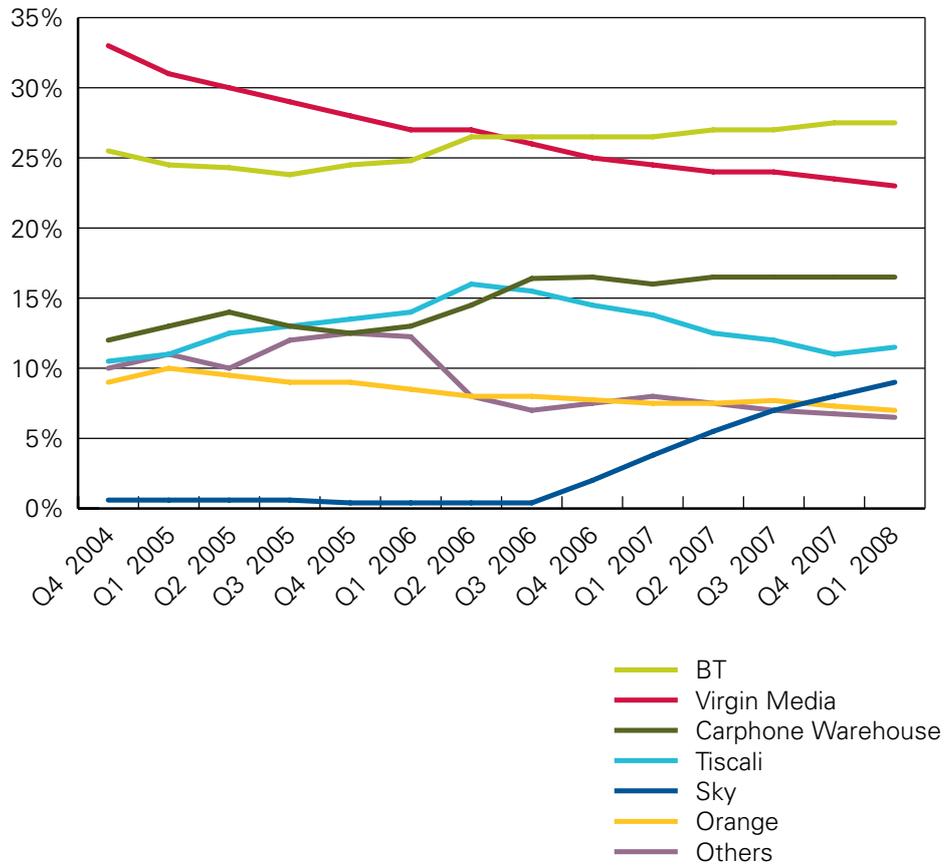


Source: OECD

## Figure 6 Total LLU lines
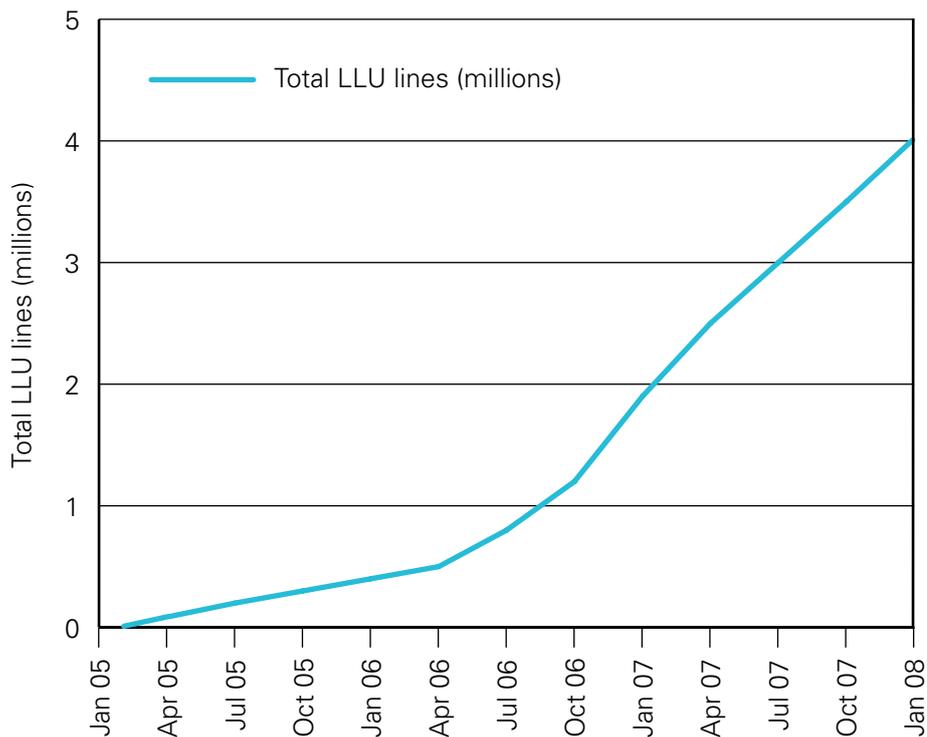


Source: Point Topic for BSG

## Figure 7 LLU present and future activity

| | Unbundled customers | % of total customers | Exchanges unbundled | % of population covered | Publicly stated targets |
|---|---|---|---|---|---|
| Carphone Warehouse/ AOL | 1,598,000 | 61.4% | 1,625* Full 1,049* Partial | c. 72% | 1,650 Full LLU exchanges by March 2008 |
| Sky/Easynet | c. 1,085,000 | 90.5% | 1,179* | | 1,200 exchanges by end June 2007 |
| Tiscali (incl. Pipex) | 640,000 | 35.0% | 818 Tiscali LLU* 760 Full LLU 630 Tiscali TV | 55% | 740 IPTV exchanges by 2008 1,000 LLU exchanges by 2008 1,100 LLU exchanges by 2009 |
| Orange | 344,000 | 30.2% | 506 (22nd March) | 40% | Uncertain |
| O2/Be Unlimited | 71,000 | 100% | 992* | 52% | 833 exchanges by mid 2007 |
| Cable and Wireless | Agreements with Virgin Media and Pipex | | 802 | 55% | Roll-out complete |

According to www.samknows.com on 03/04/06
Data at 31st December unless stated

Source: Enders Analysis

## Figure 8 Indicative standalone broadband prices
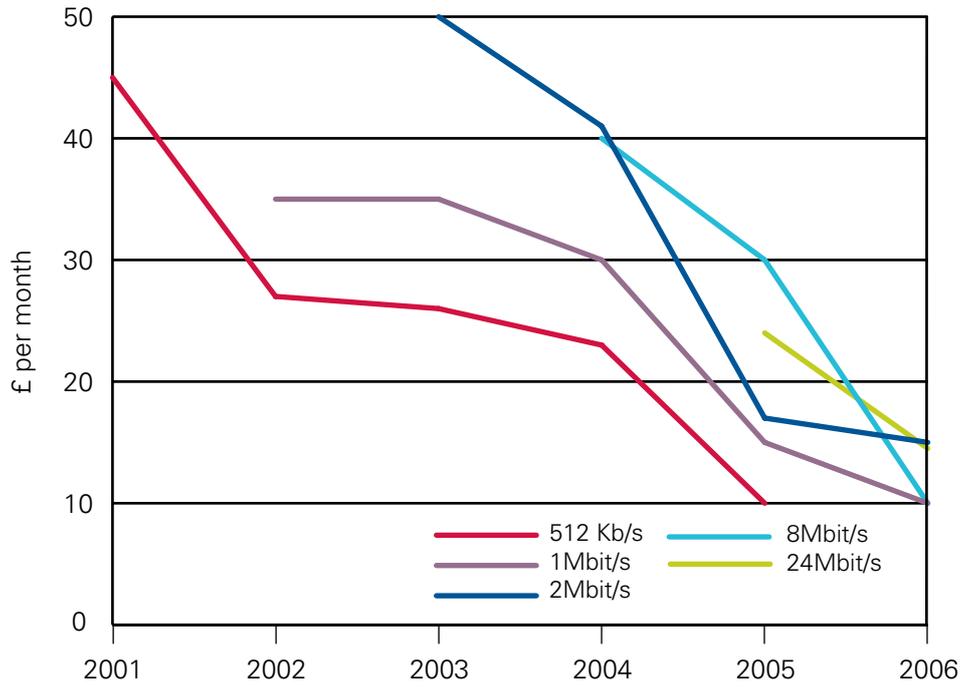


Source: Ofcom

## Figure 9 World statistics



Cable Modem **21.66%**
FTTx **11.45%**
Other **2.16%**
DSL **64.74%**
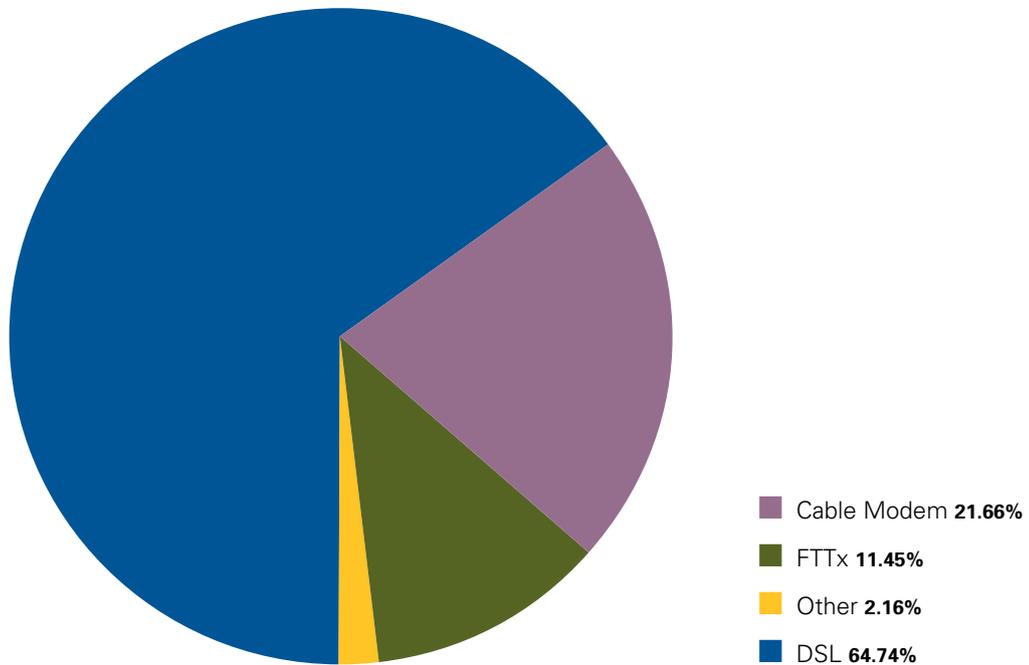
Source: Ofcom

## Figure 10 Reach of DSL broadband
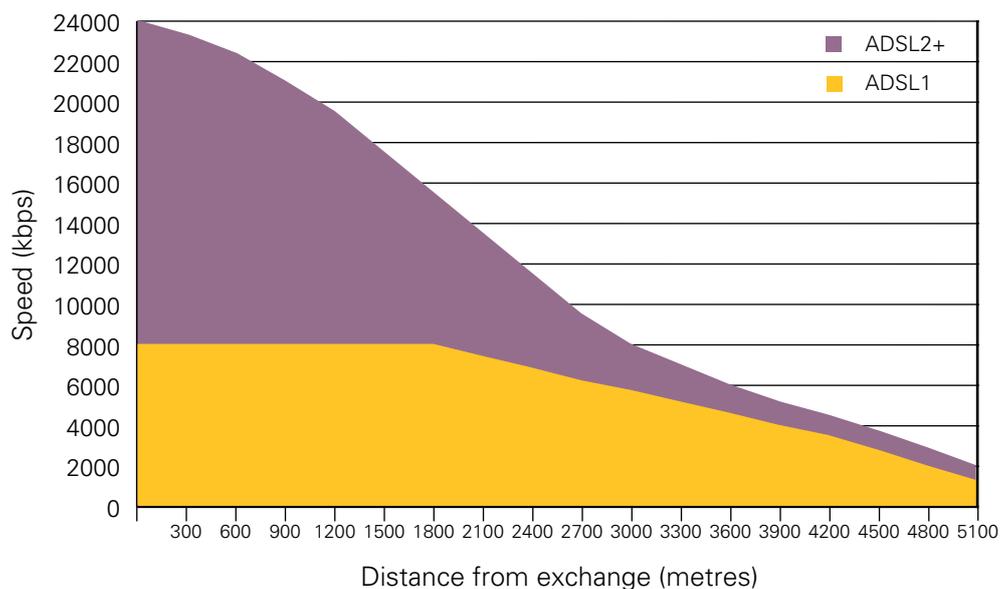


Source: Ofcom

## Figure 11 Streetworks in 2007 & 2008

| | England (exc. London) | London | Wales | England + Wales total for all authorities |
|---|---|---|---|---|
| 2007 | 14,288 | 11,769 | 5,509 | 2,152,695 |
| 2008 | 16,548 | 13,220 | 4,978 | 2,448,796 |

Source: ALARM study

# Annex G: Development of NGA around the world

A simple tour of different countries provides more detail on the drivers of roll-out.

## Japan

The Japanese broadband market was built upon a strong platform of competition following the split of NTT East and West and the unbundling of the local loop. The two NTT businesses hold a combined market share of around 45%, up from around 32% in 2004, in part attributable to their investment in fibre access without a requirement to unbundle. Since 2005, Japan has seen more new FTTH/B subscribers than DSL subscribers, with 800,000 adding a quarter, and more than 10m in total. FTTH now accounts for 38% of the total broadband market.[15] The government has set a target of 30m subscribers by 2010, although at current rates of growth this will prove very challenging.

The government is now reported to be examining the potential for establishing unbundling in fibre last mile access in densely populated areas (from Japan Telecom, KDDI and PoweredCom, albeit mostly targeted at business customers).

The government through its u-Japan broadband strategy, provides money for cities to wire schools and community centres, provides zero-interest or low-interest loans for cities and businesses to deploy broadband, and provides tax breaks for the purchase of networking equipment. The Universal Service requirements on the NTTs are currently provided for by charging all subscribers. There are though proposals to allow the NTTs to cover remote areas through wireless.[16]

## Korea

In Korea, often cited as the world leaders in broadband, the government has taken an active role in investing in infrastructure. The Government sought to offset costs of upgrading the access network by funding its own backbone network connecting government departments, on which SPs can rent capacity[17]. It has additionally funded R&D for $700m and provided low interest loans of around £1bn, mostly targeted at access networks in remote areas.

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15   Source IDATE
16   Source on strategy Global Insight
17   At a cost of US$25.3 bn (source McKinsey)

Additionally, the Korean government provided low interest loans to Service Providers, initially for urban roll-out and then increasingly to facilitate roll-out in remote areas. By contrast with Japan, the strategy has not been built upon local loop unbundling, which is not a major feature of the market, but low barriers to market entry and a relaxed licensing structure have provided for a number of competitors.

## France

In France[18], fibre deployment is happening as result of fierce competition in current generation broadband services, brought about principally by the introduction of a rigorously-enforced local loop unbundling regime in the early part of this decade. A number of companies responded to this regulatory development by entering the market to offer bundled broadband packages including VoIP, IPTV and a home gateway to provide in home-connectivity between different devices such as TVs and PCs.

An entrepreneurial startup firm, Iliad (ILD.PA), which offers broadband services under the name Free, launched DSL service in October 2002, and now has over 2.5 million subscribers, all of whom use VoIP and get 90 channels of IPTV through the company's Freebox offering. This service is offered for a monthly subscription of €29.99, a price point that has stayed the same throughout the period since launch although the offering itself has expanded very substantially during that time.

Iliad, and fellow new entrant Neuf Cegetel, have subsequently moved to replace their leased copper loops with self-provided fibre connections. This is particularly attractive in larger urban conurbations in France where population density is generally high, most people living in apartment blocks, and per customer costs of upgrading to fibre hence relatively low.

Iliad is planning to deploy fibre in Paris (although this may be delayed pending resolution of some regulatory issues). The City has provided low cost access to the sewers. The solution – a point-to-point fibre-to-the-home architecture – might be rolled out in other major French cities. The overall cost is estimated to be around EUR 1bn. At the end of 2007, Iliad had passed 240,000 homes with fibre.

The operator Neuf is also offering FTTH in Paris (point-to-point) and a GPON offering in other cities, and reported 17,000 customers by the end of 2007. It plans to spend EUR 300m to pass 1m homes, and by end 2007 was reported to have passed 120,000.

18  French details draw on http://lw.pennnet.com/display_article/321309/63/ARTCL/none/none/1/France-Telecom-plans-massive-FTTH-roll-out-in-2009/; figures for rollout and homes passed from IDATE

This competition has prompted France Telecom into deploying fibre, on a GPON basis, with a major roll-out planned for 2009. By the end of 2008, France Telecom plans to have 1 million homes passed and 150,000 homes connected (by end 2007 it was reported to have passed 146,000). The French regulator ARCEP is also active in securing access to France Telecom's duct space for its competitors, including by undertaking an audit of FT's ducts to establish whether there is space for additional fibre. ARCEP has now stated its intention to mandate access to FT's ducts.

Actual numbers of subscribers to fibre products in France remain reasonably low – less than 50,000 in total.

## Italy

One of the most striking scale deployments of fibre in Europe is that of Fastweb, a Milan-based new entrant which, IDATE estimates, had passed more than 2m homes with fibre connections by the end of the 2007. Its original operations involved building a new, overlay fibre network in municipal ducts, initially in Milan and subsequently extending to other northern Italian cities. The Milan municipality was an original partner in the Fastweb consortium, and subsequently the infrastructure and civil works were split off into a separate entity, Metroweb, in which the City of Milan retained a controlling interest up to a sale to private equity investors in 2007.

In contrast to the French experience, Fastweb did not enter the market as an unbundler and then upgrade to providing its own fibre connections, but the exact opposite – with the availability since 2004 of a fit for purpose LLU product in Italy, Fastweb's business expansion has been increasingly based on selling LLU-based DSL services, and of its circa 1m customers, only around a quarter are believed to be using fibre-based products.

Nonetheless, the competitive pressure from Fastweb has prompted a competitive response from the incumbent Telecom Italia, which in 2007 announced a plan to upgrade its network using principally FTTC technology, with an initial target of making the new platform available to around 5% of Italian households by the end of 2009, and a target to cover 65% of the population within 10 years.[19]

In Italy too the regulator has required the incumbent to open its civil access infrastructure to competitors.

## Germany

In Germany[20], Deutsche Telekom has been engaged in a debate over regulatory forbearance. In 2005 it announced a strategy to deploy FTTC and VDSL in

19   Source: http://www.telecomsitaly.com/2007/03/telecom_italias_ngn2_ultrabroa.html

20   Information on Germany drawn from Analysys (see http://www.analysys.com/pdfs/FTTx_product_pack.pdf) and McKinsey

Germany's 50 largest cities covering 10.6m households at a cost of EUR3bn. The German regulator BNetzA has removed the obligation on DT to unbundle fibre, but has proposed new obligations to share ducting. The European Commission has reacted to this by launching a legal challenge. The resultant uncertainty has led to DT scaling back its investment plans. The regulator has, meanwhile, required DT to provide access to fibre ducting and dark fibre.

## Sweden

Sweden has one of the highest rates of broadband penetration in the world, based on a highly diverse and competitive market featuring incumbent DSL offerings, alternative operators using LLU and bitstream access and cable broadband offerings.

The Swedish market has the highest total number of fibre subscribers of any EU country, estimated as around 300,000 by IDATE at the end of 2007. The European Commission's 13th Implementation Report puts the number of fibre connections higher, at 475,000 in total as of January 2008[21].

Much of this high rate of fibre connections in Sweden can be attributed to the existence of municipal fibre schemes. The Commission notes that 150 such companies or schemes are currently in existence, but also highlighted concerns of the Swedish regulator, PTS, that there was no consistent business model in these schemes and less than half offered wholesale access to third party providers, thus reducing the scope for effective competition.

## USA

The US currently has two providers rolling out different technological solutions: Verizon are deploying their FiOS service over FTTH; while AT&T are rolling out their U-serve service over FTTC. Verizon aims to pass 18m homes by 2010 as part of a $23bn deployment, while AT&T plan to reach 18m homes by the end of 2008, at an estimated cost of $6bn.[22]

The main rationale for the deployment of these fibre networks is the competitive pressure created by the presence of the cable network. Competition in the provision of TV services within individual states increased the pressure on copper network operators and increased the need to build out fibre closer to the home.[23] Roll-out has been aided by regulatory forbearance, as the regulator decided the competition between fibre and cable networks was sufficient that mandating wholesale access on the fibre network was not required.

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21   http://ec.europa.eu/information_society/policy/ecomm/doc/library/annualreports/13th/SEC(200)356DTSVol1final.pdf

22   http://online.wsj.com/article/SB117856112849694724-search.html?KEYWORDS=AT%26T&COLLECTION=wsjie/6month

23   For a fuller discussion of evidence from the US, see Appendix C, pp 99-103, in 'A Framework for Evaluating the Value of Next Generation Broadband', Broadband Stakeholder Group, June 2008.

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# Annex I: Glossary

**3G –** Third generation of mobile systems. Provides high-speed data transmission and supports multimedia applications such as full-motion video, video-conferencing and internet access, alongside conventional voice services.

**Access network –** Electronic Communications Network which connects end-users to a service provider; running from the end-user's premise to a Local Access Node and supporting the provision of access based services. It is sometimes referred to as the local loop or last mile.

**ADSL –** Asymmetric Digital Subscriber Line. A digital technology that allows the use of a standard telephone line to provide high-speed data communications. Allows higher speeds in one direction (towards the customer) than the other.

**Broadband –** A service or connection generally defined as being 'always on' and providing a bandwidth greater than narrowband.

**Contention ratio –** An indication of the number of customers who share the capacity available in an ISP's broadband network. Figures of 50:1 for residential broadband connections and 20:1 for business are typical).

**CPS –** Carrier Pre-selection. The facility offered to customers, which allows them to opt for certain defined classes of call to be carried by an operator that has been selected in advance and has a contract with the customer. CPS does not require the customer to dial a routing prefix or use a dialler box.

**Digital switchover –** The process of switching over the current analogue television broadcasting system to digital, as well as ensuring that people have adapted or upgraded their televisions and recording equipment to receive digital TV.

**Dongle –** A physical device, attached to a PC's USB port, which adds hardware capabilities.

**DSL –** Digital Subscriber Line. A family of technologies generally referred to as DSL, or xDSL, capable of transforming ordinary phone lines (also known as 'twisted copper pairs') into highspeed digital lines, capable of supporting advanced services such as fast Internet access and video-on-demand. ADSL, HDSL (high data rate digital subscriber line) and VDSL (very high data rate digital subscriber line) are all variants of xDSL).

**DTT –** Digital Terrestrial Television, currently most commonly delivered through the Freeview service.

**DVR –** Digital Video Recorder (also known as Personal Video Recorder and Digital Television Recorder). A digital TV set-top box including a hard disk drive which allows the user to record, pause and rewind live TV.

**FTTC (Fibre-to-the-cabinet) –** Access network consisting of optical fibre extending from the access node to the street cabinet. The street cabinet is usually located only a few hundred metres from the subscriber premises. The remaining segment of the access network from the cabinet to the customer is usually a copper pair but could use another technology, such as wireless.

**FTTH (Fibre-to-the-home) –** A form of fibre optic communication delivery in which the optical signal reaches the end user's living or office space.

**FTTB (Fibre-to-the-building) –** A form of fibre-optic communication delivery in which an optical fibre is run directly onto the customers' premises.

**GSM –** Global Standard for Mobile Telephony, the standard used for 2G mobile systems.

**HDTV –** High-Definition Television. A technology that provides viewers with better quality, high-resolution pictures.

**Headline connection speed –** The theoretical maximum data speed that can be achieved by a given broadband. A number of factors, such as the quality and length of the physical line from the exchange to the customer, mean that a given customer may not experience this headline speed in practice.

**HSPA –** Jointly, downlink and uplink mobile broadband technologies are referred to as HSPA (High Speed Packet Access) services.

**Internet –** A global network of networks, using a common set of standards (e.g. the Internet Protocol), accessed by users with a computer via a service provider.

**IP (Internet Protocol) –** The packet data protocol used for routing and carriage of messages across the Internet and similar networks.

**IPTV –** Internet Protocol Television. The term used for television and/or video signals that are delivered to subscribers or viewers using Internet Protocol (IP), the technology that is also used to access the Internet. Typically used in the context of streamed linear and on-demand content, but also sometimes for downloaded video clips.

**ISP –** Internet Service Provider. A company that provides access to the internet.

**LAN (Local area network) –** A network for communication between computers covering a local area, like a home or an office.

**Leased Line –** A transmission facility which is leased by an end user from a public carrier, and which is dedicated to that user's traffic.

**LLU (Local Loop Unbundling) –** LLU is the process where the incumbent operators (in the UK it is BT and Kingston Communications) make their local network (the lines that run from customers premises to the telephone exchange) available to other communications providers. The process requires the competitor to deploy its own equipment in the incumbent's local exchange and to establish a backhaul connection between this equipment and its core network.

**Local Loop –** The access network connection between the customer's premises and the local PSTN exchange, usually a loop comprised of two copper wires.

**LTE –** (Long Term Evolution). Part of the development of 4G mobile systems that started with 2G and 3G networks.

**Mobile Broadband –** Various types of wireless high-speed internet access through a portable modem, telephone or other device.

**Multichannel –** In the UK, this refers to the provision or receipt of television services other than the main five channels (BBC ONE & TWO, ITV1, Channel 4/ S4C, Five) plus local analogue services. 'Multichannel homes' comprise all those with digital terrestrial TV, satellite TV, digital cable or analogue cable, or TV over broadband. Also used as a noun to refer to a channel only available on digital platforms (or analogue cable).

**Narrowband –** A service or connection providing data speeds up to 128kbit/s, such as via an analogue telephone line, or via ISD.

**Next generation core networks (NGN) –** Internet Protocol based core networks which can support a variety of existing and new services, typically replacing multiple, single service legacy networks.

**Next generation access networks (NGA) –** Broadband access networks that connect the end-user to the core network capable of with a bandwidth quantity and quality significantly in excess of current levels (a benchmark of 20 Mbit/s or more is often used).

**Peer-to-peer distribution –** The process of directly transferring information, services or products between users or devices that operate on the same hierarchical level.

**PVR –** See DVR

**Service provider –** A provider of electronic communications services to third parties whether over its own network or otherwise.

**Streaming content –** Audio or video files sent in compressed form over the internet and consumed by the user as they arrive. Streaming is different to downloading, where content is saved on the user's hard disk before the user accesses it.

**Telecommunications, or 'Telecoms' –** Conveyance over distance of speech, music and other sounds, visual images or signals by electric, magnetic or electro-magnetic means.

**TV over DSL/TV over Broadband –** A technology that allows viewers to access TV content – either in a linear programme schedule, or on-demand – using Internet Protocol via broadband services, either on a PC or (via a set-top box) on a TV set.

**UMTS –** Universal Mobile Telecommunications System. The 3G mobile technologies most commonly used in the UK and Europe.

**VoD Video on Demand –** A service or technology that enables TV viewers to watch programmes or films whenever they choose to, not restricted by a linear schedule. Also Near Video on Demand (NVoD), a service based on a linear schedule that is regularly repeated on multiple channels, usually at 15-minute intervals, so that viewers are never more than 15 minutes away from the start of the next transmission.

**VoIP –** Voice over Internet Protocol. A technology that allows users to send calls using Internet Protocol, using either the public Internet or private IP networks.

**WLR Wholesale Line Rental –** A regulatory instrument requiring the operator of local access lines to make this service available to competing providers at a wholesale price.

Source: Ofcom