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COMMISSION OF THE EUROPEAN COMMUNITIES

Brussels, 15.07.2005

**”DIGITAL DIVIDE FORUM REPORT:  
BROADBAND ACCESS AND PUBLIC SUPPORT IN UNDER-SERVED AREAS”**

*This paper only commits the Commission services involved in its preparation. The text is prepared as a basis for comment and does not prejudge the final form of any decision to be taken by the Commission.*

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## EXECUTIVE SUMMARY

The new strategic framework for the European Information Society “i2010 – A European Information Society for growth and employment” places particular emphasis on tackling the issues of both geographical coverage of broadband and the social and economic digital divide. This Digital Divide Forum (DDF) report analyses the territorial broadband digital divide in Europe and possible EU initiatives to bridge this gap. It forms the analytical basis of a public consultation which will in turn feed into a European Commission Communication on this issue during 2005.

The report is divided in three parts. The first chapter looks at market developments in urban, suburban and rural areas of the EU15/EEA. The second chapter compares costs and performance between alternative technologies. The third chapter provides information on the implementation of national broadband strategies in some Member States and on the state-aid case law currently being developed by the European Commission.

The key issues identified are:

- **Remote and rural regions are less well served:** Although broadband can bridge distances and is particularly beneficial to the development and attractiveness of remote and rural areas, roll-out is concentrated in densely-populated areas. In January 2005 broadband was available to more than 90% of EU15/EEA-urban population but only to 62% of its rural population. Commercial deployment in remote and scarcely populated regions has been constrained by high costs due to distance and population scarcity. Broadband deployment currently excludes about 15% of EU15 population. This share increases when new Member States are taken into account, although precise data on coverage for these countries are not yet available.
- **Coverage is progressing fast:** during 2004, broadband coverage in rural areas has increased by 40%. Take-up in those areas has more than doubled. Growth in the market is driven by increasing demand and innovation (such as wireless technologies and the extended reach of ADSL), facilitated in turn by the enhancement of competition. Further market developments are expected also through the promise of emerging technologies such as satellite, Wi-Max, PLC and UMTS.
- **Therefore caution is needed:** the high potential for market growth and its strong innovative character suggests that public intervention should be cautious, neither to inhibit market incentives and innovation nor to distort competition. Moreover, the difference between coverage (88% in EU15/EEA) and take-up (10% in EU15/EEA) and the lower propensity to use broadband in rural areas suggest the importance of stimulating use through Inclusion policies that go beyond the territorial access issues.
- **But some areas will suffer delays or be excluded altogether from broadband rollout:** a recent study estimates that at least 4.7 million would-be broadband users will be excluded by commercial rollout in 2013 in the EU25. Under these circumstances, public intervention may be considered desirable or necessary.

Decisions on public intervention should be informed by:

- **Minimising competition distortions:** Current analysis confirms that competition distortions are minimised when public funding concerns open access infrastructure, defined according to technological neutrality and managed by an independent authority.
- **Local decision making:** There is no one optimal mix of technologies for under-served areas. Choice of the optimal technology mix by public authorities should be made on the basis of the price/quality ratio the solutions that will be most appropriate will depend on local geography (distance from the point of presence), topography and demography (density of population and/or assessment of demand). For these reasons, the report highlights the importance of targeting public intervention in under-served areas to the effective requirements identified through an assessment of local demand.
- **Integrated approaches to broadband:** Initiatives fostering broadband coverage should be framed in a wider information-society approach, with special attention for example to the enhancement of skills through training and digital literacy.

The report illustrates current examples of public intervention in the EU to increase coverage of under-served areas. It also highlights the main principles that have emerged so far from state-aid analysis, responding this way to several requests made by industry and local authorities. The possibilities for EU level action include:

- **Structural funds:** The eEurope 2005 Action Plan highlighted the role Structural Funds can play in bringing broadband to disadvantaged regions. Structural Funds can be used to increase broadband coverage in under-served areas on the basis of guidelines published by the Commission in July 2003 to minimise competition distortions and safeguard a technology-neutral approach.
- **Public-private partnerships:** The Commission supports the establishment of public/private partnerships that facilitate investment in open infrastructure as long as competition rules are respected.
- **Exchange of best practices and reinforced monitoring:** Because of the large variety of examples and the many questions that are often posed in relation to the legitimacy of public intervention, the exchange of best practices at the national/regional/local level should be intensified. There is also a need for strengthening the monitoring of the various activities undertaken in this context.
- **A pan-European initiative for very sparsely populated areas to ensure coverage by satellite.** The Commission services believe that new initiatives need to be technology neutral and take into account regional prerogatives and local needs. The Commission services support the idea of demand aggregation as a means of helping to reduce the costs of user equipments in the context of satellite solutions in areas where satellite is considered to be the only practicable solution for broadband delivery.

The report concludes by proposing two policy orientations: *the strengthening of national broadband strategies in the framework of the Integrated Guidelines of the renewed Lisbon strategy and the set-up of a web-site gathering information on tenders and undertaken projects to strengthen the exchange of best practices.*

## INTRODUCTION

This report follows the request by the White Paper on Space<sup>1</sup> to set up a Forum on the broadband digital divide within the framework of eEurope. The Digital Divide Forum is coordinated by the eEurope Advisory Group<sup>2</sup>. It has gathered input from stakeholders represented in the Second Section of this group<sup>3</sup> and from studies launched by the European Space Agency (ESA) and by the Commission services<sup>4</sup>. The report is open to public consultation to stimulate an on-line forum for discussion.

The concept of “digital divide” within the scope of the White Paper on Space and of this document refers to the gap between “have” and “have-nots” in terms of broadband access. The report therefore focuses its analysis on the geographical coverage of broadband infrastructure. It considers the need for further EU initiatives and aims to facilitate local projects by providing information on available technologies and current practices.

The report does not cover other digital inclusion issues such as skills availability and other socio-economic variables that may impact on broadband take-up and on the participation to a knowledge-based society. These issues will be taken into account in the framework of i2010, the post-eEurope initiative.

The term ‘broadband’ is commonly used to describe Internet connections that are ‘always on’ and that provide speeds significantly faster than dial-up connections. These features support the delivery of innovative content, applications and services.

The delivery of advanced applications allows individuals and organisations to communicate and access services regardless of their geographical location. It enables businesses to communicate with clients and suppliers and limits business migration to urban areas. Broadband allows households to access advanced e-government, e-health and e-learning services, improving their quality of life and their participation into the social and democratic life. By its own nature, broadband bridges distances and is particularly beneficial to the development and attractiveness of remote and rural areas. Nevertheless, broadband roll-out has been concentrating in more populated areas.

Commercial deployment in remote and scarcely populated regions has been slower than in urban areas mainly because of high costs due to distance and population scarcity. As a result, in July 2004 broadband was available to more than 90% of EU15-urban population but only

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<sup>1</sup> White Paper - Space: A new European frontier for an expanding Union. An Action Plan for implementing the European Space policy, COM(2003) 673. More details can be found in the Communication eEurope 2005 Action Plan: An Update, COM(2004) 380.

<sup>2</sup> The eEurope Advisory Group monitors progress in the implementation of the eEurope 2005 Action Plan and provides a strategic overview for future initiatives. More information on the role of the eEurope Advisory Group is available at [http://europa.eu.int/information\\_society/europe/2005/all\\_about/advisory\\_group/index\\_en.htm](http://europa.eu.int/information_society/europe/2005/all_about/advisory_group/index_en.htm)

<sup>3</sup> The Second Section of the eEurope Advisory Group is formed by 40 experts competent to express the concerns and interests of all other stakeholders (e.g. industry, consumers, user groups, social partners and other interest groups). It mainly helps the Commission address technical issues relating to the eEurope Action Plan and to focus more on the wider challenges and perspectives addressed in the eEurope initiative.

<sup>4</sup> These contributions are annexed to this report and available at [http://europa.eu.int/information\\_society/europe/i2010/digital\\_divide/index\\_en.htm](http://europa.eu.int/information_society/europe/i2010/digital_divide/index_en.htm)

to 50% of its rural population. Six months later, in January 2005, population coverage in rural areas reached 62%. Broadband coverage is increasing fast, but on average it still excludes about 15% of EU15 population, and certainly a higher percentage when taking new Member States into account. Market dynamics suggest that commercial forces will drive further deployment, although some areas of the EU will suffer delayed coverage or will be excluded altogether from broadband rollout. Under these circumstances, public intervention may be considered desirable or necessary.

The scope for public intervention in under-served areas was emphasised in *eEurope 2005*<sup>5</sup>. The Action Plan set ‘widespread availability and use’ as its broadband objective and highlighted the role Structural Funds can play in bringing broadband to disadvantaged regions. The European Initiative for Growth reiterated this message<sup>6</sup>. Structural Funds can be used to increase broadband coverage in under-served areas on the basis of the “Guidelines on criteria and modalities of use of Structural Funds for electronic communications”<sup>7</sup>, published by the Commission in July 2003. The guidelines are based on competition rules and on the regulatory framework for electronic communications. They aim at minimising competition distortions due to public support on the basis of a technology-neutral approach.

Implementing *eEurope 2005*, Member States committed to put in place national broadband strategies. All fifteen pre-accession countries did so by the end of 2003, while the new Member States committed to follow one year later<sup>8</sup>. All strategies recognise the role of competition in driving private investment and achieving the widest possible commercial broadband deployment. In the presence of market failure or in the absence of markets, national strategies acknowledge the role of government in ensuring widespread availability of broadband services and announce supporting initiatives.

These initiatives are coordinated at the national level, but their implementation is carried out at the regional and local levels. A workshop<sup>9</sup> organised by the European Commission in December 2003 showed that a whole variety of practices and experiences is taking place on the basis of local needs.

The recent *i2010*<sup>10</sup>, the European initiative for the Information Society proposed by the Commission on 1<sup>st</sup> of June 2005, framed the broadband territorial digital divide into the wider framework of *eInclusion*. By calling for a comprehensive approach, it recalled that “*during 2005, the Commission will address e-accessibility through a mix of research and stimulation measures to make ICT systems easier to use for a wider range of people. It will give guidance to extend the geographical coverage of broadband in under-served areas and will review the scope of the Universal Service Directive in 2005 and the directive as a whole in 2006. In 2006, the Commission will also review the contribution of ICT and digital literacy to key competences targets in the ‘Education and training 2010’ initiative.*”

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<sup>5</sup> COM(2002) 263

<sup>6</sup> COM(2003) 690

<sup>7</sup> Available at [http://europa.eu.int/comm/regional\\_policy/sources/docoffic/working/sf2000\\_en.htm](http://europa.eu.int/comm/regional_policy/sources/docoffic/working/sf2000_en.htm).

<sup>8</sup> “Connecting Europe at High Speed: National Broadband Strategies”, COM(2004) 369 final

<sup>9</sup> See

<sup>10</sup> [http://europa.eu.int/information\\_society/eeurope/2005/all\\_about/broadband/bb\\_regional/index\\_en.htm](http://europa.eu.int/information_society/eeurope/2005/all_about/broadband/bb_regional/index_en.htm)

COM(2005) 229



This document is divided in three parts. The first chapter looks at market developments in urban, suburban and rural areas, and discusses the dimension of the geographical broadband digital divide. Because data for rural areas for the new Member States are currently unavailable, the discussion mainly relates to the EU15 plus Norway and Iceland. As broadband access can be provided through a variety of networks and platforms, the second chapter compares costs and performance between alternative technologies. The third chapter provides information on the implementation of national broadband strategies in terms of increasing coverage and on the case law currently being developed by the European Commission.

## 1. CHAPTER 1: MARKET DEVELOPMENTS

Definitions of broadband have continued to evolve and are changing with time and place. Initially a simple notion was anything perceptibly better than a basic ISDN line. This implies a rate around or exceeding 144 kbps, although customers did accept less if this was the best available to them. A common current understanding is “a service that is always on, and can scale up to at least 2 Mbps”. Other definitions do not specify transmission capacity because of the continued evolution of bandwidth. A 2004 Commission Communication<sup>11</sup> referred to “a wide range of technologies that have been developed to support the delivery of innovative interactive services, equipped with an always-on functionality, providing broad bandwidth capacity that evolves over time, and allowing the simultaneous use of both voice and data services”.

### 1.1. General developments

Europeans are connecting to broadband fast. The number of broadband access lines has almost doubled in the past two years. In January 2005 there were almost 40 million connections in the EU25, corresponding to a penetration rate in terms of population of 10% in the EU15 and of 8.6% in the enlarged Union (Figure 1)<sup>12</sup>.

EU25 Broadband penetration rate - January 2005

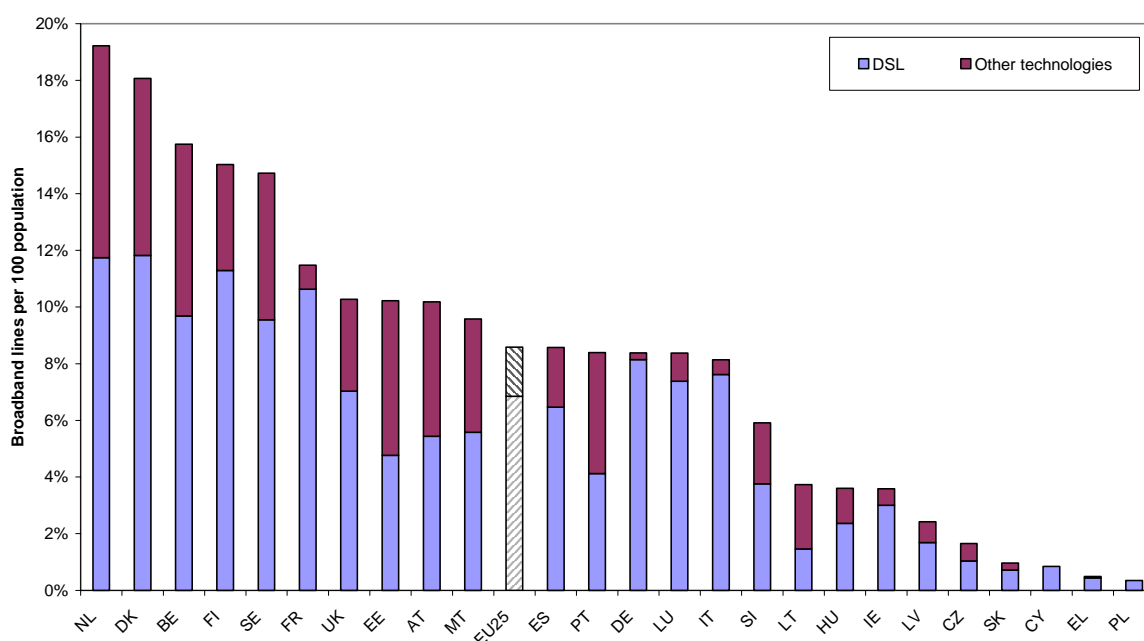


Figure 1: Broadband penetration rates in EU25.

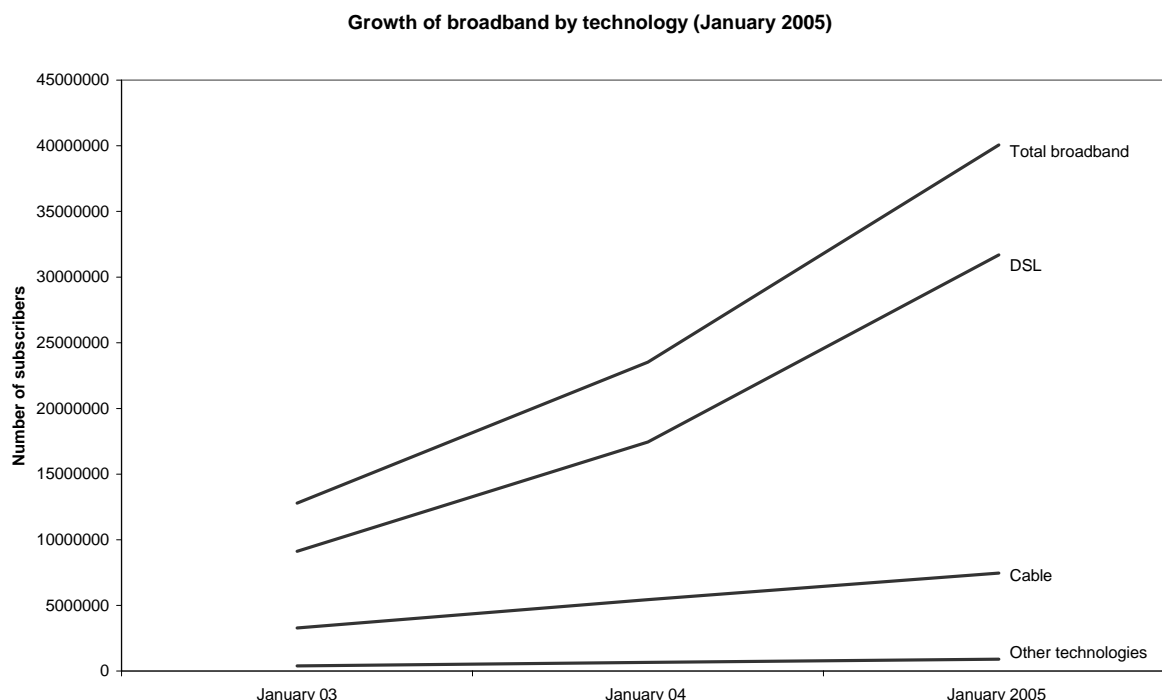
Source: Communications Committee (data do not take ISDN into account and relate to speeds above 144 kbps)

Digital Subscriber Line (DSL) is the predominant access technology in the EU. It accounts for an increasing share of the overall broadband market, standing at 80% of total broadband lines,

<sup>11</sup> COM(2004) 369: “Connecting Europe at High Speed: National Broadband Strategies”

<sup>12</sup> The penetration rate calculated in terms of households would be higher than in terms of population. Unfortunately, currently available statistics do not allow this distinction, and all rates in this report are expressed in terms of population.

up from 74% in 2004. Cable modem is the second most important technology in terms of penetration. Its share of the broadband market is currently decreasing and stands at 18%. Other technologies such as satellite, fibre and wireless local loop account for the balance of about 2% (Figure 2).



**Figure 2: Broadband connections in EU25 by technology**

Source: Communications Committee

Despite the increase in connectivity, several Commission Communications<sup>13</sup> underlined the persistence of a *broadband digital divide* in terms of geographical coverage. Relative to urban areas, access in more rural regions is more limited because of low density of population and remoteness. Population scarcity limits the exploitation of scale economies, entails lower rates of demand and reduced expected returns from investment. Remoteness often implies the need of bridging longer distances from the local exchanges to the premises and from the local exchanges to the backbone. The latter, the ‘backhaul’, is a high-cost extension of the network. Commercial incentives to invest in the provision of broadband to these areas often turn out to be insufficient. However, technological innovation (reducing costs of deployment and extending the reach of wire-line and wireless technologies) is delivering positive results in terms of developments and is facilitating market-driven rollout.

## 1.2. Broadband coverage is increasing

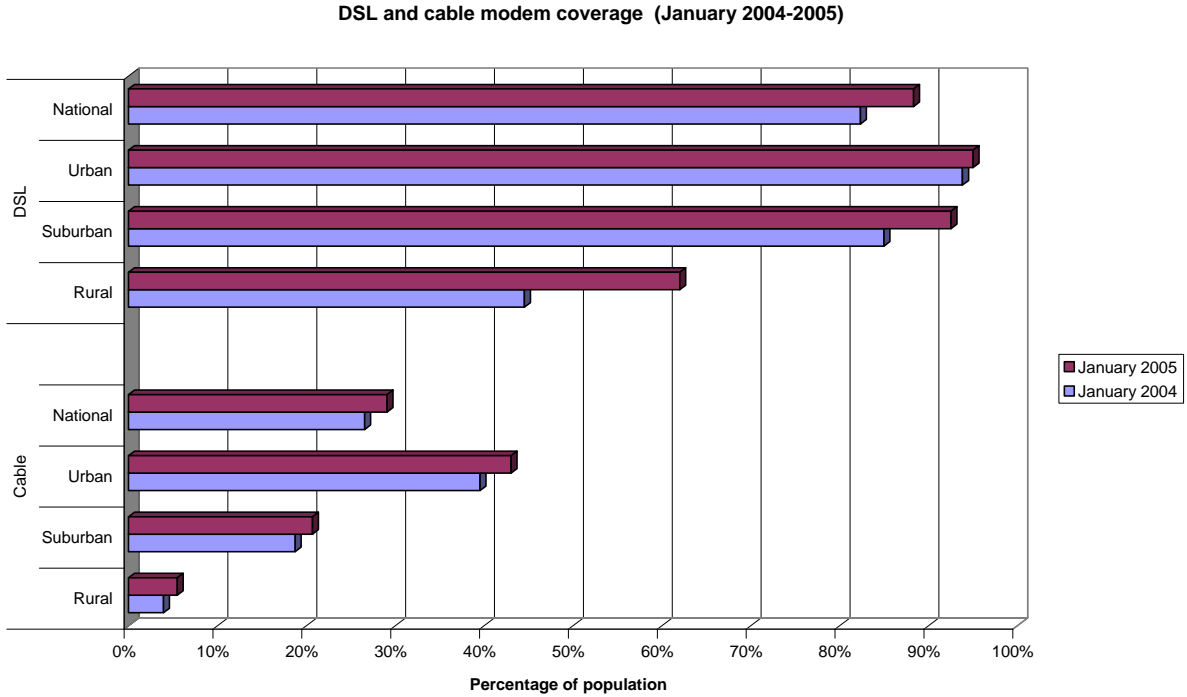
The term “coverage” denotes the percentage of population that is able to access broadband<sup>14</sup>. Broadband coverage has been increasing fast in the past year (Figure 3). 88% of the

<sup>13</sup> COM(2003) 65, COM(2003)673, COM(2004) 61, COM(2004) 369, COM(2004) 380.

<sup>14</sup> In terms of the most diffused access technologies (DSL and cable), coverage denotes the percentage of population depending on switches equipped for DSL and/or living in houses passed by an upgraded cable. The definition of DSL coverage includes individuals and businesses located too far away from the switches to be reached, underestimating effective coverage. For example, Figure 4 shows that DSL

population is reached through DSL, up from 82% one year before, while 29% is reached through cable networks, an increase of two percentage points. These figures relate to the EU15/EEA. Data on coverage in the new Member States are not yet available.

For the purpose of this report, the term “digital divide” concerns the difference between those who have and those who do not have access to broadband. In terms of geography, those having access to broadband are concentrated in urban and suburban areas (Figure 3). DSL only reaches about 62% of the population in rural areas while cable modem reaches 5% of them. The increase in DSL coverage in rural areas in the past year has been considerable.



**Figure 3: Broadband coverage: The ‘size’ of the digital divide**  
**Source: Commission services**

- Urban areas:** areas with population density > 500 inhabitants/km<sup>2</sup>
- Suburban areas:** areas with population density > 100 and < 500 inhabitants/km<sup>2</sup>
- Rural areas:** areas with population density < 100 inhabitants/km<sup>2</sup>

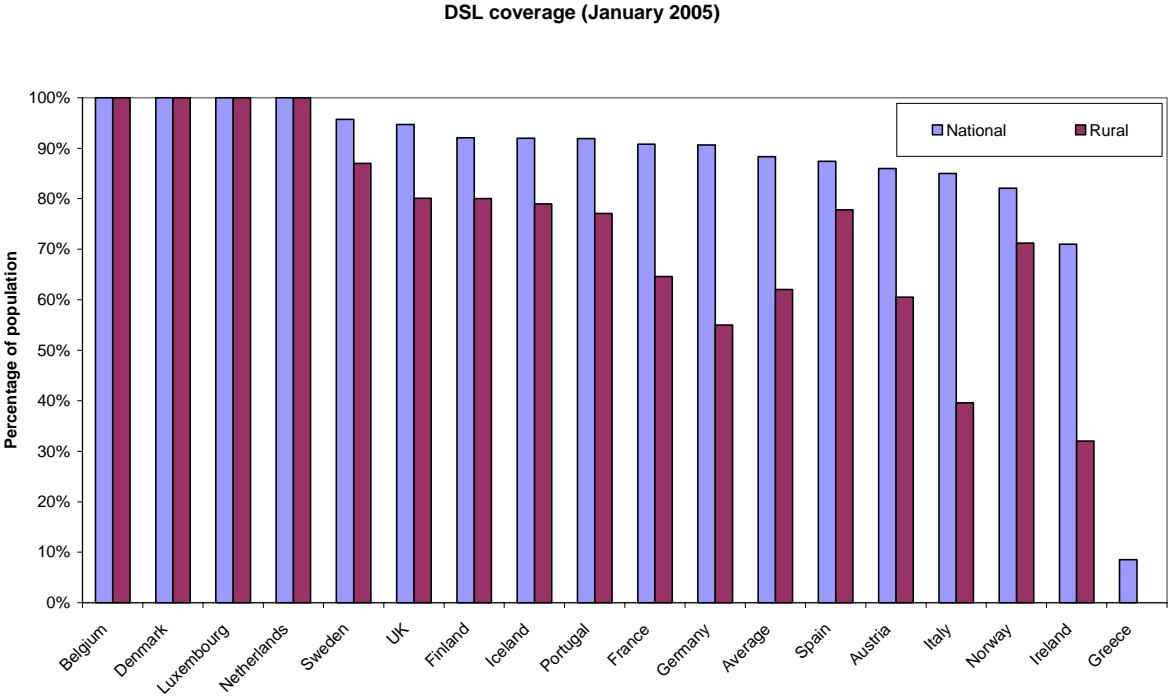
Relative to more populated areas, coverage of rural areas has been increasing fast in terms of DSL but slowly in terms of cable modem. Deployment of cable modem in scarcely populated areas involves high costs and is not expected to have a significant impact. Moreover, the two access technologies are often overlapping. For simplicity, DSL coverage of 88% will be taken

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coverage in Denmark achieves 100% of population, although 2% of the Danish population is estimated to be out of DSL reach.

as a conservative estimate of broadband coverage in the EU15. The rest of this section will look more in detail at data on deployment and take-up of DSL only<sup>15</sup>.

The extent of the digital divide per Member State in the EU15 is illustrated by the difference between DSL national and rural coverage (Figure 4). Four countries have already achieved 100% of coverage, although this measure overestimates the availability of broadband as explained in footnote 10.



**Figure 4: The digital divide in 15 Member States**  
**Source: Commission services**

Country	Urban area	Suburban area	Rural area
Austria	30%	40%	30%
Belgium	56.4%	38.8%	4.8%
Denmark	30.3%	39.4%	30.3%
Finland	35%	30%	35%
France	53%	23.8%	23.2%
Germany	40%	43%	17%
Greece	56.7%	14.8%	26.7%

<sup>15</sup> The exclusion of cable modem data does distort the picture for the Netherlands, where cable networks are deployed extensively also in rural areas. However, the bias can be considered negligible as only a small portion of the Dutch population lives in these areas.

Iceland	62%	0	38%
Ireland	40.8%	18.4%	40.7%
Italy	48.4%	38%	13.6%
Luxembourg	44.3%	38.4%	17.3%
Norway	26%	29.8%	44.2%
The Netherlands	65.6%	32.1%	2.3%
Portugal	30.5%	44%	25.6%
Spain	54.7%	23%	22.4%
Sweden	40%	43.3%	16.7%
UK	61.9%	28.6%	9.5%

**Table 1: percentage of population residing in urban, suburban and rural areas**

The broadband digital divide is particularly pronounced in large EU countries such as DE, IT, and FR (Figure 4). It is also prominent in smaller countries such as Austria and Ireland. The importance of the problem also depends on the amount of population residing in rural areas and needing access. However, contrary to what expected, the relationship between coverage of rural areas and percentage of population residing in those areas is insignificant.

Table 1 provides the percentages of population living in urban, suburban and rural areas in each country. Three countries feature a low percentage of population living in rural areas (less than 10%): NL, BE, UK, and they are mostly covered; four countries are characterised by a medium percentage (between 10 and 20%): IT, LU, SE, DE, with Sweden and Luxembourg featuring high coverage. Five countries are characterised by a high percentage (between 20 and 30%): FR, AT, DK, EL, PT, ES, with France and Austria, but especially Greece, lagging behind; and three countries by a very high percentage, IC, IRL, NO, FI, with Iceland and Finland featuring an outstanding performance in terms of coverage given sparsely populated areas. The largest gap is registered for Ireland, where the penetration rate in rural areas is significantly lower than the national average and is amongst the lowest in the EU15. In this country, more than 40% of the population resides in rural areas.

In some countries, like the UK and the Netherlands for example, the increase in rural DSL coverage over the past year has been significant (Figure 5). Portugal, France and Norway have also featured important developments. This is relevant as these countries are characterised by a high percentage of population living in rural areas. Austria and Sweden, on the other hand, have not progressed much, but coverage in Sweden was already relatively high.

On average, rural coverage in the EU15/EEA has increased significantly from 45 to 62%. Initiatives by local authorities have contributed to this fast growth, but most of it has been market-led.

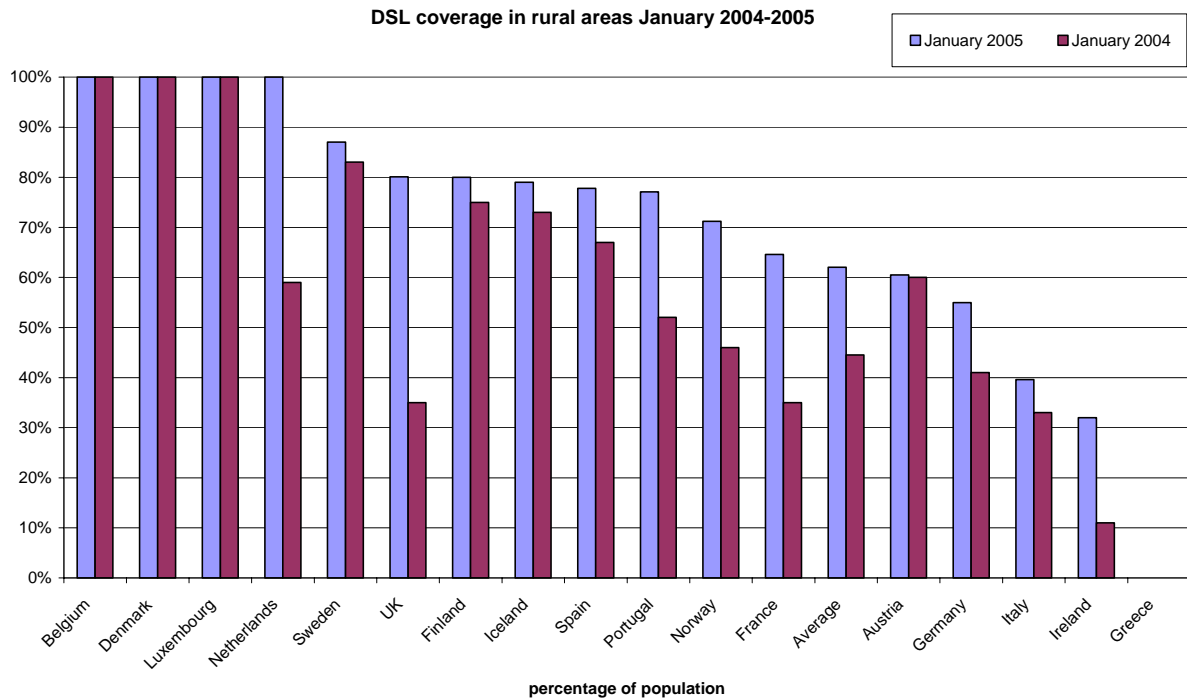


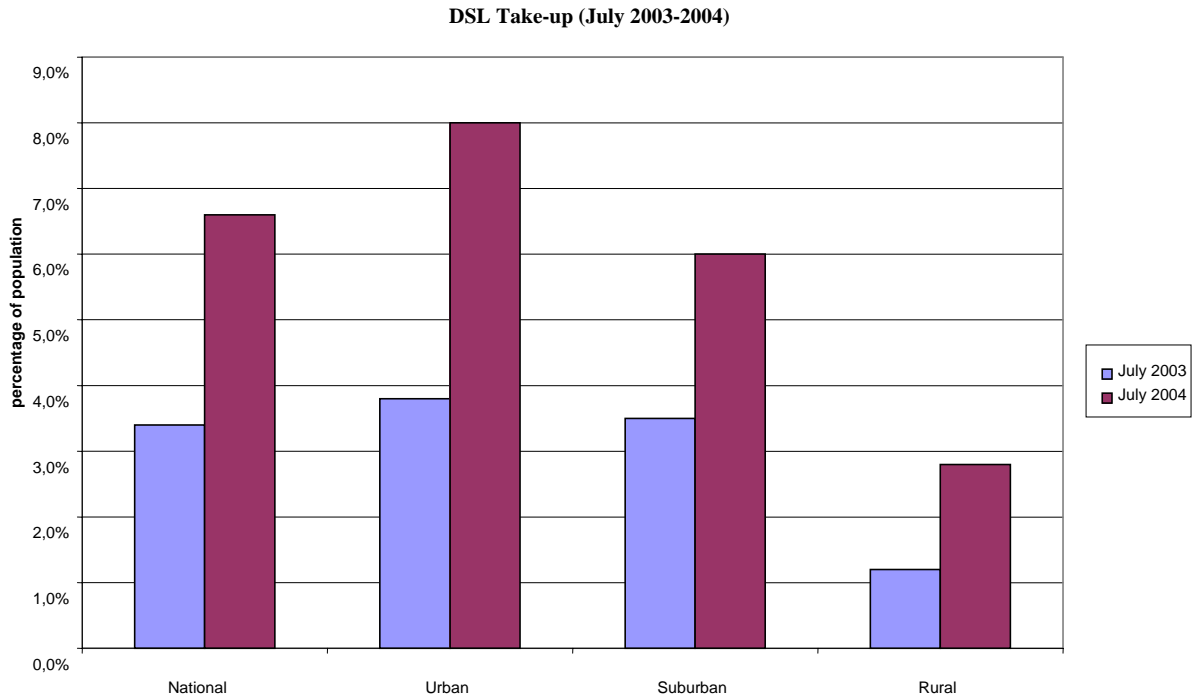
Figure 5: Increase in rural coverage in the period 2004-2005

Source: Commission services

### 1.3. Broadband take-up is lagging behind

Effective broadband take-up in general lags behind coverage in all areas (Figures 1 and 4). On average, by January 2005, only 10% of EU-15 population chose to purchase a broadband subscription, when broadband was available to about 88% of them. The gap shows that the market is still in its infancy.

7% of urban population chose to purchase a DSL connection against 5.7% of suburban population and almost 3% of rural population (Figure 6). The fast broadband take-up observed in Europe in the period 2003-2004 has concerned urban, suburban and rural regions, and the average penetration rate has doubled. However, growth has been particularly fast in urban areas.



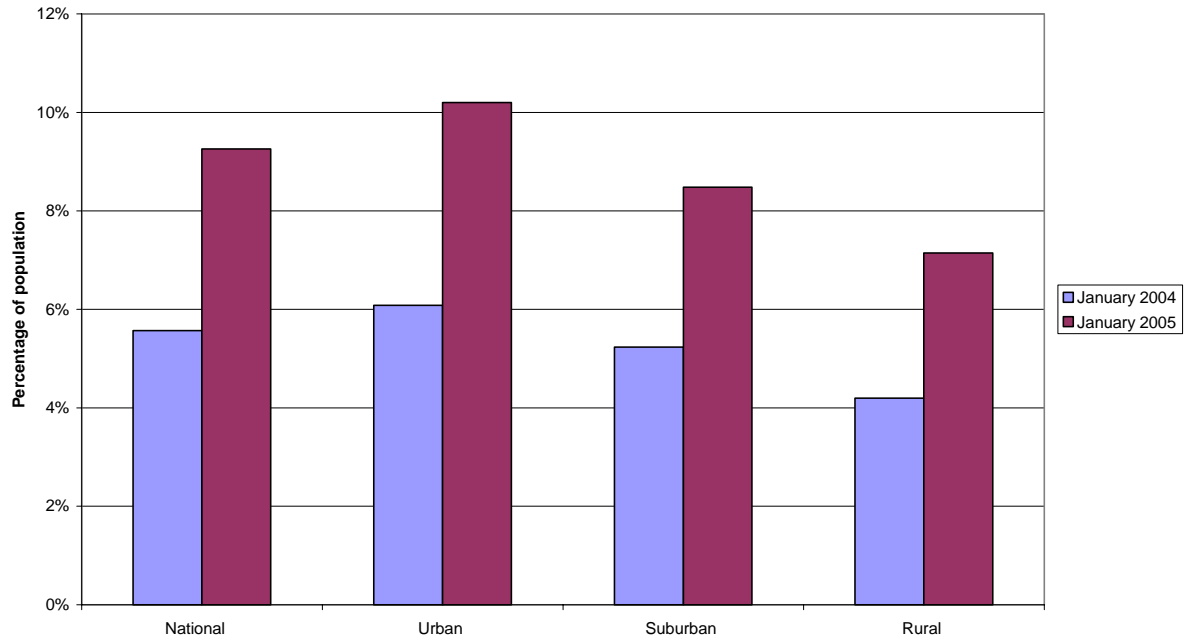
**Figure 6: DSL take-up is lower and growing less in rural areas**  
**Source: Commission services**

**1.4. The propensity to subscribe in rural areas is lower than in urban areas**

Are Internet users in rural areas less inclined to use broadband? This issue is often brought up to highlight the existence of demand uncertainty in these areas. The penetration/coverage ratio shows the percentage of users choosing a DSL connection when access is available. Even when DSL is available, in rural areas fewer people are currently willing to purchase a connection than in more populated ones (Figure 7). The penetration/coverage ratio has been increasing in all areas, implying that take-up increases faster than coverage. However, growth has been slowest in rural areas. This result seems to substantiate the common wisdom relating to the lower propensity to subscribe to broadband in rural areas.



DSL Penetration/coverage ratio January 2004-2005

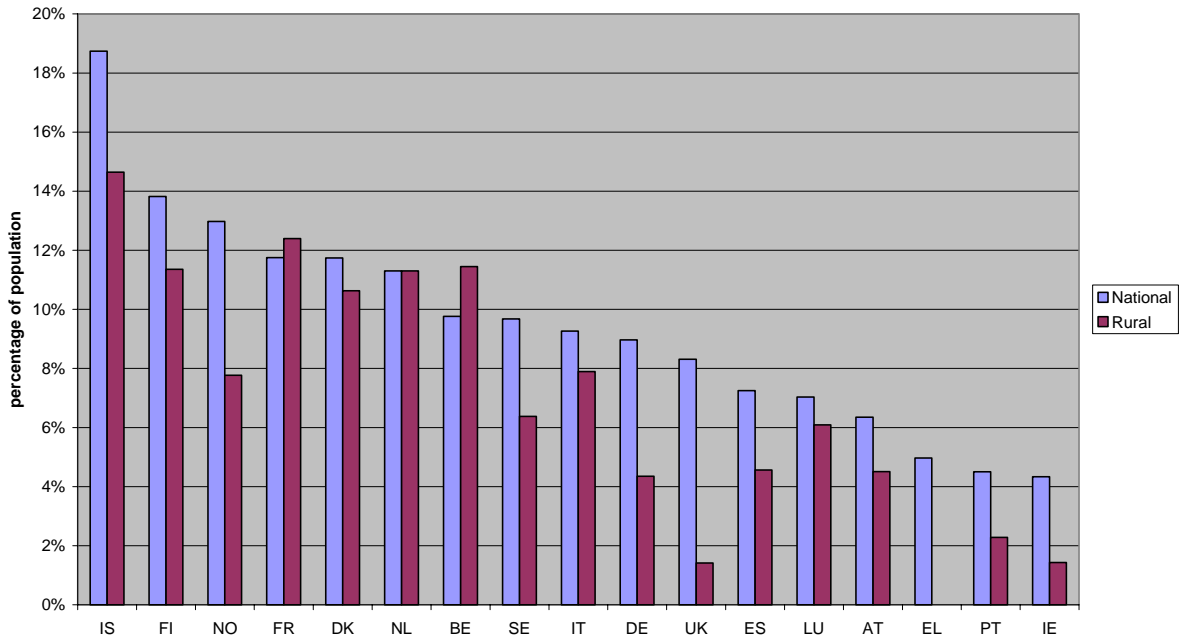


**Figure 7: When broadband is available, growth in take-up is strong.**

Source: Commission services

When broadband is available, take-up in rural areas varies considerably across countries (figure 8). France, Netherlands and Belgium feature a higher penetration/coverage ratio in rural areas than average. Only a small percentage of the population lives in rural areas in the Netherlands and in Belgium (table 1), but the result for France is remarkable. When broadband is available, a small percentage of the population chooses to subscribe in the rural areas of the UK, Portugal, Greece, Spain, Germany and Sweden. When broadband is available, take-up in national and rural areas is more balanced in Italy, Luxembourg, Denmark and Finland.

DSL Penetration/Coverage ratio per country (January 2005)



**Figure 8: When broadband is available, take-up is fragmented across Member States**

Source: Commission services

Causes of digital divides are often attributed to low income, poor education, large presence of smaller enterprises and other socio-cultural factors. These features may partly justify the lower propensity to use broadband in rural areas, but other geographic-related features such as higher prices, low-quality connections, lack of awareness of the broadband potentials, lack of appropriate services, etc. are also likely to be relevant. Infrastructure deployment may not be sufficient to realise the benefits of the information society without due consideration of the barriers to usage.

In urban areas broadband is almost ubiquitous and there is no correlation between access and take-up. The correlation is positive in rural areas, where take-up is higher in those countries where broadband is more widely available (Figure 9). Even if the rural population may be less inclined to adopt the new technology, lack of access may very well be constraining would-be users.

Correlation between DSL Coverage and Penetration rates in Rural areas (January 2005)

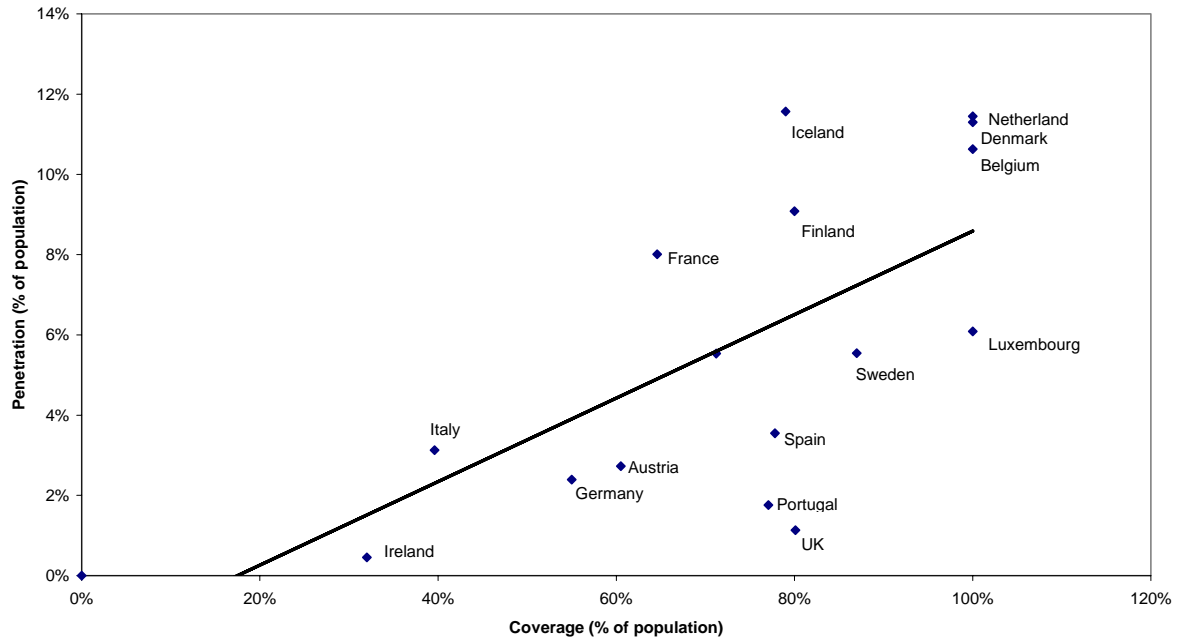
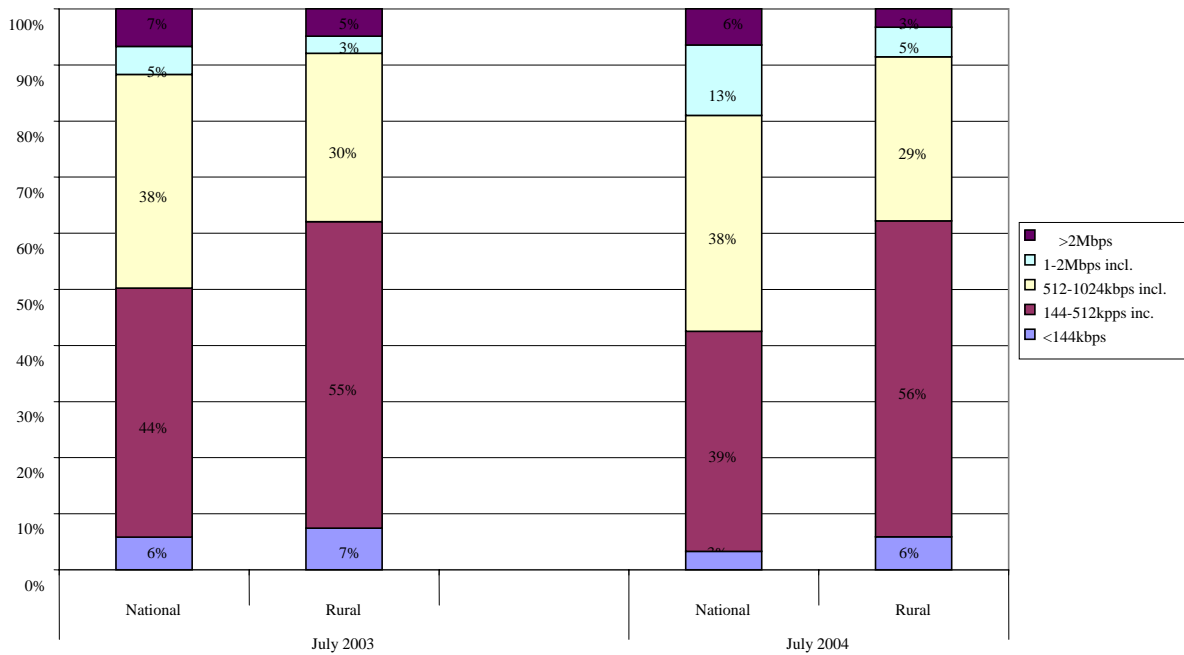


Figure 9: Take-up in rural areas is higher in those countries where broadband is more widely available  
Source: Commission services

### 1.5. Speeds in rural areas are lower than average

Speeds in rural areas tend to be lower than average (figure 10). Download speeds between 144 kbps and 512 kbps have been the most common speeds rural users have subscribed to in the past two years (55-56% of users). At the national level, in July 2004 the percentage of subscriptions to this bracket of speeds is down to 39%, and a similar percentage is registered for speeds up to 1 Mbps. Since 2003, at the national level, the share of low speeds has been declining, while higher speeds above 1 Mbps have increased their share. The share of high speeds in rural areas has remained overall constant.

Shares of DSL speeds (July 2003-2004)



**Figure 10: speeds subscribed to in rural areas are lower than average**  
**Source: Commission services**

Growth in speeds assures that a service is at least a little better than what was available before, but does not tell whether the speed is good enough. On the one hand, e-mail and instant messaging are prominent examples of applications that do not depend on large amounts of bandwidth, but that provide evidence of demand for convenient Internet-based communication. On the other hand, as consumers start transmitting video clips (produced using increasingly inexpensive digital video cameras) and watching TV channels on the Internet, bandwidth requirements could significantly increase. New applications, such as peer-to-peer, place increasing demand on the upstream channel.

### 1.6. New Member States

Comparable data on broadband coverage in the new Member States are not yet available. The Commission services will soon launch a study to collect data for the urban, suburban and rural areas of the EU25. Most of the new member States have medium levels of rural population and medium levels of disposable income. The broadband market is just starting to develop but is restricted by lower levels of PC and telephone line penetration

(around 30% of population on average). In some countries, however, TV cable networks are significantly deployed and represent an important alternative to the upgrades of telephone exchanges.

Operators in these countries are currently concentrating their offers in urban areas. According to 2003 estimates, national coverage in the Baltic countries and in Malta is similar to the

EU15 average (around 80%). In other countries it ranged from 25% in Slovakia to 45% in the Czech Republic and to 60% in Hungary and Slovenia.<sup>16</sup>

While broadband rollout in the EU15 is mostly based on the upgrading of existing networks, it is reasonable to expect a different pattern of development in the new Member States. From the point of view of voice communications, there is a clear trend in these countries towards take-up of mobile instead of fixed phones. When available, people are likely to retain a fixed line for Internet access (either dial up or ADSL), but wireless developments are expected to contribute to driving broadband coverage in these areas.

### **1.7. Future perspectives**

The growth in deployment highlighted in Figure 3 suggests that coverage is likely to be increased further through market forces. The question is how far will the market grow through commercial means, and how many potential users could be excluded as a result.

This question has been recently analysed by a study by PriceWaterhouse Coopers (PWC)<sup>17</sup>, sponsored by ESA, specifying a model to estimate future broadband connectivity and take-up by 2013. The study concludes that broadband will be available to more than 95% of urban population in the EU25 by 2010, although coverage in rural areas will be much lower (achieving 75% by 2013 in the wealthier countries but no more than 35% in most of the recent accession countries). In particular, the analysis indicates a potential of at least 4.7 million would-be users with a requirement of broadband services that is not likely to be met by commercial broadband roll-out. About 1.3 million of these would-be users are likely to be businesses, predominantly micro-enterprises.

The PWC study also attempted a quantification of the benefits delivered by broadband-enabled services. The study estimates the net present value of the benefits for provision of broadband services across the EU25 in 2013 to be 69% larger than the costs.

### **1.8. Government intervention**

The slower deployment of broadband infrastructure in scarcely populated areas raises a debate on the opportunity for government intervention. Broadband-enabled services may give a new meaning to living in remote areas. Rural areas may become attractive for business people, families with young children etc., allowing the existence of virtual communities existing in real time and in different professions. In areas where the benefits of broadband may exceed the traditional benefits brought to more densely populated areas, and deployment costs are higher, governments may wish to accelerate deployment and/or ensure the availability of first-class infrastructure at higher speeds.

For policy makers, the issue is how to determine whether government intervention to accelerate broadband deployment is necessary or desirable. As private investment is restricted by high costs and risks, remote and rural areas will be late in getting the necessary infrastructure in place or may be excluded by commercial roll-out. Because of distance, the quality of the infrastructure in terms of speed and capabilities may be reduced.

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<sup>16</sup> Source: OECD, available at <http://www.oecd.org/dataoecd/29/29/33864206.pdf>

<sup>17</sup> Price Waterhouse Coopers (2004), "Technical assistance in bridging the digital divide - A Cost Benefit Analysis for broadband connectivity in Europe", annexed to this report.

Seeking to accelerate or enhance the delivery of telecommunications services in their communities, a number of municipalities and regions have considered or launched initiatives aimed at facilitating, encouraging, or directly building infrastructure for broadband. These initiatives have been widely justified through the launch of national broadband strategies.

National broadband strategies have been adopted in 2003 by the EU15 Member States. The new Member States committed to draw up national plans by the end of 2004, although these have been so far submitted by Poland, Hungary, Slovenia and Czech Republic only. Where relevant, all Member States addressed the broadband territorial digital divide issue, acknowledging the role of government in stimulating deployment in under-served areas.

Many local and regional activities are underway (some examples are illustrated in the third chapter of this report). Local governments have a direct interest in the community. They may be in a better position than national providers to collect and verify local information, such as discovering and/or aggregating demand for broadband services. They may support the deployment of infrastructure that translates into service competition. They may decide to support the roll-out of high-capacity infrastructure that will not become obsolete with time. They may also launch pilot projects to explore new technologies, demonstrating the viability of a system and the extent of demand for them at the local level.

Local initiatives are not without critics. For instance, it can be as hard for local decision makers as for service providers to predict consumer demand. Moreover, commercial operators tend to protest against local efforts to provide broadband because of potential competition distortions and negative impact on private investment. It is also argued that local efforts are less likely to be commercially sustainable in the long run and will not support upgrades. Local efforts also risk becoming overly politicized and may translate in a waste of public resources. Local governments are likely to be less familiar with the technology and the business side, and local governments in small communities may have limited capabilities.

Taking into account both benefits and costs, action at all government levels can be important to increase coverage in under-served areas. To the extent that policy makers are simply uncertain about the pace of broadband deployment, the benefits of government intervention to accelerate that process would have to be clear and substantial in light of the risk that such intervention may have undesirable consequences. One risk is that by picking particular technologies or defining particular services, some government programs aiming at bringing a technology to all may end up inhibiting technological development. Another risk is that government intervention may bring up distortions of competition. Finally, given the current gap between coverage and take-up, people may simply not be willing to use the technology. Policy makers seeking to promote rapid, efficient broadband deployment should assess the effectiveness of strategies that help avoid these risks - including demand stimulation and aggregation, grant and loan programs, municipal initiatives fostering market entry and competition, and increased participation to the exchange of best practices. This analysis would require policy makers to collect and review reliable broadband data on an ongoing and timely basis. For this reason, availability of mapping of infrastructure in each country is particularly relevant.

Another option to extend coverage in under-served areas is through the introduction of universal service obligations for broadband. However, the existing gap between coverage and effective take-up shows that the broadband market is still in its infancy. Because of this difference, the Commission's analysis based on the Universal Service Directive 2002/22/EC

to review the scope of universal service concludes that broadband should not be considered universal service at this point in time<sup>18</sup>.

## 1.9. Conclusions

The broadband market is still nascent and it is very innovative. Market forces are pushing towards wider broadband markets, albeit slower in more scarcely populated areas. There is a general gap between coverage and take-up, and the propensity to use broadband is currently lower in rural areas. Lack of access may well be constraining higher usage. Speeds tend to be lower in rural areas, limiting the exploitation of advanced services such as eHealth, eLearning and videoconferencing that deliver important benefits in more remote areas.

Government intervention in these areas may accelerate deployment and enhancement of infrastructure and satisfy the requirements of local businesses, administrations and citizens in general. However, government intervention needs to take care of not distorting competition, not inhibiting private incentives to invest, nor preventing innovation and future developments.

The benefits and the risks of public intervention call for the need for governments to be cautious and forward-looking. The gap between broadband coverage and take-up reveals the importance of demand-led approaches (based on the assessment of local demand) and of a comprehensive and balanced approach to the development of the information society. Competition distortions may be limited by following the rules and the technology-neutral approach provided by the Guidelines on the use of Structural Funds.

Broadband coverage and take-up are fragmented across Member States. Because of such diversity, the implementation of eEurope 2005 has taken place through national broadband strategies. Strategies could be strengthened through the introduction of national targets for coverage and, where appropriate, with minimum speed requirements. In this respect, authorities need to take into account that although certain thresholds (for example, 2 Mbps) could prove inadequate in the future, they may raise questions about whether their costs today in rural areas would exceed what customers are willing to pay.

- **Coverage is currently led by market forces and facilitated by innovation. Government intervention should be based on a careful assessment of local needs attempting to minimise market distortions.**
- **The importance of local needs makes government intervention best when carried out at the local level.**
- **To bridge the digital divide, national targets should focus on coverage of under-served areas on the basis of a mapping of existing infrastructure.**
- **Initiatives fostering broadband coverage should be framed in a wider information-society approach, with special attention for example to the enhancement of skills through training and digital literacy.**

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<sup>18</sup> The Communication on the Review of the Scope of the Universal Service Directive is available at [http://europa.eu.int/information\\_society/topics/ecom/useful\\_information/library/communic\\_reports/index\\_en.htm](http://europa.eu.int/information_society/topics/ecom/useful_information/library/communic_reports/index_en.htm)

## 2. CHAPTER 2: BROADBAND TECHNOLOGIES

As highlighted in the previous section, rural broadband is generally believed to be more expensive than urban broadband for two main reasons: distance and population scarcity. However, innovation is reducing the gap.

Rural dwellings and businesses are normally further away from the point of supply, or “point of presence”, than their urban counterparts. The point of supply for rural broadband is typically a local exchange building or radio base station. Many solutions, and especially the cheapest, operate only up to modest distances. For some access technologies, limited reach prevents their use for many rural customers. This is known as the “last mile” bottleneck, referring to the costs of giving direct access to the end-user. Technological innovation is succeeding in providing access technologies with increased reaches, for example new forms of ADSL and Wi-Max.

Broadband services depend also on the interconnection from the local point of presence to a high-capacity backbone optical network. Backbone networks provide plentiful high bandwidths and may do it very cheaply. However, they are cheap only when their capacity is filled. Such networks naturally serve continents, countries and cities, but rarely visit rural areas. Remote communities must bear extra costs for distant connection between the local point of presence and a backbone network. This linkage to a main network node is known as *backhaul* or the “middle mile”. The cost of backhaul increases with remoteness, but is generally small in the urban environment. In this context, innovation is introducing new technologies (PLC, for example), and improving the performance of others (a new generation of satellite, for example).

Finally, broadband access frequently depends on platforms which have high basic costs but a capability to serve many, perhaps a few hundred or more, connections. There is thus often a scale economy that cannot be realised in a rural community, raising unit costs. Technological innovation can play a major role here, since it may succeed over time in reducing the minimum operational size of a platform. This shifts the scale economy, making the technology available to a wider customer base, and facilitating its exploitation also by rural communities.

### 2.1. Broadband service parameters

To better understand the role of the various broadband technologies in rural areas, this section outlines the characteristics of a broadband service through four basic technical parameters. These are:

- The bandwidth, a data transmission speed in kilobits or megabits per second;
- The contention ratio, a ratio of how many users share one backhaul connection;
- The latency, the speed of response (or delay) in milliseconds or seconds;
- The asymmetry, the difference in bandwidth available between the downstream direction (data received by the user) and the upstream direction (data sent by the user).



Contention arises because some broadband delivery solutions use shared bandwidth (for example cable modem, satellite and Wi-Max), where a high-capacity channel is distributed to and pooled between users. Since the services used by most broadband consumers need fast peak transmission but not continuously, contention systems can be highly effective solutions. However, contention does matter to users, in particular when many heavy users are accessing the Internet at the same time. Comparisons between different technology solutions need to take note of contention.

Systems with long propagation paths, notably satellites, introduce the concept of latency: the user may have a high bandwidth channel but face a time delay for the data to arrive. A channel with a high contention ratio might cause latency, where the total bandwidth is insufficient and users are forced to queue for channel capacity. While latency is not a problem for file transfers, it could frustrate Internet surfing, and might completely defeat interactive services such as electronic games and videoconferencing.

## **2.2. Applications and their requirements**

The range of applications and services based on broadband communications is very large, each having unique characteristics. The technical requirements for a given service are often imprecisely defined. In only very few cases is it possible simply to say that a service has a minimum bandwidth or latency such that the service works perfectly with it and fails completely without it. The actual quality of the service, as it appears to the user, could vary greatly.

It is possible to identify five broad categories of broadband applications:

- Simple messaging
- Large file transfer
- Unidirectional real time data (including images and video)
- Interactive real-time messaging (including gaming)
- Bi-directional real-time data

Users can and do adapt to inferior service where necessity exceeds convenience. Many users, once happy to surf the Internet at dial-up modem speed (56 kbps), now assert that broadband speeds are essential. Nonetheless, where services work in an impaired form over channels not having the ideal characteristics, there must be a minimum point at which users judge the service inoperable for normal purposes. Defining that point will often be a matter of intuition, conjecture, operating experience and market judgement.

*Simple messaging services* include simple e-mail, instant text messaging, remote login, simple web and Internet access, electronic shopping and business, electronic government and chat. These services can operate at the lowest bandwidths such as 256 kbps or 512 kbps, although they are considerably more convenient and enjoyable when enriched by higher bandwidths. Most users receive more than they send, so these services are compatible with asymmetric broadband (higher downstream than upstream capacity). These services can tolerate latency, or time delay to respond.

*Large file transfer services* are similar to messaging, but the messages contain larger quantities of data, perhaps 100's kilobytes or megabytes as opposed to the tens of kilobytes envisaged for simple messaging. They may be extensions of simple messaging services that need larger messages, for example rich-content Internet surfing, electronic catalogue shopping, remote healthcare, home working, remote working and business virtual private networks (VPNs). Large-scale file transfer services include downloading of games, software, educational material, films and other entertainment content. These services ideally require 1-2 Mbps or higher, if the user is not to be kept waiting too long. Large file transfer services are compatible with asymmetric links and can tolerate latency.

*Unidirectional real time services* are mainly broadcast services such as audio and video streaming, and radio and television broadcasting. These services typically require high (at least 1.5 Mbps for video) or very high bandwidths, and are inherently asymmetric. They can tolerate high latency as the data flow is one way only. For video on demand, downstream contention is not acceptable as the high bit rate is constant. For broadcast services, there is no problem in sharing bandwidth between all the people receiving the same thing.

*Interactive real time messaging services* operate between users who are communicating in real time one with another, for example for interactive gaming, tele-education and tele-presence. These services ideally require 1-2 Mbps or higher, need to be symmetric and cannot tolerate latency.

*Bi-directional real time services* include video-conferencing, interactive video, interactive gaming, integrated business telecommunications services supplied over a broadband link and wide area networks for businesses. These typically require high or very high symmetric bandwidths. They cannot tolerate latency.

### **2.3. Overview of technologies**

Broadband services can be delivered using various combinations of communications network technologies ("platforms"). These technologies can substitute or complement each other according to the situation at hand, but each type of technology has different features and a different impact on the overall network capacity and capability.

For the purpose of broadband deployment in rural areas, two principal features differentiate the various technologies. The first is their requirement for fixed transmission infrastructure:

- Some methods of transmission rely on a fixed, physical medium such as copper wire, coaxial cable, electric power supply line or optical fibre between each user and the point of presence. This may require new installation. Sometimes legacy (existing) infrastructure will suffice.
- Other methods do not rely on a fixed physical medium of transmission. These are essentially radio-based solutions.

The second feature is the distance ("reach") between the user and the point of connection to the existing public broadband network. This comprises the "local loop" link, which is the length of the connection from an individual user to the first aggregation point, plus the "back-haul" link from the first aggregation point to the public network connection point. In some cases it is possible to extend the reach of a technology by installing remote supply points with

an additional interconnection (“secondary backhaul”) between the remote supply points and the main point of presence.

- *Near-reach technologies* work over a few kilometres and are most suitable for “local loop” links. These will be applicable to some users in the rural environment, but will be mostly inapplicable in isolated communities.
- *Middle-reach technologies* work typically over a few tens of kilometres. These are applicable to large segments of the rural environment, though they can be restricted by geographical terrain, for example if radio propagation needs a line of sight path that is unobstructed by hills and forests. These middle-reach technologies may be used both for local loop and backhaul links.
- *Unlimited reach technologies* are fundamentally distance-independent and so can in principle serve almost any user. These include satellite and high altitude platform solutions. These may be used for local loop, backhaul and backbone links.

Table 2 gives a qualitative overview of the various technologies available for providing broadband access delivery according to the two features highlighted above. The reference list of commonly used acronyms is detailed in Table 3. A more comprehensive description of available technologies is annexed to the report (Annex 1).

		Near-reach <10 km	Middle reach 10 – 100 km	Unlimited reach
Fixed transmission medium	New infrastructure		HFC Optical fibre (FTTU)	
	Legacy infrastructure	ADSL, HDSL, VDSL PLC (low voltage network)	HFC PLC (medium and high-voltage networks)	
Non-fixed transmission medium		B-WLL unlicensed B-WLL 10-40 GHz (LMDS) W-LAN	B-WLL 2-10 GHz (MMDS) 3G Cellular radio WiMax W-LAN	Satellite HAP

**Table 2: Quality overview of broadband technologies**

Overview of technology solutions according to the need of fixed infrastructure (rows) and reach (columns)  <b>Acronym</b>	Explanation
3G	Third-generation (cellular radio), also known as UMTS
ADSL	Asymmetric DSL
B-WLL	Broadband WLL
CATV	Cable television
DSL	Digital subscriber line (family of technologies ADSL, HDSL and VDSL)
FTTB	(Optical) fibre to the building
FTTC	(Optical) fibre to the cabinet
FTTU	(Optical) fibre to the user
HAP	High altitude platform
HDSL	High bit-rate DSL
HFC	Hybrid fibre-coaxial cable (a CATV distribution system)
LAN	Local area network
LMDS	Local multipoint distribution system
MMDS	Multipoint multichannel distribution service
PLC	Powerline communications
UMTS	Universal Mobile Telecommunication Systems
VDSL	Very high speed DSL
W-LAN	Wireless LAN
WLL	Wireless local loop

**Table 3: Acronym list for broadband technologies**

## 2.4. Comparison of costs for broadband access technologies

The Commission services launched a study<sup>19</sup> to analyse the cost factors of a number of single technology and hybrid technology broadband solutions. The cost factors are applied in three rural community scenarios (an isolated scenario, a scattered scenario and a small town scenario). These scenarios are not accurate models of any particular location or European region, but simple tools for technology comparison. Table 4 summarises the reference scenarios.

	SMALL TOWN	SCATTERED	ISOLATED
<b>Backhaul distance from point of presence to main network node (km)</b>	10	25	60
<b>Mean loop length from point of presence to user (km)</b>	1.5	4.5	15
<b>Number of user dwellings taking the service</b>	80	40	20

**Table 4: Definition of reference community scenarios**

- **The small town scenario** is a clustered community in a rural area 10 km from a larger town, where 80 users take broadband services and a majority are within the near-reach distance of the point of presence
- **The scattered scenario** is a more scattered community 25 km from a larger town, where 40 users take service. Some are within the near-reach distance of the point of presence.
- **The isolated scenario** is a remote area with isolated dwellings whose centre is some 60 km from a large town. 20 users in this area take service. No (or hardly any) dwellings are within the near-reach distance of the point of presence, though most are within the middle-reach distance.

In terms of technology comparison, the main difference between the three scenarios lies in the necessity of the backhaul, currently unlikely to exist in the isolated scenario. Here, the distance of most users from the point of presence excludes many cheaper solutions such as DSL and Wireless Local Loop (WLL) (because of insufficient reach) and cable modem (because cable networks are rarely established in rural areas). It also excludes new built fibre to the user, whose cost reflects a green field situation and includes civil works and new ducting. The study finds that in the isolated scenario the cheapest solution is a bi-directional satellite solution (Annex 2, Table A1), although of limited performance (512 kbps downlink and 128 kbps uplink with contention and with low evolution potential). Employing the new radio Wi-Max technology, in which self-backhauling could reduce the costs of the backhaul as sometimes claimed, could provide a better scalable solution than satellite. However, the satellite solution for isolated scenarios becomes particularly attractive if large demand

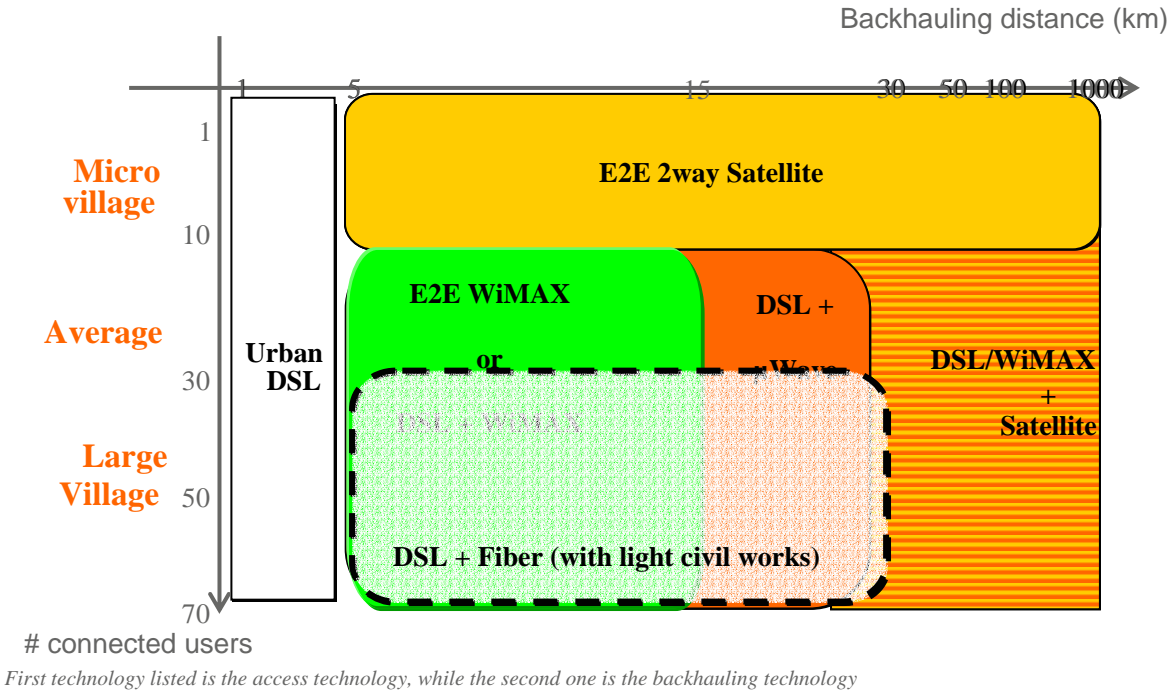
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<sup>19</sup> John Buckley (2003), "Alternatives for extending broadband coverage to under-served EU regions in the context of the Digital Divide Forum", annexed to this report.

volumes can be exploited. Any costs that may arise in relation to the licensing and use of radio spectrum have not been included in the analysis.

Details of comparison between costs can be found in Annex 2.

In the scattered village and the small town scenarios, ADSL, Wi-Max and B-WLL appear as the most promising solutions (Annex 2, Tables A3 to A6). These results are similar to the conclusions provided by the Second Section of the eEurope Advisory Group (Figure 10), which plots the most efficient technologies according to remoteness (summarised by backhauling distance) and population density.



Reference price is the cost to deploy DSL in urban areas (min 200 users/DSLAM) for a competitive operator (local loop unbundling in line sharing mode)

**Figure 10: Best performing technologies according to remoteness and density of population**  
**Source: eEurope Advisory Group Second Section, calculations by Alcatel.**<sup>20</sup>

While a mix of technologies is likely to be the relevant solution for most of the European territory, satellite solutions are the cheapest (and sometimes the only) option in isolated areas. This same conclusion is reached by the PWC study, by that launched by the Commission services and by the Second Section of the eEurope Advrsory Group. The advantage of satellite solutions clearly lies in the provision of the backhaul at no extra cost, but its total costs are very sensitive to demand volumes.

Key issues in the consideration of satellite broadband will be the cost trends for satellite services themselves and the likelihood that newer technologies will challenge satellite for providing cost-effective services in rural areas. Volume manufacturing can give satellite solutions a much more attractive price positioning. Taking as an example asymmetric service

<sup>20</sup> These calculations were provided by the Report of the Second Section of the eEurope Advisory Group annexed to this report. Costs differ in absolute terms from those provided in Annex 2, but the ranking is similar. These calculations do not take into account PLC nor UMTS.

at 512 kbps to the user and 128 kbps from the user, the present value of the costs of five years' service are currently €13,500 per user, but would fall to €3,000 given a volume of 300,000 units. This looks very respectable against other possibilities in the isolated scenario, though there are other options in a similar price range in the scattered scenario, and significantly cheaper options in the small town scenario.

These conclusions are relevant for the current costs and technologies. Continuous product and process innovation are likely to affect the optimal mix of technologies as time evolves. Forecasting the extent of innovation and commercial deployment remains a difficult task.

## 2.5. Conclusions

No specific technology option will offer the best connectivity in all situations. The optimum is often achieved by a combination of technologies and hybrid solutions. Finding the right mix of technologies and applying them to a given situation remains a difficult task. Many factors have to be taken into account when assessing the technologies that have the greatest capability to serve rural and remote areas. These factors include geographical topographies, remoteness, costs, existence of alternative infrastructure, medium or longer-horizon perspectives by the relevant authority, etc. For these reasons, technological choice is best implemented at the local level.

The PWC report stresses that, overall, most urban users, whether businesses or consumers, will be served by ADSL and cable modem (where available) as equally optimal solutions for medium speeds. As the infrastructure becomes established, optical fibre will be taken increasingly closer to the end users' homes and premises, providing an optimal solution for high speed services. Where urban users have affordability issues or roll-out is patchy, wireless services may bridge the gap.

ADSL is often the optimal solution in rural areas too, in particular given continuous innovation in extended reach. Consumers in difficult topographical environments or sparsely populated areas will adopt radio technologies. In remote areas with very few potential users even radio technologies will be available only through demand aggregation schemes. These may involve either self-backhaul or satellite backhaul.

Satellite services are likely to be optimal in very isolated areas, in areas with difficult topographies, or as a medium-term provision when terrestrial roll-out is uncertain. According to the PWC report, a combination of existing and new satellites could serve about 2 of the 4.7 million would-be users estimated to be beyond the commercial rollout of terrestrial services.

Although satellite systems are very efficient for delivering broadcast services and wide-area coverage, they have struggled to enter the market for two-way broadband services. This is a function both of the amount of spectrum available to them and of their costs. Being expensive also affects their scalability. The satellite industry is responding to these limitations by introducing new capacity at Ka-band. Satellite is expected to develop more attractive services when the next generation of advanced satellites is brought into service. The Second Section of the eEurope Advisory Group makes the following recommendation:

*“A Pan European initiative for very sparsely populated areas with less than 20 users to assure broadband coverage via satellite. The European Commission can play an important role in aggregating demand, with public support to be sought at different levels (SF, national and local funds).”*

Given current technologies, satellite appears as the cheapest solution in areas characterised by long distance from the backbone when the backhaul is not available. The expansion of satellite services into the broadband access sector is held back by several factors, most of which are a function of the small scale of its existing market base. The most important obstacles are probably a distribution network that is still in its infancy and the lack of competitively priced two-way services. Price is a significant constraint, but costs could be brought down by demand volumes, achieved for example through the aggregation of a certain number of users.

The proposition on a Pan European initiative has not received overwhelming support by some Member-State representatives within the eEurope Advisory Group for the following reasons: (1) an initiative on satellite violates the technology-neutral principle; (2) the best technological choice is made at the local level; (3) satellite capacity is limited as well as speed and scalability; (4) the potential of emerging technologies such as Wi-Max and PLC could be undermined; (5) local authorities may prefer to spend more and purchase roll-out of future-proof high-speed networks or scalable technologies.

New initiatives would need to be compatible with technological neutrality and would have to take into account regional prerogatives and local needs. Support could be envisaged to help reducing users' costs for satellite services, but should be limited to areas where a technology (e.g. satellite in very sparsely populated areas) is the only solution or where it is considered to deliver the best price/quality ratio.

The proper identification of these areas requires detailed regional and local mappings, and can only be achieved through the active support of the appropriate authority at the national/regional/local level. One main caveat relates to the fact that launches of projects are rarely synchronised, and this could hinder the exploitation of scale economies for users' equipment. Uncertainty about the way the market would be split among operators could also make it difficult for the operators themselves to make an offer on the basis of their costs. Finally, a centralised call for tender is not compatible with local funding and may bring about significant competition distortions. Because of these reasons, the Commission services privilege a more regional and local approach to demand aggregation.

Finally, costs relating to Wi-Max and PLC are still uncertain. However, both these technologies are expected to provide an important alternative in rural areas. Trials of Wi-Max and PLC are currently underway. Powerline Communications based on the existing electrical grid has the potential to offer broadband services using cabling and other infrastructure currently providing electrical power. The main commercial PLC networks are found in Germany, Austria and Spain, with tens of thousands of costumers. Deployment, however, has been slowed down by uncertainty about the rules governing this market, in particular in relation to electromagnetic compatibility. A Commission Recommendation<sup>21</sup> (issued in February 2005) aimed at removing regulatory obstacles by detailing how to apply the provisions of the electromagnetic compatibility directive. The Recommendation is compatible with existing legislation and with the new directive that will take effect in mid-2007.

PLC, satellite, Wi-Max and UMTS are considered particular promising to ensure coverage in the new Member States, where the fixed line penetration is particularly limited (see Section

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<sup>21</sup> COM(2005) 1031



1.6). The barriers to broadband deployment in those areas are high, as new local loop infrastructure requires substantial investment. By contrast, Wi-Max is relatively cheap and satellite offers wide coverage; PLC could exploit the electricity grid that reaches almost 100% of population, and UMTS the local high propensity toward fixed-to-mobile substitution.

**Continuous innovation and uncertainty about costs in broadband technologies makes estimates of commercial deployment difficult to forecast.**

**The optimal mix of technologies for under-served areas depends on local geography (distance from the point of presence), topography and demography (density of population and/or assessment of demand). For these reasons, technological choices should be made at the local level.**

**The current EU policy framework does not dispose of a direct mechanism to aggregate demand at the EU level. However, the Commission services intend to investigate the feasibility of a panEuropean initiative that may bring satellite services at lower price to those communities where satellite is the only available option**

### **3. CHAPTER 3: EXAMPLES OF GOVERNMENT INTERVENTION**

This chapter summarises some examples of broadband projects undertaken in various countries as a result of the implementation of national broadband strategies. Projects involve deployment of various technologies and spell out schemes and approaches that may be of interest for other national/regional/local authorities. Some of these projects have been notified to the Commission for state-aid analysis, and a summary of the case-law currently under construction is provided in the second part of the chapter.

#### **3.1. Implementation of National Broadband Strategies for rural coverage**

This section looks at examples of government intervention aiming at the increase of coverage in under-served areas. The first example concerns Northern Ireland. The example was singled out because of the design of the open tender, setting criteria for equitable and affordable prices throughout the region on the basis of a technology-neutral approach. The second example, Castilla-La-Mancha, is noteworthy for its flexible approach addressing the experimentation of new technologies.

Three country-cases provide examples for the implementation and evolution of national broadband strategies. The Swedish initiative is remarkable for its approach based on open infrastructure, capable of stimulating competition at the service level. The French example is an interesting update of the national strategy on the territorial digital divide with well-specified targets.

The Italian “National Executive Broadband” provides a balanced approach to the development of infrastructure and services while avoiding duplication of efforts. Where feasible, it privileges the use of the most modern, reliable and future-proof infrastructure, open to all operators on a non-discriminatory basis.

The Hungarian national strategy is a good example of a well-specified plan designed for the needs of a new Member State. The strategy features an integrated approach to broadband development as the enabling infrastructure for the information society, supporting the country’s competitiveness objectives and its social cohesion.

##### *3.1.1. Northern Ireland*

Broadband action in Northern Ireland (NI) seeks to fulfill the UK aim to be the most competitive region in the G7 by 2005. The NI government target is cost effective broadband services for all. The Department of Enterprise Trade And Investment (DETI), through its Telecommunications Policy Unit, has focused its activities on developing local access to achieve the target.

DETI has set the following targets in relation to broadband in NI:

- To be the leading broadband region in the UK
- To be the first region in the UK to have 100% coverage of broadband services
- 100% broadband access with a minimum of 512 kbps for all households and businesses by end of 2005

- 12% of household broadband take-up and 20% of business take-up by end of 2005
- 100% broadband availability at 2 Mbps at cost competitive prices by end of 2006.

**“Building Sustainable Prosperity Programme”:** The Structural Fund programme “Building Sustainable Prosperity Programme” places particular emphasis on ensuring that communications infrastructure and services are of the standard that a modern information society requires in order to promote competitiveness, enterprise, innovation and creativity. Under the Programme, the Northern Ireland Executive’s entrusted funding to the DETI to take this strategy forward and to secure more equitable access to broadband services for users across all of NI.

The programme includes a measure on Telecommunications with a budget of €3.33 millions, 75% of which dedicated to a basic infrastructure project. The measure foresees four strategic directions for the provision of broadband telecommunications services:

- support the provision of broadband access where necessary
- educate the user about the benefits of broadband services
- represent the concerns of e-business and
- increase competition in the market.

The overall objective of the project is to promote equitable and comprehensive access to broadband services across Northern Ireland according to a minimum of standards of broadband service and a set of requirement including user price, coverage, viability (technical and financial), timescale, wholesale offerings, etc.

Respondents to the call for tender were asked to offer a single price (taking into account DETI financial support during 5 years) at which the contractor would guarantee broadband service delivery to at least 95% of the population by 31 December 2005.

The project adopted a technology neutral approach by placing no restriction on the technology that could be employed. The winner would be requested to provide the service to wholesale buyers at the same price, regardless of their location in the country. Under the resulting contract the contractor would be required to provide the broadband service for a period of five years from the start of contract and meet a minimum of service requirements: including Asymmetrical service, Minimum Data Rate, Downstream: one-half of a megabit per second, Upstream: one-eighth of a megabit per second, Contention Ratio.

Proposals were assessed in terms of the best value for money and from the perspective of cost reduction structures and the sharing of benefits reflecting the development of the market for the broadband services provided by the would-be contractor.

DETI published a Prior Information Notice (PIN) in the Official Journal of the European Union on 7 May 2003 to inform private sector companies of a tender for the provision of broadband services. As a result of the PIN DETI approached many telecom operators operating in the marketplace and came to the conclusion that the delivery of broadband to 100% of Northern Ireland was both realistic and achievable.

A tender was subsequently published in the European Journal on 22 July 2003 seeking the provision of broadband services for up to 100% of Northern Ireland's population and with the intention that the provider of the broadband services would retain ownership of the infrastructure and that the contract would be constructed to contain a sharing of risk and benefit between the public and private sectors.

On 22 August 2003, the 6 respondents shortlisted (out of the 27 initial respondents), were invited to negotiate further. The award of contract was announced and awarded to British Telecom (BT) on 29 March 2004.

BT has indicated that it will have enabled all of Northern Ireland's 191 exchanges (ADSL technology) by March 2005, reaching approximately 90% of the population. To date some 87% of the population here has access to broadband. The remaining homes and businesses will be given access to broadband by December 2005 by a wireless broadband technology.

### *3.1.2. The broadband initiative by the Region of Castilla-La Mancha*

Castilla-La Mancha aims at improving regional competitiveness by enabling regional enterprises to market, promote and publicise their products and services through access to broadband networks. The regional broadband initiative is expected to cater for the needs of home users, institutions as well as companies irrespective of their geographical location. The use of satellite, wireless, PLC as well as cable technologies is expected to tackle the digital divide affecting small population centres and sparsely populated and remote areas.

***The Nerpio-Sat project:*** Nerpio, a town council of one thousand inhabitants situated in the province of Albacete, has given name to one of the most ambitious projects through which the regional government of Castilla-La Mancha aims to extend the advantages of the Information Society to 100% of the citizens of the region. The Project Nerpio-Sat (started in 2002) aims to supply satellite Internet access up to 1,800 population centres which cannot be reached by wireline infrastructures .

Through the Nerpio-Sat project the Government of the Castilla-La Mancha is subsidizing city councils with difficult access to broadband services to establish an ADSL equivalent to Internet access through satellite and wireless networks. Since 2003 the regional Council of Science and Technology has been contributing up to €2,000 to the financing of the necessary equipment for satellite connection and the transmission of data and images, for each population centre, including the most isolated ones. The regional operator (Telecom CLM) collaborates with this initiative through the financing of equipment necessary to access the network system via satellite.

The Project Nerpio-Sat foresees two-way Internet access combining satellite with wireless network systems. The installation of a medium-sized satellite dish and reception and transmission equipment in key sites of these population centres together with the small antennas and modems will enable users (located up to few kilometres away) to access broadband Internet through a number of base stations. The technological platform is based on the DVB-RCS standard and enables Internet access with a 2 Mbps downstream and 512 kbps upstream connection.

By installing a USB card in Desk Top PC, portables, electronic personal agendas or PDA, users can access cultural, news, economic, employment and leisure services, as well as e-

government, public databases, broadcasting, security or emergency services. The project is already operational as a pilot in some populations centres.

In the attempt to catch up with recent technological developments and to respect the principle of technological neutrality, in March 2004 the region has opened the possibility for the NERPIO-Sat project to subsidise broadband access through any other technology that can satisfy the criteria of quality and service established in the original call. As from the 25<sup>th</sup> of March 2005 the Regional Council of Science and Technology will be subsidising each municipality through an amount included between €1200 and €2400 (for the most isolated areas) for the installation and equipment necessary for accessing broadband Internet service.

**Cable project:** In 2004 Castilla-La Mancha has also launched a new broadband service through cable. It aims to the provision of the same kind of integrated services of voice, fixed telephony, access to high-speed Internet to and a multitude of television channels already enjoyed by the citizens of Albacete (one the of the European cities with highest cable penetration). A public call for concession of the provision of communication services via cable (awarded to the company Cableuropa) foresees the provision of these services to population centres with more than 40.000 inhabitants. The initiative foresees an investment of €345 million in ten years and is expected to create 380 jobs.

The next phases foresee the coverage of population centres between 20.000 and 40.000 inhabitants within the next three years; the coverage of town councils between 10.000 and 20.000 inhabitants (thereby reaching 50% of total population) within the next five years; the coverage of the rest of town councils below 20.000 inhabitants within the next seven years.

**PLC project:** In order to achieve an even greater broadband penetration, the regional Council of Science and Technology, in collaboration with the electrical company Iberdrola, have started a pilot project aimed at testing Internet access through PLC in “La Puebla de Montalbán” in Toledo at conditions (in terms of price and quality of service) similar to the ones provided by ADSL technology.

### 3.1.3. France: New CIADT plan

The new CIADT<sup>22</sup> plan presented in September 2004 confirmed the principles and the objective of the French broadband strategy. The plan includes a Government commitment to provide broadband to all the municipalities at affordable price, in particular in areas unable to attract private investment. The objective is to reach 10 million broadband subscribers by 2007.

**Market developments:** At the end of June 2004, about 5 million individuals and organizations had taken up broadband. This corresponds to a penetration rate of 8.4%, well above EU average. These numbers reflect a significant rise in broadband subscribers during the first half of 2004. Growth has been mainly driven by a significant increase in the unbundled local loops, bringing about reductions in prices and increases in capacity. During this time, the first triple-play offers came into the French market.

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<sup>22</sup> Comité Interministériel pour l'Aménagement Du Territoire

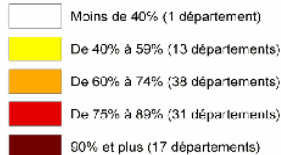
In June 2004, around 84% of the population had access to DSL, a five percentage point increase in six months. Large under-served areas remain. The plan estimates that even a 95% broadband coverage would leave more than 15,000 small municipalities unserved.

## ORTEL

### Taux de couverture, par département, de la population en ADSL France Télécom

Fin Juin 2004

Source France Télécom  
Réalisation cartographique ORTEL

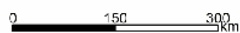


Population desservie en ADSL France télécom	Population <sup>(1)</sup>
Couverture totale et partielle	82,31%

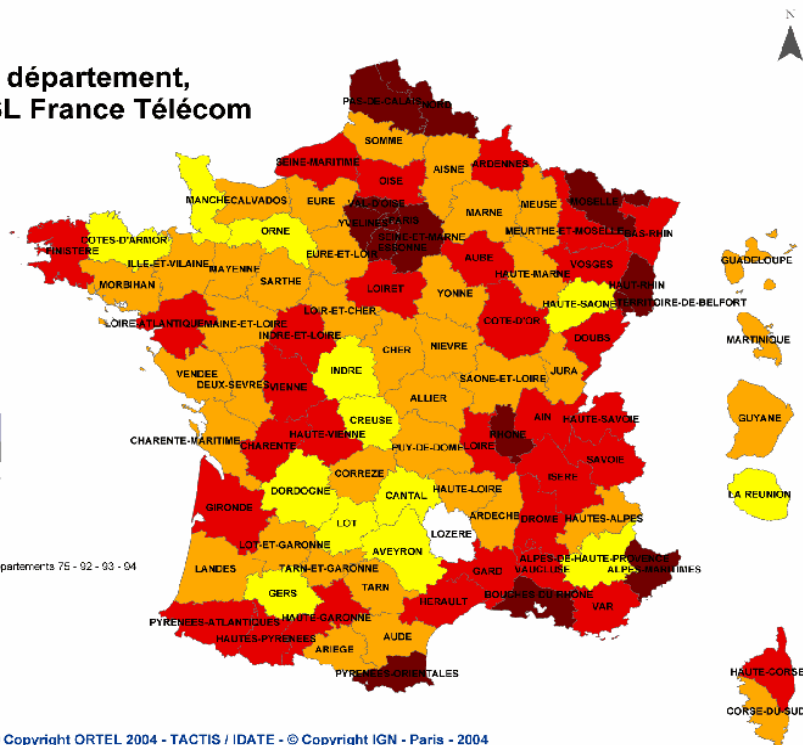
Source : France Télécom - Direction des Réseaux au 30/06/2004

Tratament ORTEL - Hypothèse de calcul pour le service DSL  
Couverture totale: 99% de la commune pris en compte  
Couverture partielle: 40% de la commune pris en compte  
30% de la commune pris en compte pour les départements 75 - 92 - 93 - 04

<sup>(1)</sup> Population - Source INSEE Recensement 1999



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www.ortel.fr



**The CIADT plan:** The plan sets ambitious aims: A 2005 target of broadband coverage of 500 kbps for at least 96% of the national population and at least 70% of the population of each department; enabling a 2 Mbps Internet access to 85% of individuals in France.

A set of targets for 2007 are:

- Enterprises in the main development areas should be able to benefit from broadband services up to 100 Mbps at reasonable cost;
- Each municipality must be able to offer 2 Mbps Internet access to 80% of its inhabitants. Where population density allows it, 5 Mbps access rate must be offered, enabling the delivery of the full set of broadband services.
- Small isolated municipalities (not covered by ADSL) will be provided with Internet connection to the town hall and in another public Internet access point.

The plan identifies a number of measures:

- Direct support to alternative technologies: It includes a €5 million call for proposal for projects experimenting alternative technologies and a €6 million project on Internet usage with an extra €2 million for the 2005-2006 period.

- Pulling knowledge on infrastructure: An on-line database updated by ORTEL<sup>23</sup> on geographical mapping of broadband networks, including reference to local initiatives.
- Strengthening regional broadband action: Regional government offices will organise actions to facilitate local authorities' delivery of broadband services, including advice on public/private partnerships and actions ensuring synergy with other information society measures.
- National fund in support of broadband: A national fund for the support of broadband for the 2004-2007 period will accompany local broadband initiatives. €100 millions have been earmarked from Structural Funds.
- Support for telework and telecentres: Call for projects supporting telework and the creation of telecentres with a €3 million fund over three year (€2.7 million for the building of telecentres within enterprises and €300,000 to support teleworkers).
- Supporting Enterprise's ICT ownership: A € 1 million fund supporting the integration of ICT in enterprises and SMEs in particular.

***The Law for the Digital Economy (LEN):*** The recently approved LEN includes an article enabling local Authorities to become operators. The law stipulates that the local authorities and their groupings can provide telecommunication services to end-users only after having noted an "insufficiency of private initiatives" able to satisfy the needs of the end users and having informed the National Regulatory Authority. This "insufficiency of private initiatives" has to be made evident by a call for tender declared unfruitful, and officially recognized as such by the national regulatory authority.

#### 3.1.4. Sweden

The Swedish Government considers that households and businesses in all Sweden should have access to high-capacity IT infrastructure (broadband). Although expansion of broadband network will mainly be market driven, overall responsibility for ensuring that the infrastructure can be accessed from all parts of Sweden rests with the State.

The Swedish broadband funding is meant to stimulate broadband expansion in rural areas, including thinly populated localities, where the market will be unable to sustain this expansion. Rural areas, defined as areas outside urban centres with at least 3,000 inhabitants, account for approximately 30% of total population. Most local authorities (270 out of 290) are characterised by sparsely populated areas and could therefore apply for government funding. A total of SEK 4,150 million has been earmarked for the period 2000–2005. The measures are aimed at all parts of the network hierarchy, which for purposes of simplicity may be divided into four levels: the national backbone, the regional network, the local network and the access network.

The latest plan for distribution of funds is the following:

- SEK 400 million for a national backbone network

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<sup>23</sup> Observatoire Régional des Télécommunications

- SEK 2,050 million for regional networks (1,900m) and administrative support (150m)
- SEK 1,200 million for local networks
- SEK 500 million to be used for any network hierarchy in strongly under-served areas

**Conditions for use of broadband funding:** Detailed conditions for broadband funding are drawn up in five Governmental ordinances<sup>24</sup>

- Each local authority must draw up an IT-infrastructure programme;
- Funding should only be used
  - for network prioritised for regional development
  - in areas with no market players (less than 3000 inhabitants)
  - after a procurement process (an open call for tender)
  - to establish an operator neutral network with high transfer capacity in both directions. It should be possible to transfer multimedia services with high quality in both directions.
  - Under the condition that the local authority meets part of the cost.

In addition, economic assistance from the Structural Funds and national regional policy programmes (worth a total of SEK 575 million) will be used for the development of broadband infrastructure. The Budget Bill for 2004 proposes that funds be redistributed so that SEK 500 million of the SEK 1,600 million originally earmarked for access networks are transferred to the network expansion programme.

**Current progress:** Approximately 200 local authorities have broadband projects running at different stages in the process.

<b>Total financing broadband projects 31 May 2004</b>	
<b>Actors</b>	<b>Percent</b>
Operators	24
Local authorities	13
Government funding	53
Structural Funds	10
Others	0,1
<b>Total</b>	<b>100</b>

<sup>24</sup> Ordinance no: SFS 2000:1469, 2001:349, 2001:350 , 2003:62, and 2004:619



The Swedish open access model segments the telecom industry into horizontal layers: Infrastructure is separated from services and content, and the infrastructure is openly available to all operators that have a license to provide services. The infrastructure can be owned by (local, regional or national) government, the private sector, or any mix or consortia. The model is applicable on rural or urban situations, and on local, national or international levels. This business model is widely used in Sweden amongst municipal networks - i.e. urban networks, mostly owned by a city community, providing broadband services to the private sector and individuals via a range of operators.

### 3.1.5. Italy

The “National Executive Broadband Programme” intends to provide a favourable environment for ICT investments through a balanced approach towards the development of broadband infrastructure and services.

The programme comprises of:

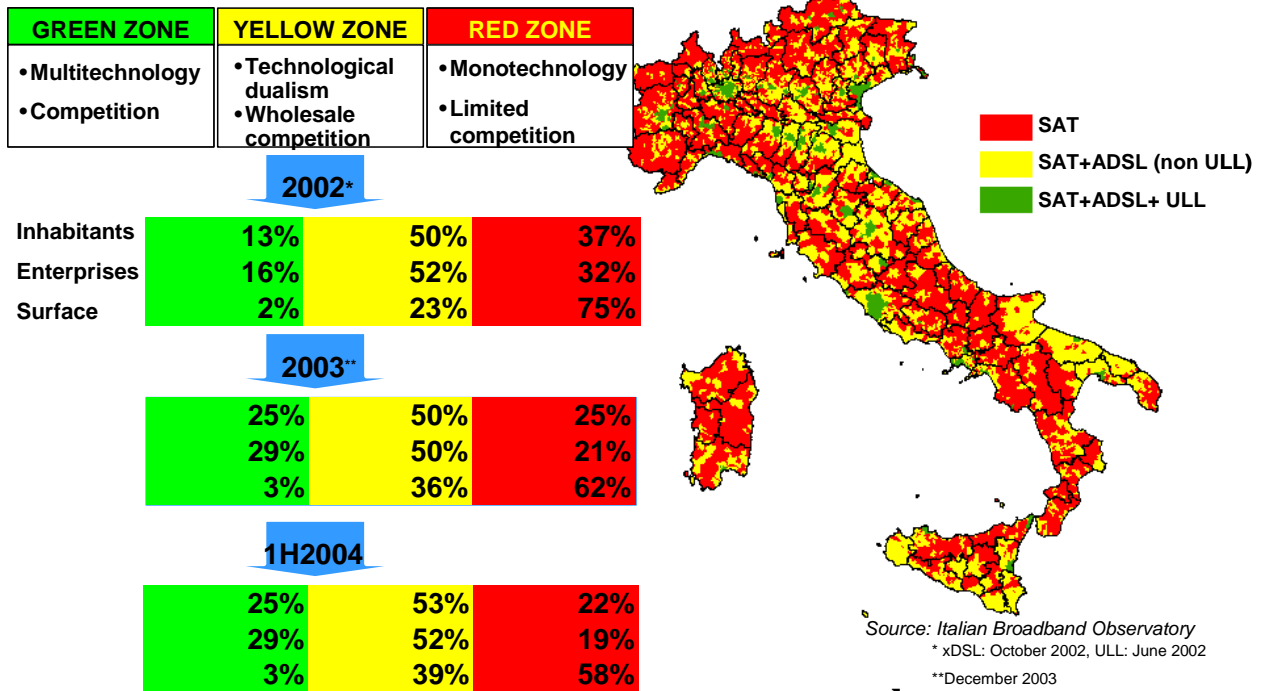
- The building of a broadband network for public services: “Public Connectivity System”, enabling the exchange of information among all Public Administrations (central and local government), citizens and enterprises with high-quality and security.
- An increase in broadband connected schools
- The stimulation of private demand through incentives for the use of digital technologies
- Facilitation measures for infrastructure building

The programme foresees an overall investment of €1,930 million of which €1 billion for the stimulation of demand and services and the rest for infrastructure (including a public contribution from local/regional funds and private investors). The first-stage implementation of the national programme includes two sub-programmes. An infrastructure programme run by *Infratel* (a company set up by the Ministry for Communications) with a funding of €150 million. A demand-support programme (promoting the implementation of high added value applicative multimedia services), run by *Innovazione Italia* (a company set up by the Ministry for Technological Innovation) with a funding of €150 million.

***The digital divide in Italy:*** A recent investigation from the Italian Broadband Observatory (a project monitoring the development of broadband in Italy) has revealed that around 4,400 out of 10,400 local exchanges are not connected to the backhaul broadband infrastructure.

## The Evolution of the Digital Divide in Italy

Source: Italian Broadband Observatory, 2004



This evaluation has also estimated that closing the digital gap will require an investment of €1.8 billion for connecting the remaining 4,400 local switches to the broadband backhaul, and around €1.1 billion for service provision (upgrading switches and network) for a total of €2.9 billion to be realised within 2-3 years. The investigation revealed that while an average of 76% of the Italian population can access ADSL services, the average is significantly lower in the Mezzogiorno regions (coinciding with the Objective 1 areas), with examples of 54% accessibility in the Southern region of Calabria, 48% in Basilicata and 64% in Abruzzo.

**Recent Developments: Main features of INFRATEL Operative Action Plan:** Infratel's own investigation, which aimed at verifying broadband ADSL availability on Fixed Telecom Italia infrastructure for all 8,101 Italian municipalities, revealed that at May 2004 5,951 municipalities (24% of the population and 22% of enterprises and public administrations) do not have access to ADSL.

INFRATEL's action plan is based on the following *approach*:

- Avoid duplication of investments by reusing existing infrastructure as much as possible;
- Use the most modern, reliable, future proof, technologies;
- Open the use of infrastructure to all operators and to public administrations interested without discrimination

- Identify pilot projects in Puglia, Basilicata, Calabria, Sicilia, Defence Ministry and industrial districts (based primarily on the verification of demand for broadband);
- Identification of modalities of collaborations with partners and local users
- Definition of action lines for the 2004 budget and business plan for 2005-2008

Infratel is currently developing an operative model aimed at attracting additional resources from a variety of sources including regions, local branches of the public administrations, telecom operators, private enterprises and Innovazione Italia. All Information Society actions (strategies and programmes) are expected to be agreed and implemented by central and regional/local government through specific framework agreements.

The first call for tender, published by Infratel on 22<sup>nd</sup> of March 2005, foresees an investment of €127 million for the building of 1800 Km of optical fibre network, including 600 Km of MAN (Metropolitan Area Network) covering 30 major cities and a backhaul infrastructure connecting 265 municipalities (currently without broadband service) with the backbone network.

### 3.1.6. *The Hungarian National Broadband Strategy*

The primary objective of Hungarian "National Broadband Strategy" is to make broadband electronic services available to the population, enterprises and public institutions. Its aim is to support the spreading of ICT communications, increase the supply of content, improve the country's competitiveness, strengthen social cohesion and help in the development of the information in Hungary.

ESTIMATED TOTAL RESOURCE NEEDS OF THE EHUNGARY PROGRAM UNTIL 2006 (IN MILLION HUF)

EU Resources	Local resources		Total resources	Local	Grand total
	Public	Private			
6000	9200	4800	14000		20000

Source: eHungary Points, Information Society of Small Communities (HISS, Strategy Program Booklets series)

The National Broadband Strategy has three main strategic objectives:

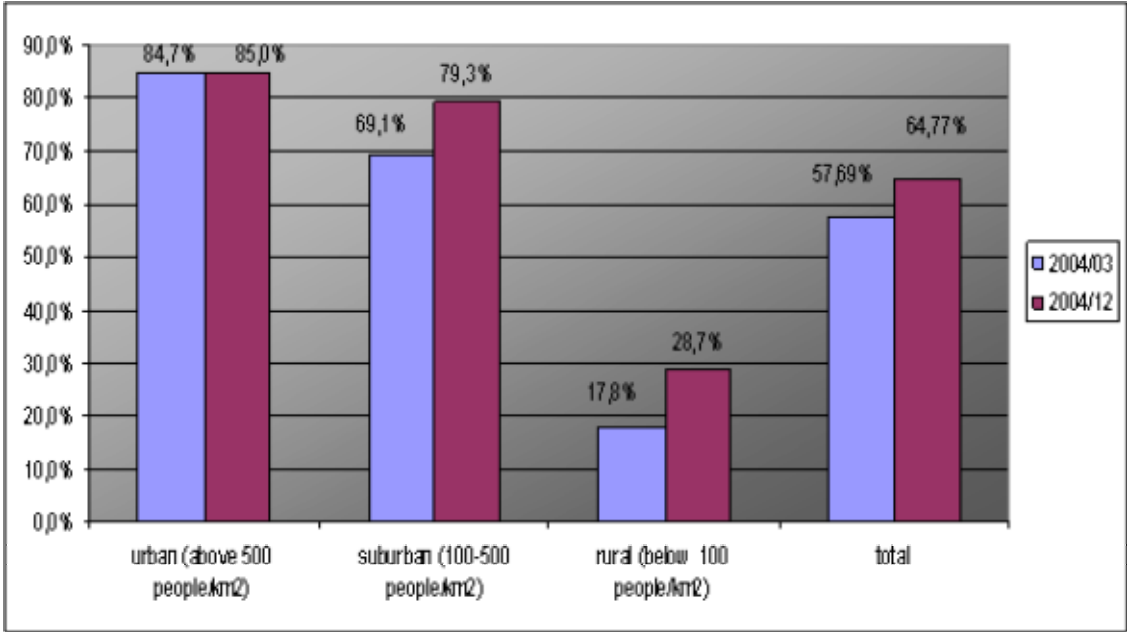
- Broadband coverage for the citizens and enterprises
- Broadband public access points for municipalities
- Broadband access for the public sector

**Market developments:** As of March 2004, 265 of Hungary's 3,200 municipalities have ADSL coverage – making ADSL available to some 58% of the total population. ADSL coverage significantly depends on the size of a given municipality. As of March 2004, three quarters of the households in Budapest and over 80 % in other towns and cities with a population over 10,000 had access to ADSL. In contrast, in smaller towns and villages ADSL coverage

decreases in direct proportion to the size of the municipality. In villages with a population of less than 2,500 (i.e. the municipalities where 20% of the country’s population live) ADSL coverage is only 3%. Larger towns and cities are also better off from the point of view of competition: only municipalities with a population of over 10,000 stand a real chance of having technological competition through the availability of cable modems.

Hungary’s low availability in rural areas is partly caused by bottlenecks in the telecom infrastructure and by insufficient demand (due to customers’ low purchasing power). Coverage has recently been improving and some ongoing projects are expected to increase residential ADSL coverage by eight percentage points (bringing it to 64 %) by the end of 2004. Even though the most impressive development is expected to take place in municipalities with a population below 10,000, a significant difference in service availability between rural and urban areas is expected to continue.

**Expected changes in ADSL coverage in 2004 by population density**



Source: National Broadband Strategy

**The National Broadband Strategy**

**(a) Broadband coverage for citizens and enterprises**

The strategy aims at providing affordable broadband services to over 80% of the population and to over 90% of SMEs by 2006. Some of the most significant actions under this objective include a new “*electronic communication act*” (in force since 1/1/2004), a new frequency band for wireless broadband service, a tax concessions for broadband access, the launch of funding schemes supporting innovative and technology intensive infrastructure developments.

Priority 4.4 of the OB1 Hungarian Operational Programme on Competitiveness (part of EU structural funds 2004-2006) will also contribute to this objective. The purpose of the program (10.48B HUF) titled “Support of Construction of Broadband Networks by Small and Medium-size Enterprises in Poorly Developed Regions”, is to increase broadband Internet

penetration in small towns and villages (i.e. those with a population of less than 15,000), currently underserved and unattractive to private investment.

**(b) Broadband public access points for municipalities**

This strategy aims at finalising the operational framework, the base infrastructure and the organisational background for the community access points ("eHungary" points) in the course of 2004. The aim is to provide 2700 broadband "eHungary points" by the end of 2004 and 4000 by the end of 2006.

In terms of public access points, Hungary is currently at the top among new EU member states and average within the whole of the EU. Public Internet access points provide a permanent broadband Internet connection, in buildings accessible by disabled, using the assistance of trained assistants, free of charge or at reduced tariffs.

**(c) Broadband access for the public sector**

By the end of 2004 small regions and towns will be surveyed and classified, identifying those where major state intervention is required to establish state-of-the-art broadband infrastructures. Actions under this objective include the "Közháló" program, which will consider demand aggregation and aim at the following goals:

- Provide broadband access to towns and villages by end 2006;
- Connect all public institutes and private non-profit organisations working for public goals by end 2006;
- Launch model (local and small) regional network deployment programs.

In the first phase 7,300 public access points (endpoints) will be connected to the Public Network ("Közháló"), which will offer market services by the third quarter of 2005. In the course of the second phase (local and small regional) *network deployment programs* will be launched in areas with poor infrastructure development. In the third phase, full national broadband network coverage will be reached and isolated networks will be connected, using the experience gained in the course of model programmes.

### **3.2. State-aid rules and public support to broadband projects**

Since December 2003, the European Commission has given its approval to seven cases on public funding of broadband projects in under-served areas that had been notified to the Directorate General on Competition. These cases are summarised in Annex 3. The case law is currently limited, but there is a general perception that public intervention in the area of broadband may take various forms with different implications in terms of impact on competition.

Today, next to 'black areas', where demand is sufficiently high to support competitive supply, there may be 'grey areas' where the network is controlled by a single operator refusing access to its basic infrastructure. Finally, there are 'white areas' with no broadband supply at all.

The fact that an operator refuses access to its infrastructure may seriously restrain competition. Ex-ante access regulation of wholesale broadband access addresses some of these issues. However, effective competition is not yet ensured in all markets.

Although individual projects differ widely in the details, the projects assessed by the Commission so far<sup>25</sup> can be broadly classified in two main categories: infrastructure projects and projects involving end-to-end services provision. The following description is based on the cases analysed so far.

In a typical case of infrastructure project, public authorities may want to support the creation of an infrastructure (for instance ducts, masts, collocation sites, dark fibre) which is made available to all operators on non-discriminatory terms. Typically the infrastructure is owned by the state, but its management is tendered out to an independent company that offers access to service providers. They, in turn, will supply broadband serviced to final users.

In the case of projects involving end-to-end services provision, the selected bidder would normally have both to make the necessary infrastructure available to third parties providers, and to offer itself the retail service to the end users. It is left to the selected bidder to choose between leasing or building the infrastructure necessary for the delivery of the required services. The assets would typically be owned by the selected bidder.

In general, the level of distortion of competition goes from very low in the provision of passive infrastructure to very high in the exploitation of the network to provide services to the end-users, passing through an intermediate level of distortion consisting in the provision of active infrastructure (for example, lit fibre or satellite). Indeed, deployment of passive infrastructure is capable to generate platform competition at the level of the services. In the other cases, this effect is more limited. The effect on competition, however, should be analysed on a case-by-case basis.

### 3.2.1. *Public intervention not involving state aid*

***The Market Economy Investor Principle:*** When public authorities intervene on the market on the same terms as private investors, there is no granting of State aid.

Nevertheless, it might still be the case that a public investment project in a broadband project is capable of securing revenues that are sufficient to repay its costs within a reasonable time-horizon and provide a rate of return in line with the market remuneration for projects of similar risk. For pure infrastructure projects the appropriate repayment period might be longer, and the return on investment might be lower than those required by the market on integrated telecom projects. The Commission accepts the principle that the business model of a ‘utility’ company involved in pure infrastructure provision would be different from that of a telecom operator investing in a network and providing electronic communications services to end-users.<sup>26</sup> However, conformity with the Market Economy Investor Principle (MEIP) would have to be supported by a sound business plan, foresee a pricing policy that is justified on

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<sup>25</sup> At the time of the drafting of this section only 5 state-aid cases had been decided: the “Project Atlas”, the “Broadband Business Fund”, “Broadband in Scottish remote and rural areas”, “Haut Debit Pyrénées Atlantiques”, and “Cumbria Broadband”.

<sup>26</sup> Commission decision of 9 September 2004 in case N 213/03, *Project ATLAS* (Corrigendum).

commercial rather than on policy grounds and possibly envisage a relevant participation of private partners to the venture on equal terms with public investors.

**General infrastructure not distorting competition:** It is sometimes suggested that certain projects do not fall within the scope of Article 87(1) EC, but should rather be seen as a typical task of the public authority of providing general infrastructure. It could be argued that this is the case of a project that serves the interest of the general public, provides a facility that the market is not capable of supplying and is planned in a way that avoids granting of selective advantages.

These conditions, however, should be interpreted strictly. As the Commission argued in *ATLAS*,<sup>27</sup> infrastructures that do not serve the general public, but are rather dedicated to specific economic operators cannot be seen as a typical task of the public authority outside of the scope of Article 87(1) EC. Similarly, projects that duplicate market initiatives or provide services already available are deemed to potentially distort competition. The infrastructure argument appears therefore tenable only if limited to basic civil works and passive elements such as ducts and dark fibre in unserved areas. So far, no such case was the object of a Commission decision.

**Funding of a service of general economic interest:** Use of public resources might not constitute State aid also in relation to the funding of a Service of General Economic Interest (SGEI). The Court of Justice has indicated that compensation for costs that result from public service obligations are not within the scope of article 87(1) of the Treaty, providing certain conditions are fulfilled. These conditions are described in the *Altmark* judgement of 24 July 2003.<sup>28</sup>

In its decision on *Pyrénées-Atlantiques* the Commission assessed whether those conditions were fulfilled for a broadband project.

### 3.2.2. Services of General Economic Interest

The Commission acknowledged that Member States have a large power of appreciation concerning the identification of a service as SGEI, but – on the basis of the case-law of the EU courts – indicated that some general principles should nevertheless be respected:

- the definition of SGEI must not be in conflict with Community legislation in the given field;<sup>29</sup>
- the service in question must carry a general interest that goes beyond the generic interest associated to each economic activity;<sup>30</sup>
- the public intervention must be justified by the nature and needs of the public service.<sup>31</sup>

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<sup>27</sup> Cf. footnote 8

<sup>28</sup> Judgement of the Court of 24 July 2003, in case C-280/00, *Altmark Trans*, ECR 2003 p. I-7747 paragraphs 89 to 93 of the judgement.

<sup>29</sup> Judgment of the CFI of 27.02.1997 in case T-106/95, *FFSA*, ECR 1997 p. II-0229.

<sup>30</sup> Judgement of the Court of 10 December 1991, in case C-179/90, *Merci convenzionali porto di Genova SpA*, ECR 1991 p. I-5889, point 27.

<sup>31</sup> Judgement of 13 December 1991 in case C-18/88, *GB-INNO-BM*, ECR p. I-5941, point 22.

*Community legislation in the field:* In the electronic communications sector, Community legislation harmonises the principles applicable to the universal service obligation<sup>32</sup>, which concerns the supply of a minimum set of basic services to all end-users at affordable prices. As already indicated, the scope of universal service includes a narrowband connection capable of supporting voice and data communications at a speed sufficient to access the Internet; typically at or equal to 56kbit/s. Member States may decide to make additional services publicly available in their territory, in addition to those included in the scope of universal service. It is considered important that the characterisation of a broadband service as SGEI does not modify the scope of universal service, and as such does not imply any obligation to offer or finance broadband services imposed on telecom operators.<sup>33</sup> This could represent a heavy burden, especially for small operators and new entrants in the market.

In Pyrénées-Atlantiques, the qualification of the provision of broadband access as SGEI did not alter the scope of the universal service while being in line with Community priorities and not raising competition concerns. This allowed the conclusion that the qualification as SGEI in the areas concerned was not in contrast with Community legislation.

*General interest:* The Commission also acknowledged that broadband services can be considered to carry a general interest that goes beyond that of generic economic activities. Broadband services are becoming a widespread support not only for the development of business initiatives, but also for responding to numerous citizens' needs and for the supply of government services. The possibility to offer, thanks to broadband, e-Health, e-Government, e-Education and tele-working render this type of initiatives more relevant to the general interest than projects for pure economic development, which would generally be assessed under the existing State aid rules, for example on regional aid. Naturally, SGEI projects must be related to the provision of a service to the general public and not be exclusively targeted at businesses.

*Public intervention justified by the nature of the service:* The Commission also found that the already mentioned economic peculiarities of this network industry justified public intervention in certain geographic areas. What is worthwhile emphasising is that the same conclusion would not necessarily hold for projects that, contrary to *Pyrénées-Atlantiques*, concerned areas where offers by competing operators are already present ('black areas').

It was also considered that only the investment in the network justified public support. Indeed, the market might not be able to undertake the high fixed-cost investment in the infrastructure, but once an open infrastructure is available, market operators would normally not need additional funding for the supply of the downstream services.

Finally, only if the infrastructure is fully open on transparent and non-discriminatory terms, it can provide a service of truly general interest. The funding of a network belonging to one operator that may restrict access to competitors, would risk foreclosing the market from new entrants in the medium term. On the contrary, public intervention should not create monopoly positions and should ensure open and non-discriminatory access to the financed network.

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<sup>32</sup> Directive 2002/22/EC of the European Parliament and of the Council of 7 March 2002 on universal service and users' rights relating to electronic communications networks and services (Universal Service Directive), OJ L 108 of 24 April 2002

<sup>33</sup> Op. Cit. Footnote 2.



The open access requirement should concern the basic element of the infrastructure – e.g. access to dark fibre in case of an optical fibre infrastructure. If this is the case, competition can take place in the segments of the market with the highest value-added and lead to the greatest advantage for the end users.

***The Altmarm criteria:*** The assessment of the fulfilment of the *Altmarm* criteria is based on considerations which are not necessarily specific to broadband projects, but apply to SGEI in general. Some of the crucial elements are worth recalling:

#### *Clearly defined obligations*

Public support is not considered aid if it is possible to establish a clear correspondence between the extra costs of public service obligations and their compensation. This requires a precise identification of the services demanded. In general, the attribution of a public service mandate through an open procedure implies a detailed specification of the required services and fulfils this criterion.

#### *Parameters of compensation established beforehand*

If the mechanism for compensation left some margin of discretion or the possibility to grant ex-post additional funding, the risk of overcompensation could not be excluded. Again, the criterion is normally satisfied when the service is attributed through open procedure, since the overall amount of aid, or the parameters for compensation, would be determined before the starting of the contract.

#### *No overcompensation*

Whatever the mechanism for the choice of the operator and the determination of compensation, the compensation must “*not exceed what is necessary to cover all or part of the costs incurred in discharging the public service obligations, taking into account the relevant receipts and a reasonable profit for discharging those obligations.*”

Indeed, there could be circumstances in which the attribution through an open procedure on the basis of the best available offer on the market would not be sufficient to exclude overcompensation. This might be the case if the number of potential competitors is limited – notably because of the atypical character or the complexity of the service – or if an operator has privileged access to an infrastructure necessary to provide the service.

To avoid this problem, in the case of *Pyrénées-Atlantiques* the authorities required the selected operator to set up a legally independent company whose accounts would be regularly audited. A reverse payment clause in case of revenues exceeding a certain threshold was also foreseen.

#### *Choice of provider*

To ensure that the cost of public service is effectively minimised it is necessary not only to avoid overcompensation, but also to entrust the service to the most efficient operator. For this reason the fourth *Altmarm* criterion is a necessary complement to the third one.

In the case of broadband there are many variables that qualify a project: quality of service, aid amount, aid intensity, geographical coverage, chosen technical means, price to users, etc.

The case law on public service contracts indicates that when the chosen procedure is not based only on the lowest price, but on multiple awarding criteria (“the most economically advantageous tender”) those criteria must be: “*linked to the subject-matter of the contract, do not confer an unrestricted freedom of choice on the authority, ... expressly mentioned in the contract documents or the tender notice, and comply with all the fundamental principles of Community law, in particular the principle of non-discrimination*”.<sup>34</sup>

It has been suggested, however, that the *Altmark* case-law should be interpreted in a more stringent way. If aid is to be excluded, the procedure must offer sufficient guarantees that the choice reflects the ‘best value for money’ for the tendering public authority.

In *Pyrénées-Atlantiques*, the Commission accepted that the fourth *Altmark* criterion was satisfied because the selection was not mainly based on qualitative criteria, but was made on quantifiable elements and the choice between the two final offers reflected the lowest amount and intensity of aid.

### 3.2.3. *Compatible aid*

A project that does not fall within the categories described above would generally involve State aid and would need to be notified and assessed for compatibility.

This would be the case of infrastructure projects dedicated to businesses – as the Commission has indicated in *ATLAS* – or in areas where there is already competitive supply and the SGEI qualification would not be justified. It might also be the case of funding of SGEIs that does not comply with the *Altmark* criteria.

Another frequent case is that of ‘service projects’, involving the funding of an end-to-end service provision.

***Service projects:*** Projects involving end-to-end service provision have several pros and cons when compared to pure infrastructure projects. On the one hand:

- an end-to-end service typically involves a lower detail of specification as to the type of infrastructure and technical means required by the authorities. This has the advantage of allowing better exploitation of existing installations and greater technological neutrality;
- an end-to-end service might also be preferable in cases where there is less need for building and managing new infrastructure and focus is on the rapid availability of the service to end users. By tendering the final service, the authorities have greater certainty on the scope and timing of the final service;
- a project that includes the provision of the final services allows greater commercial opportunities to the selected bidder and is likely to attract a greater proportion of private funding. This might entail lesser use of public resources and lower aid intensities.

On the other hand:

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<sup>34</sup> Judgment of the Court of 17 September 2002 in case C-513/99, *Concordia*, ECR [2002] p. I-07213, point 64.

- this type of project can be seen as more distortive than one merely consisting of provision of infrastructure, since it will intervene in a greater number of markets, including those downstream markets in which public intervention appears less needed. In most cases public support for third party infrastructure (especially civil infrastructure), sold on a non-discriminatory wholesale basis to service providers, should be sufficient to reduce overall investment costs and lower barriers to service provision for numerous providers;
- it should also be noted that in certain infrastructure projects the State retains ownership of the infrastructure and attributes its management through a concession of limited duration to an independent party that cannot act as service provider. This solution preserves the neutrality of the infrastructure manager, as opposed to a situation in which a service provider also controls the infrastructure;
- finally, an end-to-end service requirement may put at an advantage the service operations of the selected provider, who is likely to be in a position to roll-out end-user services prior to the entry of third party providers benefiting from the open access. Under certain circumstances, this might lead to market foreclosure effects.

**Presence of State aid:** The funding of service projects, being a selective measure, distorts competition and constitutes State aid. The selectivity is both sectoral and geographical. Public funding supports the telecom sector and allows businesses in the concerned regions to profit from broadband services at better conditions in terms of coverage, quality and prices

The measure might also selectively favour the chosen service provider, which will be capable of establishing its business and developing its customer base, enjoying a first mover advantage over prospective competitors. It should be considered that the broadband market is rapidly evolving and that, while public authorities generally decide to intervene in view of the lack of private initiatives in the concerned areas, it cannot be excluded that those could become viable in the medium term.

The Commission has noted in several cases that the existing frameworks and guidelines cannot be applied to assess aid measures that specifically aim at widespread availability and use of high-speed broadband services in rural and remote areas. It therefore assessed the compatibility of the measure with the common market directly on the basis of Article 87(3)(c) of the EC Treaty. This involved establishing the necessity and proportionality of the measure.

**Necessity of the measure:** Broadband connectivity is a type of service that by its nature is capable of positively affecting the productivity and growth of a large number of sectors and activities. Regional economic development benefits resulting from greater broadband deployment can include job creation and retention, more industrial growth, improved education and health systems and even reduced traffic congestion.<sup>35</sup> The social and economic case for broadband takes on added significance for rural and remote communities, where improved communications can address a variety of challenges posed by distance.<sup>36</sup>

The Commission supports the principle that the deployment of broadband infrastructure needs to be encouraged where broadband connectivity is not provided by the market at affordable

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<sup>35</sup> US Department of Commerce, Office of Technology Policy, “Understanding Broadband Demand”, September 2002.

<sup>36</sup> OECD, “Broadband Driving Growth: Policy Responses”, October 2003.

prices. The scope for public intervention in underserved areas was emphasised in eEurope 2005.<sup>37</sup> The Action Plan set ‘widespread availability and use’ as its broadband objective, and highlighted the role Structural Funds can play in bringing broadband to disadvantaged regions. Structural Funds can be used to increase broadband coverage in underserved areas where geographical isolation and low density of population can make the cost of building new infrastructure or upgrading the existing one unsustainable.<sup>38</sup>

The necessity of the measure should, however, be well documented. A survey of the existing services and infrastructure should constitute the basis on which to evaluate the need for public intervention. In principle, such intervention should take place only in areas where there is no provision of service (‘white’ areas). However, because of the physical characteristics of a network, some duplication of existing infrastructure is always likely to take place and represents a sort of ‘unavoidable’ distortion. Duplication should, nevertheless, be minimised: a pure replica, in terms of geographical coverage, of existing services would not meet the requirements for necessity of aid.

**Proportionality:** In order for the aid measure to be compatible with Article 87(3)(c) of the EC Treaty, it must be proportionate to the objective and must not distort competition to an extent contrary to the common interest. The trade-off between the advantages – in terms of local economic development and support to information society – and the disadvantages – in terms of distortion of competition and possible disincentives to private investment – has to be assessed. The extent of the measure in terms of service definition, as well as project design features, should also be evaluated to ensure that the least distorting model, which would nevertheless produce the required results, is adopted.

In its decisions, the Commission has positively assessed the following elements:

- *Open tender:* The selection of the service provider through open procedure in accordance with EC rules and principles on public procurement minimises the advantages to the direct beneficiary of aid.
- *Technology neutrality:* A project which aims at achieving a certain final service leaving to the provider the choice of technological means has the advantage of not favouring a priori any given technology.
- *Open access:* The obligation for the provider to lease capacity to resale operators and service providers on a transparent and non-discriminatory basis is seen as a more pro-competitive solution.
- *Use of existing infrastructure:* The freedom for the service provider to choose the most efficient way of procuring the necessary infrastructure, either by building, buying or leasing it from third parties minimises duplication and enhances economic efficiency. Since leasing facilities is expected to be more cost effective than building new infrastructure, existing operators have the possibility to contribute their infrastructure to the project, which limits the economic impact of the project for operators that already have infrastructure in place.

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<sup>37</sup> COM(2002) 263.

<sup>38</sup> Commission staff working paper, “Guidelines on criteria and modalities of implementation of structural funds in support of electronic communications”, 28.7.2003, SEC(2003) 895.

- *Short duration, small aid amount and intensity*: Other things equal, the smaller the amount and intensity of aid and the shorter the duration of the funding, the smaller the distortion of competition.
- *Reverse payment mechanism*. The existence of a reverse payment mechanism, under which the public funding is expected to diminish as demand for services picks up, ensures that only the minimum necessary public funds are used.
- *Cost allocation transparency and monitoring*: Clear specification of the cost eligible for public funding, separation of accounts where other activities are present and regular monitoring of the financial results ensure a high degree of transparency.
- *Minimisation of price distortion*: The appropriate pricing of the services is important to ensure that business end-users benefiting from the aid are not put in a position more favourable than their competitors located in regions where the same advanced broadband services are available on market terms. The risk of sending the wrong price signals to the market as a result of tariffs charged for a State funded service should also be considered. Finally, disproportionately low prices may necessitate more aid than the minimum necessary to address the undersupply of the service in certain areas. Benchmarking with tariffs offered by service providers in areas which do not benefit from aid is a desirable proviso.

### 3.3. Conclusions

This chapter has shown current examples of public intervention in the EU to increase broadband in under-served areas. The implementation of national broadband strategies in terms of increasing broadband coverage provides a large variety of activities, although the Commission is aware of a small sample. The state-aid cases approved by the Commission are still too few to enable a general picture of good and bad doings. Furthermore, each case is *per se* as details vary widely.

The Second Section of the eEurope Advisory Group proposed the Commission one recommendation on policies to stimulate wider rollout that is currently widely debated at the EU level:

*“The establishment of public/private partnerships (PPPs) for sparsely populated areas, where the local community invests in civil works and the fibre is rented out to service operators.”*

State-aid cases show that PPPs for sparsely populated areas minimise market distortions when public funds are devoted to deployment of passive infrastructure. Competition rules suggest that public funding of open access civil infrastructure, defined according to technological neutrality and managed by an independent entity, appears to be the solution most conducive to effective (platform) competition. The civil infrastructure may include ducts, dark fibre, co-location facilities, masts and sites for equipment. It represents most of the costs of deployment. The independent entity, a third party, may manage the infrastructure and lease it to operators. Open access offered on non-discriminatory basis allows operators to compete in the provision of advanced services. Decoupling of civil infrastructure costs appears a pro-competitive way to finance deployment of advanced networks in under-served areas.

However, although attractive because of its capacity, this solution remains prohibitively expensive for isolated areas (see Annex 2, Table A2).

**Because of the large variety of examples and the many questions that are often posed in relation to the legitimacy of public intervention, the exchange of best practices at the national/regional/local level should be intensified.**

**The implementation of national broadband strategies is key to the achievement of wide coverage. There is a need for strengthening the monitoring of the various activities undertaken in this context.**

**The Commission services are favourable to the establishment of public/private partnerships that facilitate investment in open infrastructure as long as competition rules are respected.**

#### 4. CHAPTER 4: POLICY PROPOSALS

In light of the discussion above, the Commission services propose the following steps and invites comments by interested parties:

1. **Strengthen current policies** through i2010 and national broadband strategies, taking into account the Integrated Guidelines for Growth and Jobs proposed by the Commission for the period 2005-2008 in the framework of the revised Lisbon strategy. In particular, guidelines 11 and 13, “Improve EU infrastructure” and “Innovations and ICT uptake”, identify broadband as a key infrastructure for the development of the information society, and are the basis for action in this area.

There is a wide fragmentation across Member States in terms of both broadband coverage and take-up, and little sign of the catch-up process. **National broadband strategies therefore remain an important policy option** to stimulate the supply and the demand side of the market whenever identified as a national priority. In the Council Conclusions of 8.6.2004 the new Member States committed to put in place national broadband strategies by the end of 2004, but only four countries have done so as of January 2005 (PL, HU, SI, CZ), although the problem of under-served areas is particularly acute in these countries. All Member States committed to review the strategies where necessary (NL, FI and FR submitted reviews to their strategy). Developments will be further monitored through the eEurope Advisory Group and addressed by a Commission Communication in the first half of 2006.

The Commission services will continue monitoring the development of broadband markets distinguishing between urban, suburban and rural areas, and will extend the analysis to the EU-25 countries.

The Commission services reiterate the importance of national broadband strategies based on a **national mapping of infrastructure**. All strategies, where relevant, should include **national targets in terms of both coverage and take-up** to ensure widespread availability and use. Where feasible, national strategies should introduce **minimum speed requirements** to ensure that investment does not become quickly obsolete. They should also provide a clear roadmap for the achievement of targets.

Where relevant, planned action should be explicitly linked to the use of Structural Funds.

Public intervention should be based on the rules summarised in the Guidelines on the use of Structural Funds for electronic communications. Legislation is also being developed through state-aid decisions.

The Commission proposal for a “*Cohesion Policy in Support of Growth and Jobs: Community Strategic Guidelines 2007-2013*”,<sup>39</sup> includes a limited number of key themes for the new generation of ‘operational programmes’. The information society/ICT issue is one of main topics being considered for action within the theme “Guideline: Improving knowledge and innovation for growth”. The guidelines recognise the importance of ICT dissemination as a major lever for improving productivity and competitiveness of regions. The guidelines for action specifically refer to (i) ensuring uptake of ICTs, promoting development through a balanced support of supply and demand, as well as through increased investment in human capital; (ii) ensuring availability of ICT infrastructure where the market fails to provide it at an affordable cost and to an adequate level to support the required services, especially in remote and rural areas and in new Member States.

The Commission proposal for a decision on the “*Community Strategic Guidelines for Rural Development 2007-2013*”,<sup>40</sup> adopted on 5 July 2005, highlights how take-up and diffusion of ICT is essential in rural areas for diversification, as well as for local development, the provision of local services and the promotion of inclusion. Economies of scale can be achieved through village Information Society initiatives combining equipment, networking, and e-skills through community structures. Such initiatives can greatly facilitate ICT take-up by local firms and rural businesses and the adoption of eBusiness and eCommerce. In this way, full advantage can be taken of the possibilities offered by the Internet and by broadband communications to overcome the disadvantages of location.

A political agreement on a Regulation on rural development support through the European Agricultural Fund for Rural Development for the next programming period (2007-2013) was reached by the Agriculture Council on 20 June 2005.

## **2. Provide active assistance by using a website for regional and local authorities to publish their plans on a voluntary basis.**

The site would have several objectives:

(i) Bring together relevant information relating to policy and practice, including official documents concerning regulation, decisions regarding public interventions, case studies of successful applications, acting as a tool for the exchange of best practices and a source of information for regional and local authorities.

(ii) Allow local and regional authorities to publish information about the extent of under-served areas, their assessment of demand, and their plans for tackling the

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<sup>39</sup> COM(2005) 299

<sup>40</sup> COM(2005) 304

problem. This would provide information to a large number of operators about open tenders and plans of public intervention, facilitating the assessment of demand by operators regardless of the technology provided.

(iii) The Commission services support the idea of demand aggregation as a means of helping to reduce the costs of user equipments in the context of satellite solutions in very sparsely-populated areas. For this reason the Commission services will use the website to investigate the feasibility of demand aggregation in areas where satellite is considered to be the only practicable solution for broadband delivery.

(iv) Represent a source of information for the monitoring of national broadband strategies and stress the link with other information society policies undertaken by regions.

(v) Organisation of workshops and surveys of regional administrators could be foreseen to better identify the needs.

## 5. ANNEX 1: APPLICABLE COMMUNICATIONS NETWORK TECHNOLOGIES

### (1) Access network solutions using legacy infrastructure

Some delivery solutions make use of current infrastructure, so saving the need for new build. However, some of the solutions may need investment to upgrade the existing plant.

- The **DSL (Digital Subscriber Loop)** family of technologies transmits high bandwidth signals over the ubiquitous copper pairs of the traditional switched telephone network.
- **Co-axial cable** delivery transmits high bandwidth data signals in the frequency assigned to one or more TV channels, through the tree-and-branch network of a cable TV (CATV) system. Older systems may require upgrading for bi-directional transmission.
- **Hybrid-fibre-coaxial (HFC)** systems make use of existing CATV networks, but improve the overall bandwidth delivered to users installing optical fibre connections down to the street or neighbourhood nodes of a tree-and-branch system.
- **Powerline communications (PLC)** solutions transmit high bandwidth data signals over the ubiquitous electrical power distribution network.

### (2) Solutions using new-build fixed infrastructure

The alternative to using existing infrastructure for delivering broadband communications is to construct new access infrastructure to users' homes or business premises.



- **Hybrid-fibre-coaxial (HFC)** CATV systems may be installed as a new network platform, to provide broadcast service distribution and broadband communications.
- **Fibre-to-the-user (FTTU)** is the provision of an optical fibre direct to each and every user.
- Variations on the optical fibre approach include **fibre-to-the-building (FTTB)** and **fibre-to-the- (roadside) cabinet (FTTC)**, where fibre provides a high bandwidth signal to a point short of the individual user. FTTB and FTTC necessarily form part of hybrid (composite) solutions, since in both cases, onward distribution from the termination of the fibre to users requires another solution. This might be based on new or legacy copper or co-axial wiring, or a wireless solution.

### (3) Terrestrial wireless solutions

Terrestrial radio-based solutions use radio as the transmission medium to every user. Although this needs no physical path, these solutions are not exactly infrastructure-free, since they do need a network of transmitter and receiver sites, generally known as “base stations”. Depending on the radio frequencies employed, some solutions may demand an unbroken line-of-sight path between the user’s site and the base station, while others may have a signal that “goes round corners”.

- **Broadband wireless local loop (B-WLL)** solutions provide a separate bi-directional wireless path between individual users and a base station.
- **Cellular solutions** rely on the radio cells already established or being established for “second generation” and “third generation” mobile communications networks. Designed initially to serve the needs of mobile users, including while they are on the move, these networks can also be employed to deliver service to fixed users.
- **Wireless local area networks (W-LAN)** provide a shared access bi-directional radio carrier over a limited area, that can provide a service to any suitably equipped user terminal within reach of the signal. A new variant is called Wi-Max.

### (4) Satellite solutions

Satellites promise a ubiquitous delivery platform for broadcast and broadband services over any part of the earth’s surface, except where cover or terrain obscures the line-of-sight path to the satellite. They can be used to give direct access links to individual users, or for backhaul.

- **Unidirectional satellite delivery** platforms provide broadband communication in the downstream direction (that is, to the user). However, these solutions must be combined with another solution for the upstream (that is, from the user) direction.
- **Bi-directional satellite delivery** platforms provide both upstream and downstream communications over a satellite link

## (5) Broadcasting-based solutions

With broadcasting services increasingly migrating from historical analogue to digital formats, it is possible to consider digital broadcasting infrastructures to provide broadband communications.

- DVB-T is a transmission standard for digital data and broadcasting over terrestrial television channels
- DVB-RCS is a transmission standard for digital broadcasting from satellites

## (6) Future technologies

A number of potential solutions are at the stage of “good ideas”, being investigated in research and development projects. On the one hand, it is necessary to be cautious about these. There is a danger in putting one’s faith in an “ideal” future solution, especially if it causes one to give up a lesser but available solution. While promoters of new technology are enthusiastic and rightly so, the eventual benefits are unproven and probably further in the future than predicted. On the other hand, one should think about futuristic technologies, lest adopting a present-day solution made it difficult to take advantage of better solutions when they became available.

- **Fourth-generation cellular mobile** technologies are targeted at providing multi-megabit bandwidths to mobile users and users on the move.
- **Mesh radio** platforms do not have designated base stations as with B-WLL, W-LAN and cellular radio systems, but depend on ad-hoc networks where each user’s transmitter and receiver may communicate with any other site within reach, building up network connectivity over the most convenient paths.
- **Adaptive and self-configuring networks.** In the simplest form, mesh radio networks are configured by human intervention and left in a stable form to operate. Reconfiguration then happens infrequently, for example when new users join the network, or when there is failure of a path. However, adaptive networks discover themselves autonomously. They set up, and reset as necessary, the best configurations for themselves.
- **Self-configuring inhomogeneous networks** are not restricted to one type of link or one technology, but may integrate fixed, wireless and satellite links of varying bandwidths as though a coherently managed single network platform.
- **High altitude platforms** are airborne vehicles like aircraft or balloons, operating in the stratosphere at altitudes up to 22 km.
- **Free-Space optical links** use a laser beam instead of radio, to make wireless point-to-point connections.

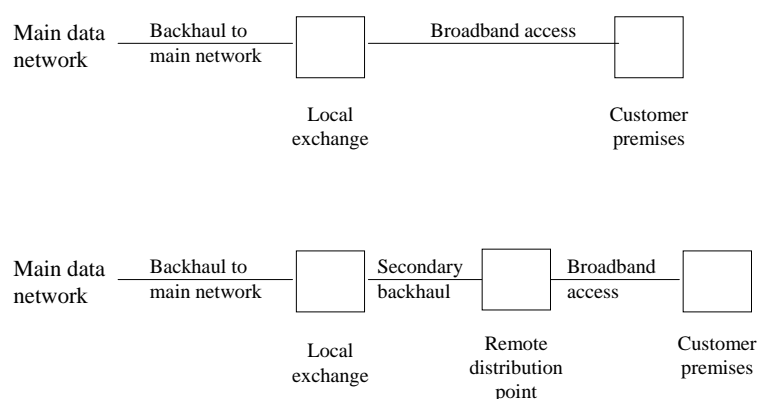
## (7) Backhaul technologies

Delivery of a broadband service to customers depends not only on the broadband local loop access network, the so-called “last mile”, but also on a means of

connection to the high capacity backbone networks that form part of public national and international data transmission networks. This connection is known as **backhaul** and has been called the “middle mile”. Backhaul is a significant issue, since high-capacity networks are normally found today only in larger towns, and obtaining connection to them is a substantial factor in the cost of rural broadband services. Backhaul to the nearest available main network node can be provided by a variety of technologies:

- Optical fibre
- DSL-family technologies over copper circuits
- Radio links
- Satellite links

Figure 1: Broadband access and backhaul



**Secondary backhaul** is a common feature of hybrid broadband access solutions. This occurs where for any reason such as cost or technology limitation, the broadband access (“last mile”) is provided from a point or points remotely scattered from the local exchange building (or point of presence). This creates a hybrid technical solution using one method of broadband access from the remote distribution point, but relying on another for secondary backhaul between the local exchange and remote distribution point.

## 6. ANNEX 2: COMPARISON BETWEEN COSTS IN THE ISOLATED, SCATTERED AND SMALL TOWN SCENARIOS<sup>41</sup>

Tables A1 and A2 summarise the five-year per user present values, at a 5% test discount rate, of access solutions (including secondary backhaul where used) and backhaul solutions respectively. All access solutions require backhaul except where shown by an asterisk. To assist comparisons, the last column of Table A1 shows the cost of the solution with the cheapest form of backhaul from Table A2 added

<sup>41</sup> These data are extracted from the John Buckley report.

wherever backhaul is necessary. The currency unit is the euro. The cost of WiMax is uncertain and the table reports the lower and higher estimates.

(1) Isolated scenario

Solution	Per user 5-year PV without backhaul	Per user 5-year PV with primary backhaul <i>where required</i>
Power Line Communication	3,550	Unknown
Satellite: 512 kbps downstream / 128 kbps upstream under hypothetical high volume pricing assumption*	3,008	3,008
WiMax (2 <sup>nd</sup> costing)	1,890	7,799
WiMax (1 <sup>st</sup> costing)	5,482	11,391
B-WLL 2-10 GHz licensed spectrum, (like MMDS)	5,482	11,391
Satellite: 512 kbps downstream / 128 kbps upstream*	13,465	13,465
2G/3G cellular	38,230	44,139
Satellite: 2 Mbps both way *	140,579	140,579
New build fibre-to-the-user	1,575,000	1,582,000
New build hybrid fibre coaxial CATV network	2,401,241	2,407,150
High altitude platform*	Unknown	Unknown

Table A1: Isolated scenario: access solutions, five-year per user present values

Solution	Per user 5 year PV
Point-to-point radio	5,909
Satellite link at 2 Mbps both way	34,545
Satellite link at 10 Mbps both way	138,879
SDH over new build optical fibre	454,137

Table A2: Isolated scenario: backhaul solutions, five-year per user present values

(2) Scattered scenario

Solution	Per user 5-year PV without backhaul	Per user 5-year PV with primary backhaul <i>where required</i>
Power Line Communication	3,550	Unknown
Upgraded hybrid fibre coaxial CATV network*	2,041	2,041
Satellite: 512 kbps downstream / 128 kbps upstream under hypothetical high volume pricing assumption*	3,008	3,008
WiMax (2 <sup>nd</sup> costing)	710	3,665
ADSL	741	3,696
Remote ADSL with SHDSL secondary backhaul	1,066	4,021

B-WLL 2-10 GHz unlicensed spectrum	1,560	4,515
New build hybrid fibre coaxial CATV network	3,241	6,196
WiMax (1 <sup>st</sup> costing)	3,709	6,664
B-WLL 2-10 GHz licensed spectrum, (like MMDS)	3,709	6,664
B-WLL 10 – 40 GHz licensed spectrum, (like LMDS)	7,800	10,755
Satellite: 512 kbps downstream / 128 kbps upstream*	13,465	13,465
2G/3G cellular	19,365	22,320
Satellite: 2 Mbps both way *	140,579	140,579
New build fibre-to-the-user	472,500	475,455
High altitude platform*	Unkno wn	Unkno wn

Table A3: Scattered scenario: access solutions, five-year per user present values

Solution	Per user 5 year PV
Point-to-point radio	2,955
Satellite link at 2 Mbps both way	17,272
Satellite link at 10 Mbps both way	69,439
SDH over new build optical fibre	95,818

Table A4 Scattered scenario: backhaul solutions, five-year per user present values

(3) Small town scenario

Solution	Per user 5-year PV	Per user 5-year PV with

	without backhaul	primary backhaul where required
Power Line Communication	3,550	Unknown
ADSL	564	2,041
Upgraded hybrid fibre coaxial CATV network*	2,041	2,041
WiMax (2 <sup>nd</sup> costing)	710	2,187
Remote ADSL with SHDSL secondary backhaul	726	2,203
B-WLL 2-10 GHz unlicensed spectrum	1,312	2,789
Satellite: 512 kbps downstream / 128 kbps upstream under hypothetical high volume pricing assumption*	3,008	3,008
WiMax (1 <sup>st</sup> costing)	2,823	4,300
B-WLL 2-10 GHz licensed spectrum, (like MMDS)	2,823	4,300
New build hybrid fibre coaxial CATV network*	3,241	4,718
B-WLL 10 – 40 GHz licensed spectrum, (like LMDS)	6,028	7,505
2G/3G cellular	9,932	11,409
Satellite: 512 kbps downstream / 128 kbps upstream*	13,465	13,465
Satellite: 2 Mbps both way *	140,579	140,579
New build fibre-to-the-user	157,500	158,977
High altitude platform*	Unknown	Unknown

Table A5: Small town scenario: access solutions, five-year per user present values

Solution	Per user 5 year PV
Point-to-point radio	1,477
Satellite link at 2 Mbps both way	8,636
Satellite link at 10 Mbps both way	19,784
SDH over new build optical fibre	34,720

Table A6: Small town scenario: backhaul solutions, five-year per user present values



## 7. ANNEX 3: DESCRIPTION OF THE BROADBAND PROJECTS ANALYSED UNDER STATE-AID LAW

The six projects notified in the United Kingdom and the one in Spain were approved as State Aid compatible with Article 87(3)(c)<sup>42</sup> of the EC Treaty.

Regarding the two French projects in the department of Pyrénées-Atlantiques and the region of Limousin, the European Commission decided that they did not constitute State Aid. The European Commission did not oppose to the qualification of this public intervention as a compensation for a service of General Economic Interest (SGEI) made by the French Authorities in their notification.

In three of the approved projects<sup>43</sup> public funding was granted for the deployment of infrastructure, while in the other six<sup>44</sup> the subsidies are given to telecommunications operators for the provision of retail services to end-users (either residential, businesses or public authorities).

All projects are in undeserved areas, either because scarcely populated or because characterised by difficult topography.

The infrastructure projects consist of the construction of an open access network technologically neutral, comprising only passive infrastructure. The infrastructure operators will lease capacity to service providers on a transparent and non-discriminatory manner. They will not be allowed to provide services to final users. The infrastructure is built in areas where no other infrastructure exists or where the existing one is not opened on appropriate commercial, technical and legal terms.

In the projects dealing with provision of services to end-users, the public investment to the projects will only be provided to the extent necessary to attain the objective of stimulating the use of broadband services within rural and remote areas.

In all cases the selection of the preferred bidder is done through a public tender procedure.

Appropriate pricing of the services is considered particularly important in all cases. Broadband services will be offered at conditions and prices consistent with those currently provided by providers in other more densely populated areas in the same country.

All projects were approved in line with the eEurope strategy to make broadband largely available within the EU, recognising the need for public intervention to

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<sup>42</sup> According to Article 87 (3)(c), aid granted by a Member State or through State resource may be considered to be compatible with the common market when the aim of the aid is to facilitate the development of certain economic activities or of certain economic areas, where such aid does not adversely affect trading conditions to an extent contrary to the common interest;

<sup>43</sup> Atlas; Pyrénées-Atlantiques; Limousin

<sup>44</sup> Regional Innovative Broadband Support in Wales; Broadband for SMEs in Lincolnshire; Broadband in remote and rural areas in Spain; Broadband Business Fund; Broadband in Scotland remote and rural areas; Cumbria

extend as rapidly as possible the coverage of undeserved areas. The deployment of an open access broadband network and the provision of broadband services in these areas are considered to have a significant socio-economic impact. This can be summarised as: maintenance and creation of employment; possibility given to enterprises to exploit new markets; localisation of new enterprises; improvement of skills and education, also through access to high speed connections and multimedia to schools; provision of e-Health and e-Government services.

The following is a short description of the projects approved by the Commission.

#### Compatible State Aid

##### (1) “Project Atlas”: broadband infrastructure scheme for business parks

The project is aimed at lowering prices of broadband services for commercial users located in business parks. It will ensure the widespread availability and use of high-speed broadband services at conditions closer to those in areas with a greater density of population and businesses.

The project will be geographically limited to providing infrastructure on business parks. Technically, the infrastructure will comprise only passive infrastructure (ducts, chambers, fibres and Meet-Me-Rooms) and no active infrastructure.

The preferred bidder will manage the assets on behalf of Scottish Enterprise (SE), which will remain the owner of the assets, and lease capacity to wholesale operators and/or Service Providers on a transparent, open access and non-discriminatory basis.

The project intends to utilise existing fibre telecom infrastructure wherever practicable. Existing fibre owners who already have fibre on the parks will be given the opportunity to supply dark fibre through an open and transparent procurement process. If existing fibre is offered on appropriate commercial, technical and legal terms, the ATLAS project will not require building duplicative infrastructure in these locations.

##### (2) “Broadband Business Fund”

##### (3) “Broadband in Scotland remote and rural areas”: provision of end-to-end services

##### (4) “Broadband for SMEs in Lincolnshire”

Scottish Executive ,East Midlands Development Agency & sub-regional Strategic partnerships and Lincolnshire County Council will provide a subsidy to a telecommunications service provider selected by a competitive tender to provide respectively:

- **mass market broadband services** to businesses and citizens in remote and rural areas in Scotland
- **broadband services** to SMEs and residential users in selected counties in East Midlands

- **advanced broadband services** to SMEs in the county

The selected provider will have a mandatory requirement to provide not only retail, but also wholesale access to its network to third party service providers.

In Scotland, the intervention budget will be between £ 12 and 17 million, while European Community funding is expected to contribute £ 5 million (applications are pending). In the Midlands, UK State resources will cover up to GBP 1.9 million of the total project costs. In Lincolnshire, from the total project costs of GBP 16.45 million, UK State resources will cover GBP 2.635 million, while Community funding is expected to contribute GBP 1.615 million

In addition, in all three cases, through a reverse payment mechanism it will be ensured that as demand for broadband services grows, the contribution of the public sector diminishes.

The projects involve the provision of end-to-end services going beyond the mere provision of infrastructure enabling access. However, the UK authorities implemented a multitude of safeguards which ensure that the aid amounts granted are minimized and do not distort competition to an extent which is contrary to the common interest.

#### (5) Regional Innovative Broadband Support in Wales

The Regional Innovative Broadband Support scheme aims at supporting the provision of first generation broadband services<sup>45</sup> to connect end-users (households and businesses), at conditions and prices similar to urban areas, in the so called “blackspot” areas of Wales. These areas are currently not served and there are no plans for coverage in the near future. The measure is part of the Broadband Wales Program, which feeds into the National Broadband Strategy of the United Kingdom.

The project aims at service provision and does not prescribe any technology. It is up to the service providers to build, buy or lease the necessary infrastructure and to provide the necessary equipment to provide the service.

The selected providers will have to offer wholesale access on a non-discriminatory basis to other operators and service providers wishing to connect customers.

The measure is partly funded by structural funds and partly by resources of the Welsh Assembly Government. The selected providers are expected to contribute a sizeable amount of the total project costs, including 50% of the capital and all the operating costs. Moreover, a rebate mechanism, under which a progressive reimbursement of the public funding is expected to take place as demand for services picks up, ensures that only the minimum necessary public funds are used

#### (6) Broadband in remote and rural areas in Spain

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<sup>45</sup> Asymmetric broadband at about 512kbps to 2Mbps downstream and 256kbps to 512kbps upstream speed.

By means of an aid scheme called *Programa de extensión de la banda ancha en zonas rurales y aisladas*, Spain aims at supporting the provision of broadband services, at conditions and prices similar to urban areas, in certain rural and remote areas, which are currently not served and where there are no plans for coverage in the near future. The notified measure is part of the Spanish National Broadband Strategy. The measure is partly funded by structural fund and partly by resources of the Spanish central government

The Spanish government envisages to cover approximately 203,000 households and businesses, at an average cost per user of €1,000. According to the calculations of the authorities, the overall cost for achieving this coverage will be in excess of €203m (€175m of which in objective 1 regions), of which most is to be borne by the selected service providers.

State funds will contribute to the overall costs via direct grants and interest-free loans. Both instruments can be applied in specific projects, depending on the request by the proponents, based on the financing characteristics of each project.

As a result of the State contribution, the selected providers are likely to build or upgrade new or additional infrastructure and communications equipment necessary to offer the retail broadband service connecting end-users in the concerned areas.

#### (7) “Cumbria Broadband”: aggregation of demand

Under the Statutory responsibility of the North West Development Agency, a contractor would be chosen through an open tender procedure for a period of three years for the provision of broadband services through Cumbria and parts of North Lancashire. Both areas are characterised by mountainous topography and a general lack of densely populated villages. Payments for the provision of services under the project are provided by the public-funded regional development agency.

The project combines two elements of demand aggregation in order to generate the critical mass of demand to attract potential service providers:

- Provision broadband services to public buildings including local authority buildings, museums, libraries and fire-stations.
- A service contract for the provision of broadband services to residential users

The selected service providers will provide a number of broadband services to public authorities in the region and broadband services to residential users of at least the same scope, content and quality supplied on a national level to end-users.

When requested by any other potentially interested ISP, the selected provider shall provide the ISP with wholesale services allowing it to provide broadband services to end-users.

Services to the end-users will be provided at a capped rate equal to the cheapest available rates for the specific broadband service being offered on a retail basis to a majority of users at a national level.

Service of General Economic Interest :

(8) “Haut débit Pyrénées-Atlantiques”

(9) “Mise en place d’une infrastructure haut débit sur le territoire de la région Limousin

The two projects concern the construction and exploitation of a public, open access network on the whole department of Pyrénées Atlantiques and in the region of Limousin respectively. The network will be made available, under transparent, objective and non-discriminatory conditions, to operators wishing to provide broadband services to residential users, business and public authorities.

In both notifications, the French Authorities underlined the fact that the measure fulfils the criteria allowing it to be defined as provision of public service, according to national law. In this framework, the realisation and management of this high speed infrastructure will be implemented by means of a public service delegation. Public funding will be provided to the concession holder as a compensation for public service provision.

In addition, the French Authorities qualified the projects as services of general economic interest (SGEI) in accordance with Art. 86 of the EC Treaty.

The four criteria of the *Altmark*<sup>46</sup> jurisprudence establishing that a compensation for a public service does not constitute State Aid are fulfilled in this project.

The four criteria are the following:

- (1) clearly defined public service obligations
- (2) the parameters used to calculate the compensation are established in advance in an objective and transparent manner
- (3) the compensation cannot exceed what is necessary to cover all or part of the costs incurred in the discharge of public service obligations
- (4) the undertaking is chosen through public procurement procedure or the level of compensation is determined on the basis of the costs of a typical well run undertaking.

Selected through an open tender procedure, the concession holders will have the status of carrier’s carrier. The infrastructure provided will be universally available to the public, technologically neutral and able to combine various types of technologies (fibre optic, DSL, satellites, Wi-Fi). It will be interoperable with any other operators’ network and able to provide “triple play” offers to end-users. In order to stimulate

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<sup>46</sup> Judgement of 24 July 2003 in Case C-280/00, *Altmark Trans*.

competition, client operators will also be able to lease dark fibre from the wholesale operator.