BSG
Broadband Stakeholder Group

Final report for the

Broadband Stakeholder Group

Models for efficient and effective public-sector interventions in next-generation broadband access networks

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Foreword

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The public sector is playing a prominent role in the deployment of next-generation broadband in a number of places around the world. In particular, in Asia and Europe there are now several examples where public funds have contributed to next-generation broadband deployment.

There are differences of views about the merits of such intervention. Some people point to these projects as pioneering examples of the positive role that the public sector can and should play in facilitating the accelerated roll-out of next-generation broadband for the benefit of local citizens and the economy. Others argue that these projects have risked pre-empting commercial deployment, created market distortions and may ultimately prove an extravagant misuse of taxpayers' money.

In our 2007 *Pipe Dreams* report, the BSG took a cautious approach to this issue. We argued that, although we could see a role for the public sector in the future – extending coverage into areas of persistent market failure – the UK market was still in a pre-investment phase and the risks of intervention today outweighed the risks of non-intervention. For this reason we argued that, as a general rule, the public sector should forbear from intervening at this stage. This remains our position today.

However, the *Pipe Dreams* report also recognised that there was value to be gained in experimentation and that there was much that could be learned from early pilot projects involving public-private partnerships. The report therefore called for further work to identify efficient and effective models for public-sector interventions, and that is the subject of this study.

With the support of the South East of England Development Agency (SEEDA), the BSG commissioned Analysys Mason to undertake a survey of broadband projects, both in Europe and beyond, that have involved some element of public funding and engagement. The aim of the report is to identify whether there are potential models for efficient and effective public-sector interventions that could be relevant for the UK.

Undertaking this work has presented a number of challenges. In particular, it is very difficult to determine whether or not an intervention has been efficient and effective in any particular case. Next-generation broadband remains a new phenomenon. It seems likely that it will generate real social and economic value, but this is unproven. A related BSG report, published at the same time as this report, tackles the social and economic value question. At the same time, the precise relationship between public interventions and next-generation broadband deployment is unclear because of the early stage of most projects. Many of the elements in the equation are consequently difficult to pin down with any certainty.

Therefore, beyond sounding a general cautionary tone about the risks of pre-emptive intervention, the report does not seek to provide a definitive answer to the questions of when, how or where the public sector should intervene. It does suggest that there may be areas where pilot projects would be appropriate. However, this is a local or regional decision and depends on factors such as the existence of political will and leadership; the availability of sufficient funding; the extent of stakeholder support; and, not least, the presence of genuine obstacles to commercial deployment. Moreover, within the European Community, any projects will need to be compliant with rules related to state aid.

However, the report does three useful things. Firstly, it sets out a practical definition of what we mean by efficient and effective. Secondly, it categorises both the drivers for intervention and the different approaches taken across Europe – with a number of common themes emerging. Finally, although no single model of intervention emerges as most appropriate, the report does identify six critical success factors, which if met, should help to ensure that interventions are more likely to prove efficient and effective in the long-term.

The report sets out a number of recommendations. Among these is a call for greater co-ordination at a national level involving the various public-sector organisations considering or undertaking projects, and relevant private-sector companies. There is much to learn about next-generation broadband on both the demand and supply side and a limited number of appropriate pilot projects could help dissipate the current uncertainty. Greater co-ordination, co-operation on standards, common ways of doing things and sharing evaluation and learning from projects would help to ensure that these pilots prove effective and of value in the long term.

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1 Executive summary

1.1 Introduction

The BSG's *Pipe Dreams* report from April 2007 looked at many of the issues surrounding next-generation broadband in the UK and put forward a number of recommendations, including the following:

Recommendation 7 – Identify models for efficient public sector intervention

"While the BSG recommends that the public sector should forbear from intervening to promote next generation broadband deployment at this stage, it is highly likely that public sector support will be required in areas where persistent market failure is most likely. Building on the Best Practice Guide published by the DTI and Ofcom in February 2007, further work should be undertaken to identify and experiment in the development of efficient and effective models for public sector interventions in collaboration with commercial stakeholders, government and the regulator."

The BSG, with the support of SEEDA, commissioned the present report to take forward this recommendation. In addition to the general requirement of Recommendation 7, the BSG set out the following questions in the terms of reference to be covered in this work:

- Q1: Why might some form of public-sector intervention be necessary in some areas?
- Q2: What local conditions might trigger the need for possible interventions?
- Q3: What form of interventions might be most appropriate?
- Q4: How should such interventions be structured and funded?
- Q5: What should be the criteria for deciding whether public-sector intervention should be considered in a particular area?

In order to address these questions, we built up an evidence base of case studies of public-sector interventions in the deployment of next-generation broadband, which are presented in Annex A. In addition to this, we also consulted with a range of stakeholders from within the BSG, and a selection of Regional Development Agencies (RDAs) and similar bodies from the devolved administrations. Experiences from both first-generation broadband in the UK and next-generation broadband intervention in both the UK and overseas have been used as part of the evidence base for this report.

We have addressed the questions to the extent possible by considering this evidence base. However, Q1, Q2 and Q5 also relate strongly to the underlying economics of next-generation access (NGA) deployment in certain geographies, and to understand this requires detailed modelling covering revenues, operating costs and capital expenditures. This is not covered in this

report, and further work, such as the Caio Review and the BSG *Economic and Social Value*[1] report should be considered when addressing these issues.

1.2 Efficient and effective

Before assessing efficient and effective models for public-sector interventions, it is important to have a common understanding of what efficient and effective means. In this report we have defined an 'efficient and effective' model as one that:

- defines clear goals in advance, with minimal political influence in network design
- invests the minimal amount required to achieve its goals
- limits market distortion
- provides competitive services to end users
- is delivered in a timely manner
- involves parties that are stable financially.

These have been chosen to cover a wide range of areas that we believe would lead to an economically efficient intervention by only diverting from free market principles to the necessary extent. Additionally, they should ensure that maximum benefits can be realised via quick delivery of next-generation broadband and the existence of a competitive market in the long term.

It is difficult to measure against a number of these factors (for example, investing the minimal amount), and in some instances it may not be possible to measure at all. We have therefore identified a set of critical success factors that we believe present good practice in intervention design, building on this definition of efficient and effective, and the evidence in the report.

1.3 Drivers for public-sector interventions

There are a number of possible drivers for public-sector intervention in next-generation broadband. We have conducted a number of case studies to identify these, primarily from outside the UK. We have also consulted with a range of public-sector bodies in the UK. From the consultations and the case studies, three drivers appear to be the most important in public-sector interventions in next-generation broadband:

- economic drivers, comprising:
  - addressing market failures
  - addressing distributional policy objectives
  - supporting economic development
- social drivers
- semi-commercial public-sector expansion.

[1] *A Framework for Evaluating the Value of Next Generation Broadband*, Plum Consulting for the Broadband Stakeholder Group (referred to throughout as the *Economic and Social Value* report).

1.3.1 Economic drivers

Market failure

There are a number of ways in which market failure could lead to next-generation broadband not being deployed, including abuse of significant market power (SMP), uncertainty over demand for next-generation broadband, and regulatory uncertainty.

The most likely cause of market failure is probably uncertainty over demand, which could be tackled by demand-side interventions. The risks associated with market failures due to SMP and regulatory uncertainty should both be reduced by the infrastructure competition between Virgin Media and BT, and the work being led by Ofcom on the regulatory environment for next-generation broadband.

Distributional policy objectives

Distributional objectives aim to help those individuals or communities that are left behind during the process of (economic) growth. Addressing such differences can also be an important part of social inclusiveness, especially if the services being offered over next-generation broadband have a wider social value. We have identified three scenarios where distributional policy objectives may be a driver for interventions:

- lack of supply due to the higher costs associated with certain geographical areas (usually rural), which makes a service unviable for the private sector to provide
- less demand for new (more expensive) services due to an area being less affluent, even though deployment costs are not higher than average
- next-generation broadband could be deployed commercially to new build or regeneration areas and not to other adjacent areas.

It is worth highlighting that the market for next-generation broadband services is not yet mature enough for *any* of our case studies (which are residentially focused) to be purely driven by the desire to address distributional policy objectives. However, experience from first-generation broadband suggests that this is likely to become an important driver in the future, as market-led deployments are made in more commercially attractive areas first.

Economic development

Economic development is a primary driver behind the proposed next-generation access interventions in both South Yorkshire and Cornwall.[2] The sponsors of these projects believe that next-generation broadband will stimulate their respective local economies, both through support of

[2] The South West RDA, in conjunction with ActNow are planning an intervention in Cornwall (using EU funds) that will see the deployment of next generation broadband. The project is likely to have a business focus, but may also cover residential premises. At present it is still in its early phases so the nature of any intervention is not yet clear.

new industries such as the creative media sector, and through improving productivity and communications for existing industries. Economic development is also cited as a driver in the case studies on Pau Broadband and Asturias.

As outlined in the *Economic and Social Value* report, there may be productivity gains from next-generation broadband that will increase economic output. However, the report also outlines that there is significant debate as to whether regions are really in competition with each other, and highlights that interventions should have a clear economic rationale, beyond investing because other regions, or countries, are also investing.

1.3.2 Social drivers

We have also observed a range of socially oriented reasons for the public sector being interested in next-generation broadband, some of which have led to interventions.

Projects with a public service-innovation goal aim to deploy a next-generation broadband network, and then work with a wide range of stakeholders to develop new services to be delivered over that network. Examples of this can be found in the European case studies, but there is also growing interest from the public sector in the UK to explore how next-generation broadband can be utilised to help deliver public services.

Our discussions with stakeholders in the UK have also raised a potential driver related to the improvement of public housing though the deployment of next-generation broadband. This is coupled with a range of projects aimed at less affluent areas that also tackle skills and social cohesion.

1.3.3 Semi-commercial public-sector expansion

In a number of countries, but not the UK, there are semi-commercial public sector-led broadband initiatives that aim to generate additional business for the local utility company. Examples of these include Wilhelm.tel and CityNetCologne in Germany. This close relationship allows next-generation broadband networks to be deployed in a cost-effective manner, e.g. being installed at the same time as new utility infrastructure.

1.4 Models for intervention

There are two main categories of intervention that we have analysed:

- **Demand-side interventions** aim to address a lack of demand for a service so that it can then be provided by the private sector. This is generally done through demand aggregation and demand stimulation.
- **Supply-side interventions** address cases where the market is not supplying a service, often after demand has been identified. Such interventions are often focused on specific

geographical areas where the costs of supplying the required service are too high for the level of demand that has been identified.

Whereas demand-side interventions are relatively straightforward to analyse, supply-side interventions demonstrate a greater diversity of models. The evidence does not point to any particular model being inherently more successful, although our case studies show that many of the interventions to date have either used a public-private partnership, or the utility-driven business model.

1.4.1 Models for demand-side interventions

Demand aggregation and stimulation

During the deployment of first-generation broadband in the UK, a number of public-sector interventions focused on demand aggregation and stimulation. We are now beginning to see a similar approach being utilised for next-generation broadband interventions. It is important to note that demand registration schemes relating to next-generation broadband have all involved consumers making a contractual commitment to take a service several months in advance of that service becoming available. This is in contrast to most first-generation broadband schemes, which were more of an 'expression of interest' with no firm commitment.

1.4.2 Models for supply-side interventions

Procurement of a defined service

Under this business model, the public sector procures a service from the private sector. Ideally, the service procured is technology neutral, though in reality the definition of the service requirements may limit the choice of technologies that can be used. Any assets required to deploy the services are owned by the private sector. As part of the procurement, the public sector will often provide an upfront payment to set up the service for a fixed period of time. Once the contract has expired, the service will continue on a commercial basis, be re-procured, or cease to be offered. This business model reduces the risk of low demand leading to long-term subsidies from the public sector, and can be simpler for the public sector to deliver than the more infrastructure-based models.

Public-private partnerships

Interventions following the public-private partnership model can be classified as those where the public sector funds the deployment of assets, but then partners with a private-sector firm (or firms) to build, operate and maintain the network for the public sector. The public sector typically retains at least some ownership of the assets. Public-private partnerships appear to be most appropriate where there is significant new infrastructure of which the public sector wishes to retain ownership. By keeping ownership of a network, it allows the public sector to change its service-delivery partner over time by re-tendering the contract, for example to replace an under-performing private-sector partner.

Utility business expansion

Some public utilities in foreign markets are expanding into next-generation broadband on a semi-commercial basis, exploiting synergies in their business that can reduce deployment costs. We believe that such a model is unlikely to materialise in the UK, due to the very different way in which the utility industries are structured in the UK. However, one area where the utility model could be pursued is in areas of new build or urban regeneration where a single provider could supply a range of utilities, including telecoms, to the area. There is also potential for utility companies to help reduce the deployment costs for next-generation broadband by enabling use of their duct networks.

Co-operatives

A local co-operative business model has been adopted successfully in some of our case studies, most notably the OnsNet project in Nuenen. An issue with co-operative models, however, can often be their relatively small scale, and therefore lack of attractiveness to service providers. If a co-operative model were to be considered in the UK, a series of local co-operatives under a national co-ordinating organisation would seem most likely to succeed. We believe that the presence of such a body (which could include aggregating wholesale services for retail service providers) could help to mitigate some of the risks we have associated with small-scale interventions.

Working with property developers

The costs of deploying next-generation broadband can be significantly reduced if it is carried out at the same time as other civil works. This is much more straightforward in greenfield deployments, but there are also potential interventions at smaller-scale urban regeneration projects where next-generation broadband networks may be deployed with the assistance of the public sector. It is worth noting that new-build and regeneration schemes have the potential to showcase the benefits of next-generation broadband. If they do prove to be successful in demonstrating demand for next-generation broadband services, they could stimulate the development of new private sector-led projects in similar areas. Such interventions are also relatively easy for the public sector to support as they often require minimal investment.

1.5 Critical success factors for efficient and effective interventions

Based on the evidence provided in this report and our definition of an efficient and effective intervention, we have categorised the following critical success factors as providing good practice for planning, designing and executing an intervention. We consider that interventions that follow these critical success factors will have a greater chance of being successful.

Not pre-empting the market unless there are good grounds to do so

Supply-side interventions should not seek to address a potential digital divide too early, as it may take some time for the full extent of demand to emerge. This may mean that initial estimates of likely coverage from next-generation broadband will be exceeded once demand fully materialises (either naturally or with assistance from demand stimulation and aggregation). However, supply-side stimulation should also consider the lead times for next-generation broadband deployment, which if deployed on a wide scale can typically take three to five years to complete; the availability of EU funds for some regions may prompt an intervention to be designed earlier than otherwise expected.

Using the open-access network model

Interventions should seek to use an open-access model, as open access networks help to promote competition from multiple service providers, support innovation in products and services, and minimise market distortion. Additionally, open-access networks help to fulfil some of the requirements for state-aid approval by the European Commission.

Designing to minimise barriers to adoption

Interventions should be structured to minimise barriers to adoption for both end users (e.g. low connection charges) and service providers. Barriers to adoption for service providers can be minimised by designing schemes so they are aggregated across regions where possible, so that they have common technical specifications (based upon standards) and wholesale products.

Stimulating and aggregating demand

Demand stimulation and registration schemes are likely to be important in future and ideally should be structured so that they have an element of commitment from users, since this helps support the significant investments required in a new network. To gain this commitment, it may be necessary to provide details of services and prices before networks are built.

Additionally, our consultations with stakeholders suggested that demand stimulation should be timed so that it is concurrent with an increase in supply, whether from the private sector or via supply stimulation effected by the public sector.

Interventions should recognise the importance of both high take-up and the impact that a strong community-based dimension to an intervention can have on a localised intervention. Local interest can also be leveraged by local demand-stimulation initiatives such as those in OnsNet.

The use of end-user incentives such as subsidised connection fees or subscription-free periods should be considered to help ensure that networks achieve high levels of take-up that will help to improve the financial performance of the network.

Anticipate risks via detailed planning

When designing interventions, careful consideration should be given to potential market developments that may lead to the infrastructure being superseded by other technologies. Contracts should also be structured so that they can react to significant changes in take-up, pricing or wholesale product requirements.

It is also important to conduct thorough due diligence as part of the project to ensure that the plan is credible and will not be subject to significant delays, increases in costs, or other potential difficulties. Public bodies should ensure that they have access to the necessary skills, either internally or externally, to design interventions and identify any forward-looking risks that could emerge.

Compliance with state-aid rules, and support via other legal frameworks

It is important for the public sector to design interventions to comply with European state-aid rules or any other relevant legal frameworks. Failure to do so could lead to significant delays due to legal challenges and could potentially lead to a project being suspended.

1.6 Conclusions

We have addressed the questions raised in the terms of reference to the extent possible by considering the evidence base, and by identifying models used and the critical success factors underpinning these to ensure they are as efficient and effective as possible:

Q1: Why might some form of public-sector intervention be necessary in some areas?

Based upon the current market outlook for next-generation broadband, we believe that it is unlikely that the market will deploy next-generation broadband to all areas of the UK due to the higher costs of deployment in more rural areas. Further, deployment would likely be phased in across the UK over a number of years, meaning the majority of areas would be disadvantaged initially.

The *Economic and Social Value* report suggests that there may be significant social and economic value from the deployment of next-generation broadband. If significant benefits do emerge, individuals and communities not served by next-generation broadband could be progressively disadvantaged over time.

A desire by the public sector to either capture these benefits sooner, or in a more extensive manner through increased coverage, could lead to public-sector interventions.

Q2: What local conditions might trigger the need for possible interventions?

A variety of economic and social drivers, as outlined in Section 3, have triggered public-sector interventions to date. The variety of drivers reflects the varied local economic and market conditions, and policy priorities.

Many public-sector interventions have been driven by the economic development rationale and the desire to pioneer next-generation broadband. However, as the market matures, we believe that distributional policy objectives will become more prevalent as the public sector seeks to address geographical variations in coverage.

The availability of funding has been observed to be an important consideration for the timing of interventions. Whilst the planned public-sector intervention in Cornwall is partly driven by distributional policy, the timing of the project is also influenced by the availability of time-limited EU funding. The availability of funding is also a consideration in the timing of the South Yorkshire intervention.

Q3: What form of interventions might be most appropriate?

The case studies have identified a wide range of approaches to public-sector interventions in next-generation broadband. This wide range of approaches is in part dictated by the different circumstances behind each intervention.

The evidence base does not identify any single approach as being the most appropriate. However, the evidence base has been used to identify a common set of critical success factors that we believe underpin efficient and effective interventions. We note that successful interventions have often sought to address both demand- and supply-side issues.

In addition to these critical success factors, we have made a number of additional recommendations that are discussed in the next section.

Q4: How should such interventions be structured and funded?

Public-sector interventions should consider how they could be designed to be efficient and effective from the outset. To do this, it is important to have an up-front definition of what efficient and effective mean. In this report, we have defined an efficient and effective model as one that:

- defines clear goals in advance, with minimal political influence in network design
- invests the minimal amount required to achieve its goals
- limits market distortion
- provides competitive services to end users
- is delivered in a timely manner
- involves parties that are stable financially.

To meet these objectives, interventions should follow, as far as possible, the critical success factors identified in this report.

We have not identified any evidence that the source of funding alone impacts the efficiency or effectiveness of an intervention.

Q5: What should be the criteria for deciding whether public-sector intervention should be considered in a particular area?

The criteria for public-sector intervention in next-generation broadband will vary depending on the local conditions. It is likely that a combination of the economic and social drivers that we have identified will provide the rationale for future interventions.

As identified in our definition of efficient and effective, it is important for interventions to be clear, consistent and transparent about the drivers for the intervention from the outset.

Where appropriate, public-sector interventions should also consider the need to comply with state-aid guidelines. In the cases where compliance with state-aid guidelines is not required, we believe that there is a role for them to be considered as they still contain important concepts that help to ensure interventions are efficient and effective.

1.7 Recommendations

To help ensure that interventions are as efficient and effective as possible, we have made the following recommendations:

1. Follow the critical success factors as far as possible

Section 5 sets out the critical success factors that we believe will help to ensure that interventions are designed to be as efficient and effective as possible.

2. Encourage next-generation broadband deployment in areas of new build, regeneration and redevelopment

It is significantly more efficient to deploy next-generation broadband as part of a new-build development, regeneration or redevelopment when compared to deploying next-generation broadband to existing sites. Public bodies should therefore work with property developers to raise the profile of next-generation broadband networks and encourage deployment of next-generation broadband in such developments.

Areas of the public sector seeking to deploy next-generation broadband to areas of new build, regeneration and redevelopment should seek further information from sources such as the guidance from the Department of Communities and Local Government on Data Ducting Infrastructure for New Homes,[3] and the recent Ofcom consultation on Next-Generation New Build. Public bodies should also consider using Local/Multi-Area Agreements and planning conditions to aid the deployment of next-generation broadband in this area.

The deployment of next-generation broadband to these areas can also be part of a supply and demand stimulation scheme, as it will showcase the technology to the private sector and allow consumers to see the potential benefits of next-generation broadband.

[3] http://www.communities.gov.uk/publications/planningandbuilding/dataductinginfrastructure.

3. Pilot projects should be co-ordinated with a clear goal

There are a number of interventions that are currently being planned. In some respects, these are pilots and may be seeking to address similar issues. We would recommend that all pilot projects from both the public and private sector work together to ensure that there is a co-ordinated approach to learning, that a full range of issues can be considered, and that efforts are not duplicated and wasted.

Such work could either be co-ordinated by a specific body, or could work in conjunction with other industry groups considering next-generation broadband. Such work should also seek to utilise the upcoming European Broadband Portal.[4]

4. Interventions should seek to offer a standard set of wholesale products

It is important that interventions are able to attract multiple retail service providers. To help minimise the costs to service providers that wish to use any networks provided by interventions, we believe it would be helpful if interventions used a common wholesale product set where possible. Ideally, this would be similar to, or the same as, products from the private sector. In this way, service providers should be able to simply add new networks to their offering with minimal additional upfront costs.

It may be appropriate for co-ordination bodies such as that proposed by Ofcom for new build, or NGNuk, the DSL Forum or others, to be involved in designing a common set of wholesale products. The Ofcom consultation document on Next-Generation New Build also recognises the importance of a common set of wholesale products and its potential positive impact upon retail competition.

5. Interventions should consider using the same commercial partners

Following on from Recommendation 4, supply-side interventions should consider the potential for aggregating their networks via a commercial partner, or partners, which operate and maintain the infrastructure. This model has been used in other countries, as outlined in Section 5.3. Such an approach would help create economies of scale. However, the risk of creating a local monopoly needs to be considered. It may therefore be appropriate for more than one commercial organisation to be involved for this purpose.

In addition to the operation and maintenance of networks, interventions should also consider any potential economies of scale from using the same commercial partner(s) during the planning and construction phases of intervention.

This recommendation is consistent with proposals from Ofcom in its consultation document on Next-Generation New Build.

[4] The European Commission are setting up a portal known as the European Broadband Portal to act as a platform for the exchange of good practice and as an inventory of information about developments in broadband, including information about the regulatory framework and the State Aid rules as they impact on public sector investments. The portal will go live in June 2008.

6. Additional work should be carried out to help provide clarity on the commercial business case

Because of the large investments required for next-generation broadband, commercial investors require a robust business case for those investments. There are two key areas where additional work can be carried out to ensure the private sector has the best-possible information:

- Firstly, on the demand side, there is great uncertainty around the willingness for consumers to pay for the additional services that could be offered over next-generation broadband. Therefore, it may be appropriate for work to be carried out to help establish the potential additional revenues for such services.
- Secondly, there is uncertainty over the costs for deploying next-generation broadband. We note that the BSG will be undertaking a study of the costs of fibre deployment in the UK, as a part of the Caio Review. This, and the work being carried out by Ofcom on the reuse of existing infrastructure, will go some way to addressing this.

7. Define appropriate metrics for measuring 'success' and measure through the lifetime of the intervention

In researching the case studies, we have found large amounts of contradictory opinion about the success, or otherwise, of some interventions. This includes both financial and non-financial performance. Intervention should therefore define suitable metrics for measuring success, against their rationale and objectives as laid down by the intervention sponsors, and measure performance against these throughout the lifetime of the intervention. This will be particularly important in the first few years, and would aid re-design of the intervention should performance fall short of the original expectations.

2 Introduction

2.1 Background to the report

Next-generation broadband is now being deployed in a number of markets around the world, including Belgium, Denmark, France, Germany, the Netherlands, Sweden, Switzerland, the USA and Japan. In contrast, the UK market is at a much earlier stage of development, with small-scale trials being conducted by Openreach and Virgin Media, although the latter has indicated its plans to rollout higher-speed services in 2008.

This has raised concerns that the UK may be disadvantaged economically and socially due to late deployment. This is an issue addressed by the BSG's *Economic and Social Value* report. A corollary of this debate has been the role of the public sector in the deployment of next-generation broadband, and it is this issue that this report seeks to address.

The costs of broadband deployment are highly dependent on economies of density, and therefore the cost per home of deploying services in rural areas is significantly higher than in urban areas. The current generation of broadband services is now available on a near-universal basis and the public sector played an important role in helping to extend the reach of broadband to many rural areas. Given the significantly higher costs involved in deploying next-generation broadband, it is likely that the market will drive deployment in some but not all parts of the UK. For higher levels of coverage to be achieved, it seems likely that the public sector will again need to play a role. Given the nature of the costs involved, the scale of intervention required could be significantly larger than was the case before.

A number of interventions by the public sector have already occurred in various markets in Europe and across the world, and some (such as the South Yorkshire Digital Region project) are planned in the UK. Many of these form the evidence base for this report. Given that other countries have already set up interventions, the UK has an opportunity to learn from these in order to inform its decisions on when, how and why the public sector should intervene in the deployment of next-generation broadband.

The BSG's *Pipe Dreams* report from April 2007 looked at many of the issues surrounding next-generation broadband in the UK and included a number of recommendations. One of these recommendations provides the motivation for this report:

Recommendation 7 – Identify models for efficient public-sector intervention

"While the BSG recommends that the public sector should forbear from intervening to promote next generation broadband deployment at this stage, it is highly likely that public sector support will be required in areas where persistent market failure is most likely. Building on the Best Practice Guide published by the DTI and Ofcom in February 2007, further work should be undertaken to identify and experiment in the development of efficient and effective models for public sector interventions in collaboration with commercial stakeholders, government and the regulator."

2.2 Terms of Reference

In addition to the general requirement of Recommendation 7, the BSG set out the following questions to be covered in this work:

- Q1: Why might some form of public-sector intervention be necessary in some areas?
- Q2: What local conditions might trigger the need for possible interventions?
- Q3: What form of interventions might be most appropriate?
- Q4: How should such interventions be structured and funded?
- Q5: What should be the criteria for deciding whether public-sector intervention should be considered in a particular area?

- We have addressed the questions to the extent possible by considering the evidence base. However, Q1, Q2 and Q5 also relate strongly to the underlying economics of NGA deployment in certain geographies, and to understand this requires detailed modelling covering revenues, operating costs and capital expenditures. This is not covered in this report. The BSG has been tasked under the Caio review to undertake fibre-to-the cabinet (FTTC) and fibre-to-the-home (FTTH) costing work that would form an important input to understanding the economics of NGA.

- There are several other challenges with addressing the recommendation and the terms of reference. A key challenge was to define what we mean by an efficient and effective model for interventions. This was particularly important, as the way this is defined would provide us with the criteria for identifying whether an intervention had been successful or not, which forms a key part of the analysis of this report. This is discussed further in Section 2.4.

- A challenge for evidence gathering was that there is a limited number of suitable projects to investigate. Clearly, operational (live) interventions that have been running for a number of years are likely to be most instructive in terms of understanding the opportunities and challenges presented by intervention. There are, however, relatively few well-established operational interventions, particularly in Europe (our main area of reference given the similarity of the regulatory environment).

- To support the case studies of operational interventions, we also considered interventions that are at the planning stage or under construction, since we believe there is merit in understanding how and why they have been designed in the way they have. Projects that are still new, or not yet live, can also provide evidence of potential pitfalls to avoid in the design and planning stages. Without knowing whether the intervention will be a success, however, it is difficult to be able to draw too many conclusions from these projects regarding their operational design.

- A final challenge when considering the success of an intervention is that, in the cases where there has been an intervention, it is not possible to determine what the market itself would have delivered if that intervention had not occurred. The experience of the UK during the deployment of first-generation broadband provides a good illustration of this.

- However, it is less easy to examine this issue for next-generation broadband given the uncertainties over the business case and long timeframes for deployment. We have considered this issue explicitly and have attempted to define approaches that would limit this effect.

2.3 Approach

In order to address the questions set out in the terms of reference, we first built up an evidence base of case studies of public-sector interventions in the deployment of next-generation broadband, which are presented in Annex A. In addition to this, we also consulted with a range of stakeholders from within the BSG, and a selection of RDAs and similar bodies from the devolved administrations. Experiences from both first-generation broadband in the UK and next-generation broadband intervention in both the UK and overseas have been used as part of the evidence base for this report.

Through this evidence base, we then sought to identify the key drivers of interventions, categorising them accordingly and examining the circumstances in which they emerged. We then identified the different models of intervention that have been used, which vary widely. These were then categorised and analysed.

Following this analysis, it was then possible for us to identify a number of critical success factors that underpin these interventions. These were the key factors that we identified as being most important for the success of an intervention. This drew on our definition of efficient and effective, set out below, which provides a framework for understanding whether or not an intervention has been, or is likely to be, successful.

Finally, we brought together the conclusions from the report, setting out how the report addresses the issues raised in the terms of reference.

This report focuses on fixed (wired) networks – mainly fibre – rather than wireless technologies as the more challenging aspects of NGA relate to wired networks, specifically barriers to deployment. However, wireless may play an important role in NGA, and those considering interventions need to take wireless technologies into account.

2.4 Defining ‘efficient and effective’

In this report we have defined an ‘efficient and effective’ model as one which:

- defines clear goals in advance, with minimal political influence in network design
- invests the minimal amount required to achieve its goals
- limits market distortion
- provides competitive services to end users
- is delivered in a timely manner
- involves parties that are stable financially.

These have been chosen to cover a wide range of areas that we believe would lead to an economically efficient intervention by only diverting from free market principles to the necessary extent. Additionally they should also ensure the maximum benefits can be realised via quick delivery and ensuring a competitive market in the long term.

It is difficult to measure against a number of these factors (for example, investing the minimal amount), and in some instances it may not be possible to measure at all. We have therefore identified a set of critical success factors that we believe present good practice in intervention design, building on this definition of efficient and effective, and the evidence in the report.

2.5 Report structure

The remainder of this document is laid out as follows:

- Section 3 describes the different drivers for public-sector interventions
- Section 4 describes the different models used for interventions
- Section 5 outlines the critical success factors that we have identified
- Section 6 summarises our conclusions and recommendations.

In addition, the following supporting annexes are included:

- Annex A contains the case studies of international interventions in next-generation broadband network that we have conducted during the course of this project
- Annex B presents a case study of LD Collectivités
- Annex C includes a glossary of terms.

3 Drivers for public-sector interventions

There are a number of possible drivers for public-sector intervention in next-generation broadband. We have conducted a number of case studies to identify these, primarily from outside the UK, where networks are operating and supporting commercial services; these are presented in Annex A. The case studies have been undertaken to build an evidence base that helps to identify drivers for interventions, the models used, as well as efficient and effective features of interventions.

We have also consulted with a range of public-sector bodies in the UK to hear their views on next-generation broadband networks and the potential role of these organisations in supporting their deployment. In some cases, such views build on intervention experiences from first-generation broadband networks. From both the consultations and the case studies, three drivers appear to be the most important in public-sector interventions in next-generation broadband:

- economic drivers
- social drivers
- semi-commercial public-sector expansion.

It should be noted that many of the case studies cite more than one of the drivers as their rationale, highlighting the complexity, and inter-relation, of the issues surrounding next generation broadband.

3.1 Economic drivers

Guided by the joint report from Ofcom and the DTI[5] (now BERR), we have identified three sub-categories of economic drivers for interventions in next-generation broadband. These are discussed, in turn, below:

- addressing market failures
- addressing distributional policy objectives
- supporting economic development.

It is worth noting that our definitions of the drivers, particularly those related to the drivers 'addressing market failures' and 'addressing distributional policy objectives' are slightly different to the definitions used by Ofcom and the DTI as we believe they offer increased clarity.

[5] *Public Broadband Schemes – A Best Practice Guide*, Ofcom and the Department of Trade and Industry, February 2007, http://www.ofcom.org.uk/media/mofaq/telecoms/pbs/dti_pbs.pdf.

3.1.1 Addressing market failures

In the context of next-generation broadband, it may be that interventions are appropriate because of market failure. There are three potential ways in which market failure could emerge in next-generation broadband:

- **Significant Market Power (SMP)** could lead to an operator restricting output to increase profits. In the case of next-generation broadband, this would mean not deploying a service even when there is a clear demand for one to be provided. Such market failures can be overcome by increased competition.

- **Uncertainty over demand** could lead to an operator not deploying next-generation broadband. This could be a market failure if there was enough underlying demand, but operators were not able to identify it. This potential market failure can be overcome by demand-side stimulation interventions.

- **Regulatory uncertainty** can lead to operators not investing in new infrastructure as they are unclear on how regulation may impact their investment in future.

BT and Virgin Media are the primary source of infrastructure competition in the UK. Coupled with the already-announced deployment of services from Virgin Media that will offer up to 50Mbit/s across the majority of its network footprint, we believe that it is unlikely for an SMP market failure to occur within the cable footprint. However, outside these areas, there remains a risk of market failure.

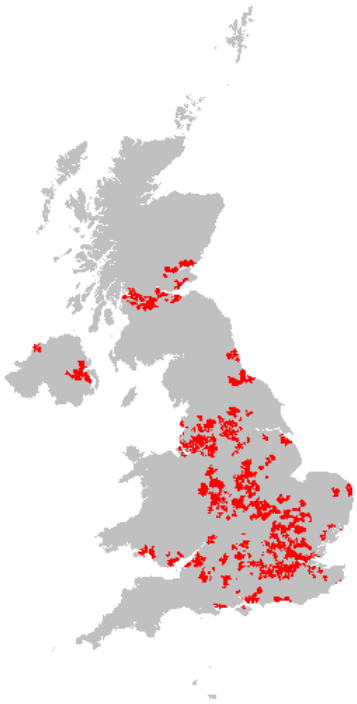

Figure 3.1: Cable network coverage from Virgin Media [Source: Analysys Mason]

The commercial deployment of services from Virgin Media should also help to lower the risk of market failure due to demand uncertainty. This risk may not be removed fully and there may be a role for the public sector in helping the private sector identify demand.

The regulatory uncertainty issue is starting to be addressed by Ofcom now. The impact of regulation is important to prevent long-term market failures in the delivery of next-generation broadband services. In order to ensure a competitive market, there may be a need for a range of regulatory policies to ensure that suitable wholesale products are made available, as they were in first-generation broadband. The work Ofcom is doing with industry on a set of wholesale products for next-generation broadband (i.e. the Ethernet Active Line Access) is a key part of minimising the risk of market failure in the provision of retail services in the future.

In summary, there are a number of ways in which market failure could lead to next-generation broadband not being deployed. The most likely cause of market failure could be uncertainty over demand, which could be tackled by demand-side interventions (discussed in more detail in Section 4.1). The risks associated with market failures due to SMP and regulatory uncertainty should both be reduced by the infrastructure competition between Virgin Media and BT, and the work being led by Ofcom on the regulatory environment for next-generation broadband.

3.1.2 Addressing distributional policy objectives

Although sometimes considered under market failure, we have chosen to separate distributional policy objectives as they are particularly important and pose unique challenges in the context of next-generation broadband.

Distributional policy seeks to address cases where the market outcome leads to an unequal distribution of an output (e.g. income, service provision). Public intervention may be used to correct the outcome *ex post* as well as to provide a more equitable solution.

Generally speaking, distributional objectives aim to help those individuals or communities that are left behind during the process of (economic) growth. Addressing such differences can also be an important part of social inclusiveness, especially if the services being offered over next-generation broadband have a wider social value (such as those discussed in Section 3.2). In the context of next-generation broadband, the aim of distributional policies is to provide sufficient connectivity to those parts of the society that have demand for a service that is not supplied by the market without intervention. We have identified three scenarios where distributional policy objectives may be a driver for interventions:

- lack of supply due to the higher costs associated with certain geographical areas (usually rural), which makes a service unviable for the private sector to provide
- less demand for new (more expensive) services due to an area being less affluent, even though deployment costs are not higher than average
- next-generation broadband could be deployed commercially to new build or regeneration areas and not to other adjacent areas

Under all three of these scenarios, the public sector may wish to address the under-supply of next-generation broadband in certain areas.

It is worth highlighting that the market for next-generation broadband services is not yet mature enough for *any* of our case studies (which are residentially focused) to be purely driven by the desire to address distributional policy objectives. However, experience from first-generation broadband suggests that this is likely to become an important driver in the future, as market-led deployments are made in more commercially attractive areas first.

In the UK, first-generation broadband deployment was supported by this kind of distributional policy intervention throughout the UK by the various RDAs and the devolved administrations in Scotland, Wales and Northern Ireland. These interventions generally used a combination of demand stimulation, followed by the procurement of a broadband service if the demand was still insufficient. This is discussed in more detail in Section 4.

We have identified two examples of interventions in next-generation broadband whose sole primary driver is distributional policy objectives: the fibre metropolitan area networks (MANs) in Ireland and the FibreSpeed project in Wales, both of which focus on services for businesses.

The current deployment of DSL-based, first-generation broadband services is subject to a number of limitations due to the nature of the technology (inherently asymmetric) and the architecture of the network, in particular the distribution of line lengths between exchanges and end-users. This has led to a significant difference in the service quality across the country that cannot be simply categorised as an urban/rural problem. Some bodies such as the South West of England RDA (SWRDA) are of the view that this issue *in itself* merits an intervention to address the distributional issues with first-generation broadband, and that the only way to address these is by deploying next-generation broadband. Such a rationale may have more merit for areas of the UK where there is no alternative infrastructure (i.e. where there is no cable coverage).

3.1.3 Supporting economic development

Economic development is a primary driver behind the proposed next-generation access interventions in both South Yorkshire and Cornwall.[6] The sponsors of these projects believe that next-generation broadband will stimulate their respective local economies, both through support of new industries such as the creative media sector, and through improving productivity and communications for existing industries.

As outlined in the *Economic and Social Value* report, there can be real productivity gains from next-generation broadband that will increase economic output. However, the report also outlines that there is significant debate as to whether regions are really in competition with each other, and

[6] The South West RDA, in conjunction with ActNow are planning an intervention in Cornwall (using EU funds) that will see the deployment of next-generation broadband. The project is likely to have a business focus, but may also cover residential premises. At present, it is still in its early phases so the nature of any intervention is not yet clear.

highlights that interventions should have a clear economic rationale, beyond investing because other regions, or countries, are also investing:

"Investing in something simply because others have does not make economic sense. The case for investment should rest on the resource cost and expected returns within the UK. If others invest in next generation broadband the UK is not necessarily getting left behind in terms of economic and social progress…

However, the fact that others are investing may change the best estimate of costs and benefits for investment in the UK for a number of sound reasons:

- *Market outcomes where others have invested provide new information about costs and demand*
- *Global orders for equipment will establish standards and contribute to global scale in manufacturing, thereby lowering costs (though some costs could rise in the short run, for example, in relation to particular skills where labour is free to move)*
- *Investment in next generation broadband by others contributes to global network effects, for example, perhaps establishing video collaboration as a standard tool in global supply chains*
- *The development of applications and services around next generation broadband will enlarge the market which can be tapped quickly in relation to any local investment*

The key point is that whilst what others do may change the expected costs and benefits of investment in next generation broadband in the UK, it is not the fact that others are investing per se that should motivate investment. Investment should be judged on its merits in terms of productivity, consumer welfare and wider gains."

In addition, our case studies have also identified economic development as a primary driver for many of the interventions, including: Pau Broadband, Asturias and South Yorkshire Digital Region; others such as CityNet, Blizznet and the fibre MANs in Ireland also consider economic development as a driver, albeit a secondary one.

3.2 Social drivers

We have also observed a range of socially oriented reasons for the public sector being interested in next-generation broadband, some of which have led to interventions.

Projects with a public service-innovation goal aim to deploy a next-generation broadband network, and then work with a wide range of stakeholders to develop new services to be delivered over that network. Perhaps the best example of this is OnsNet in Nuenen, the Netherlands. In this intervention, strong, local community support has been harnessed to develop new services and applications such as remote health monitoring and local video content. The project has worked with commercial organisations such a Philips and Rabobank (a large Dutch bank) to develop new applications. In this case, the majority of current applications do not fully utilise the bandwidth

capabilities of the network; in future, this situation is likely to change as more bandwidth-intensive applications are developed.

We have also identified a growing interest from the public sector in the UK to explore how next-generation broadband can be utilised to help deliver public services. This would build upon the increasing trend for the delivery of public services. Once again, the immediate applications (such as online tax services) do not require very high-speed networks; however, with the capability in place, it could support the development of a range of video-enhanced communication services (e.g. citizen to local authority, GP to patient).

Our discussions with stakeholders in the UK have also raised a potential driver related to the improvement of public housing though the deployment of next-generation broadband. This is coupled with a range of projects aimed at less affluent areas that also tackle skills and social cohesion.

Although such social considerations have not really been key drivers for intervention to date, it seems likely that they will become increasingly important – the initiatives in Walsall and Manchester suggest this to be the case. However, these two interventions are at present relatively small scale, and it may be that larger interventions (e.g. at a regional scale) are most likely to demonstrate a combination of drivers, encompassing economic and social factors.

3.3 Semi-commercial public-sector expansion

In a number of countries, but not the UK, there are semi-commercial public sector-led broadband initiatives that aim to generate additional business for the local utility company. Examples of these include Wilhelm.tel and CityNetCologne in Germany. This close relationship allows next-generation broadband networks to be deployed in a cost-effective manner, e.g. being installed at the same time as new utility infrastructure.

It appears that many of these initiatives are carried out on a semi-commercial basis, with no public subsidy. However, there may be sources of funding that are on more favourable terms than a purely commercial operator could obtain. They may also be willing to accept the risks associated with low demand more so than the private sector, with lower margins and a longer payback period. Although not covered in our case studies, the utility model has also been widely used in Denmark and the USA. For example, DONG Energy is the largest next-generation broadband operator in the Danish market. There are also other networks (e.g. Utopia) that utilise utility infrastructure, but these do not use a fully commercial business model. Because of often complex financial structures and limited public information, it is not possible to ascertain how commercially successful these interventions have been.

3.4 Summary of drivers in the case studies

The case studies have shown a diverse range of drivers for public-sector interventions, with some having more than one driver. This complicated mix of drivers is illustrated below in Figure 3.2.

This shows that where economic development is a primary driver, it is also often combined with another primary driver such as distributional policy. Again, the semi-commercial drivers are often combined with other drivers such as economic development or social aspects. Our case studies have not identified any interventions where market failure was the sole driver.

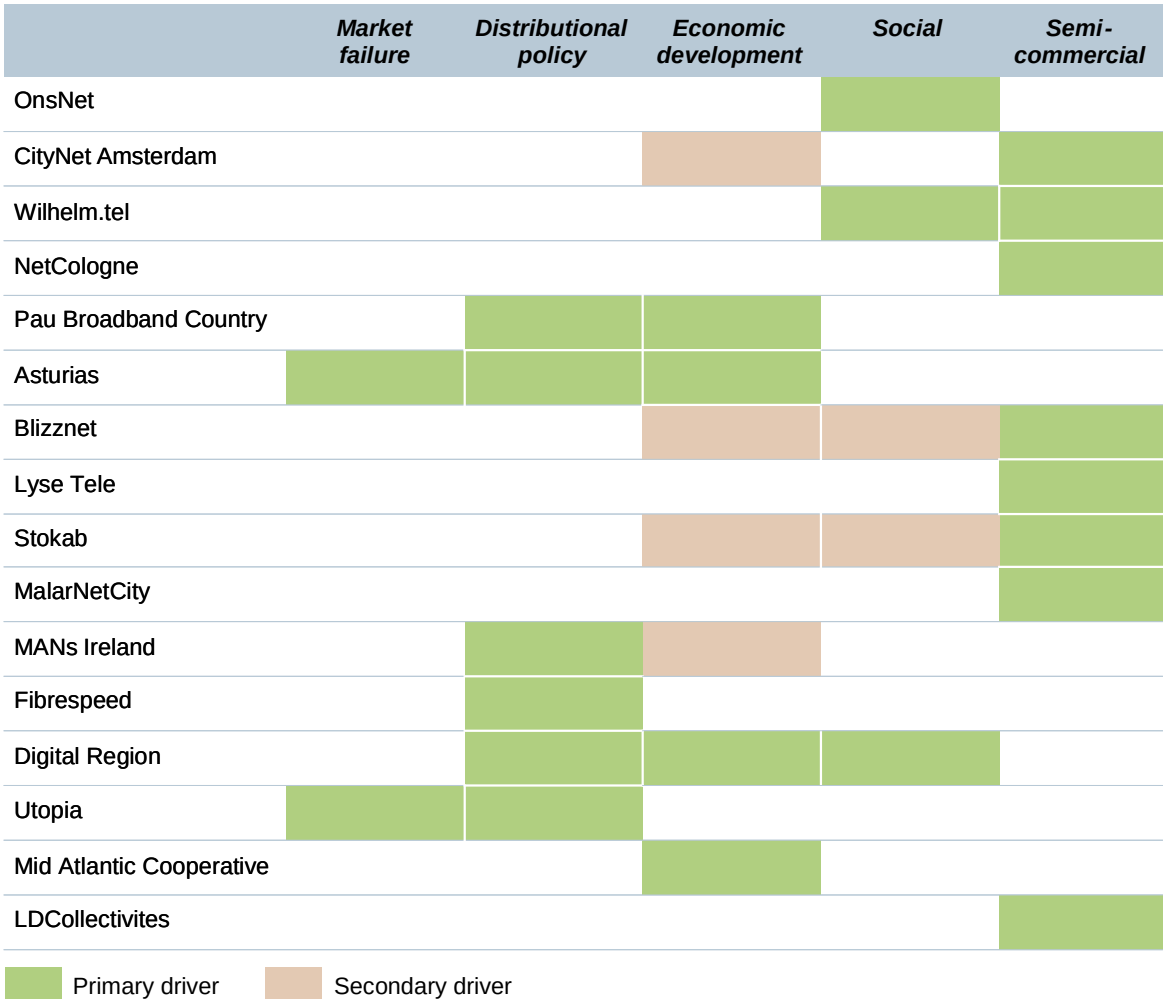

Figure 3.2: Drivers for case studies

4 Models for interventions

There is a large degree of inherent complexity in interventions, and this is one of the main reasons why numerous different models are used. Key considerations include: local market conditions; drivers for intervention; existing infrastructure; and the pilot nature of some projects.

There are two main categories of intervention that we have analysed:

- **Demand-side interventions** aim to address a lack of demand for a service so that it can then be provided by the private sector. This is generally done through demand aggregation and demand stimulation.
- **Supply-side interventions** address cases where the market is not supplying a service, often after demand has been identified. Such interventions are often focused on specific geographical areas where the costs of supplying the required service are too high for the level of demand that has been identified.

Whereas demand-side interventions are relatively straightforward to analyse, supply-side interventions demonstrate a greater diversity of models. We present five different models later in this section.

4.1 Models for demand-side interventions: aggregation and stimulation

During the deployment of first-generation broadband in the UK, a number of public-sector interventions focused on demand aggregation and stimulation. These schemes were often implemented by RDAs, or similar bodies in the devolved regions. Such schemes were employed, for example, by the East of England Development Agency (EEDA).

Demand aggregation was implemented through the use of registration schemes where individuals pledged to subscribe to broadband once it became available in their area (i.e. when their local telephone exchange was upgraded for ADSL).

These schemes were then followed by the private sector-led 'exchange trigger level scheme', run by BT, which set an explicit demand requirement for exchanges that had not yet been upgraded. These schemes helped ensure efficient resource allocation for broadband deployment, and were generally accepted as being successful, and helped to expand the extent of ADSL roll-out to over 90% of homes. Additionally, the publicity surrounding these demand-aggregation schemes probably had a positive impact on overall demand by stimulating awareness and interest in broadband.

In addition to demand aggregation, there were also numerous demand-stimulation schemes, such as those run by ActNow in Cornwall. These schemes typically focused on businesses and were part of a wider ICT development programme that aimed at increasing ICT usage among businesses. This was achieved using a wide range of techniques, with examples including the use

of ICT to promote flexible working, the development of websites for small businesses, the use of voice-over-IP (VoIP) to cut costs and aiding the move from traditional to digital photography.

In addition to the first-generation broadband schemes, we are also beginning to see a similar approach for next-generation broadband. These schemes tend to follow an approach where a local co-operative seeks to register initial user demand from enough households, and then contracts a private company to build and operate a next-generation broadband network. The applicability of the model to the private sector is illustrated by Lijbrandt Telekom in the Netherlands, which uses this model to identify areas for private-sector investment in next-generation broadband networks (with no public-sector support). In a similar vein, Lyse Tele in Norway only expands to new neighbourhoods if they reach pre-registration thresholds.

The demand registration schemes relating to next-generation broadband have all involved consumers making a contractual commitment to take a service several months in advance of that service becoming available. This in contrast to most of the schemes in first-generation broadband, which were more an 'expression of interest' with no firm commitment.

Our case studies have shown that interventions with demand-side initiatives tend to break-even relatively quickly; this is clearly an important element of being efficient and effective. Examples of this can be found in OnsNet and Lijbrandt Telekom (see Annex A).

Furthermore, our consultations with UK stakeholders have suggested that demand aggregation and stimulation are both likely to have a significant part to play in the deployment of next-generation broadband networks, although it is not possible at this stage to say whether users will respond in the same way as they did in the move from dial-up to first-generation broadband.

4.2 Models for supply-side interventions

The case studies presented in Annex A and our interviews with stakeholders identified a wide range of models to supply-side interventions which, while unique, share certain characteristics. We have classified them into five broad categories:

- procurement of a defined service
- public-private partnerships
- utility business expansion
- co-operatives
- working with property developers.

4.2.1 Procurement of a defined service

This business model was used by the Scottish Executive to increase broadband availability in Scotland. Under this business model, the public sector procures a service from the private sector (e.g. broadband of up to 2Mbit/s in remote areas, such as the Highlands and Islands, where BT deemed ADSL

unviable). Ideally, the service procured is technology neutral, though in reality the definition of the service requirements may limit the choice of technologies that can be used. Any assets required to deploy the services are owned by the private sector. As part of the procurement, the public sector will often provide an upfront payment to set up the service for a fixed period of time. Once the contract has expired, the service will continue on a commercial basis, be re-procured, or cease to be offered. This business model reduces the risk of low demand leading to long-term subsidies from the public sector, and can be simpler for the public sector to deliver than the more infrastructure-based models such as Project ATLAS in Scotland and FibreSpeed in Wales.

This model was also used to deploy broadband to the other areas that addressed distributional policy objectives. To our knowledge, all of the major residentially focused interventions of this kind in the UK have been awarded to BT, and have generally used ADSL technology. One notable exception in terms of technology is the case of Northern Ireland, where BT also used satellite to meet the 100% coverage requirement in areas where ADSL had technical limitations.

4.2.2 Public-private partnerships

Interventions following the public-private partnership model can be classified as those where the public sector funds the deployment of assets, but then partners with a private-sector firm (or firms) to build, operate and maintain the network for the public sector. The public sector typically retains at least some ownership of the assets.

The fibre MANs in Ireland and the FibreSpeed project in Wales have both been delivered using partnerships between the public and private sectors. In both cases, the network infrastructure is owned by the public sector but is maintained and operated by the private sector on an open-access basis. Such a model allows the public sector to take a long-term view on the financing and benefits of the infrastructure, whilst harnessing the skills, experience and operational efficiency that the private sector can offer. In both of these examples, the private-sector operator only offers wholesale services to other private-sector companies, which then supply retail services to end users (businesses in both examples).

Public-private partnerships have also been used in Europe, e.g. CityNet in Amsterdam. The model is also widely used in France where there is a specific legal framework, *Délégations de service public* (DSPs), which is similar to a private partnership whereby the private partner can bear part, or all, of the investment and operating costs. The revenues retained by the operator can also depend upon service performance (sometimes called ‘availability payments’). Additionally, the contract can be structured so that the financial risk lies with the public sector, the private sector, or a combination of both. Such DSP projects include Pau Broadband Country and the projects with which LD Collectivités is involved. A case study of LD Collectivités is shown in Annex B.

Public-private partnerships appear to be most appropriate where there is significant new infrastructure of which the public sector wishes to retain ownership. By keeping ownership of a network, it allows the public sector to change its service-delivery partner over time by re-tendering the contract, for example to replace an under-performing private-sector partner.

4.2.3 Utility business expansion

As discussed in Section 3.3, some public utilities are expanding into next-generation broadband on a semi-commercial basis, exploiting synergies in their business that can reduce deployment costs.

Our case studies have identified several examples of this kind, including Wilhelm.tel and CityNetCologne in Germany (see Annex A). These two intervention projects have been operating for a number of years. Both offer services over an open-access fibre network – FTTH in the case of Wilhelm.tel, whereas fibre-to-the-building (FTTB) with VDSL in the building in the case of CityNetCologne. Although not covered in our case studies, the utility model has also been widely used in Denmark – e.g. by DONG Energy, which is the largest next-generation broadband operator in the Danish market – and in the USA.

Despite the success of this type of intervention elsewhere, we believe that such a model is unlikely to materialise in the UK for two reasons:

- Firstly, the UK utilities are owned by the private sector, so it may be more difficult to invest due to the long timeframe generally required for next-generation broadband deployment and investment cycle.

- Secondly, there is less interest in telecoms from utility companies. This is illustrated by the move away from seeking to exploit opportunities in the telecoms market, e.g. the abandoned joint venture between Thames Water and 186k (which was part of Transco until late 2002), and the sale of other telecoms subsidiaries by Scottish Power (which demerged with Thus in March 2002) and United Utilities (which sold Your Communications to Thus in March 2006).

However, one area where the utility model could be pursued is in areas of new build or urban regeneration where a single provider could supply a range of utilities, including telecoms, to the area.

There is potential for utility companies to help reduce the deployment costs for next-generation broadband (particularly FTTH) by enabling use of their duct networks. Such a model is being followed extensively in France, and is being pursued by H20 networks in the UK, who currently focus on metropolitan networks. However, use of ducting into the home is likely to remain limited due to availability of suitable existing infrastructure (e.g. ducts into residential premises). The future work from Ofcom[7] on surveying the existing duct infrastructure will be valuable in identifying any potential for cost savings in this area.

4.2.4 Co-operatives

A local co-operative business model has been adopted successfully in the OnsNet project in Nuenen. The project was led by the local housing corporation (Helpt Elkander) and Kees Rovers from Close the Gap. In this scheme, residents pay to be a member of the project, and then

[7] http://www.ofcom.org.uk/media/news/2008/04/nr_20080416.

subscribe separately to services. By offering free membership and services for the first year, OnsNet was able to achieve a 97% take-up in the first year; take-up remained very high, at around 85%, after the first year. The high take-up has led to significant profits for the community of 8500 households, which exceeded EUR1million in the second year of operation.

A different co-operative model has also been used by the Mid-Atlantic Broadband Cooperative (MBC) in the USA. This project supplied a fibre backbone to rural areas that would help stimulate the supply of next-generation broadband. The co-operative has four different membership classes, with 44 members in total. Unlike OnsNet, MBC is focused on wholesale services, so its members are other telecoms operators.

There are other examples of co-operatives in the telecoms sector, such as those providing services to rural areas of the USA. In total, these co-operatives cover many millions of homes, but they are organised at a local level, with national bodies to co-ordinate activities. We have not identified any examples of a single co-operative in telecoms that has scaled to millions of members; there are likely to be good reasons for this, including organisational and operational reasons.

If a co-operative model were to be considered in the UK, a series of local co-operatives under a national umbrella organisation would seem most likely to succeed. We believe that the presence of a national co-ordinating body (which could include aggregating wholesale services for retail service providers) could help to mitigate some of the risks we have associated with small-scale interventions (which are discussed in Section 5.3). Examples of such organisations have been observed in the USA with the National Telephone Cooperative Association, LD Collectivités in France, and CESAR in Sweden. There is also a role for such organisations to reduce barriers to adoption, as discussed later.

We understand that OnsNet is planning to expand to include many more homes (there are plans for around 150 000 per annum), so may yet show that it is possible for this model to scale to larger areas under a single co-operative.

4.2.5 Working with property developers

The costs for deploying next-generation broadband can be significantly reduced if it is carried out at the same time as other civil works.[8] This is much more straightforward in greenfield deployments such as the FTTH trial at Ebbsfleet (carried out by BT in conjunction with Land Securities).

Large examples, such as Ebbsfleet (which will eventually have around 10 000 homes), are unlikely to require public support, but the likelihood of commercial deployments at smaller developments is less certain. There are also potential interventions at smaller-scale urban regeneration projects, such as those in Manchester and Walsall, where next-generation broadband networks may be deployed with the assistance of the public sector.

[8] Street works are co-ordinated at the local-authority level in the UK with the aim of minimising disruption to the public. However, this kind of co-ordination alone is unlikely to support large-scale deployment of new network infrastructure in non-greenfield locations.

The combination of public- and private-sector investment in next-generation broadband at sites with new property developments is likely to lead to notable 'islands' of next-generation broadband. The overall scale of these developments will be limited, as only around 260 000 new homes are built each year – around 1% of the total housing stock. Whilst there may also be a large number of similar brownfield sites considered for regeneration in the coming decade, they probably represent a similarly small proportion of total UK homes as the greenfield sites. Therefore, for next-generation broadband technologies to be available to large parts of the UK, there will need to be a large amount of more expensive 'retro-fitting' to existing homes and business sites.

It is worth noting that new-build and regeneration schemes have the potential to showcase the benefits of next-generation broadband. If they do prove to be successful in demonstrating demand for next-generation broadband services, they could stimulate the development of new private sector-led projects in similar areas. Such interventions are also relatively easy for the public sector to support as they often require minimal investment.

We have also come across another form of intervention in this area in the UK. SEEDA has funded the employment of an individual with the aim of stimulating investment, particularly from property developers, in deploying next-generation broadband technology in the Ashford area. Such a model does not involve large investment, but seeks to inform the private sector of the opportunities presented in localised markets.

4.3 Summary of models for interventions

The case studies have shown that there are a number of models that interventions can follow. The evidence does not point to any particular model being inherently more successful, although Figure 4.1 shows that many of the interventions to date have either used a public-private partnership, or the utility-driven business model.

Of the case studies conducted, only OnsNet has used demand stimulation in a primary role, though it has a minor role in other interventions. The success of this aspect of OnsNet, and of other demand-stimulation roles in first-generation broadband suggests that it should play an important part in future interventions.

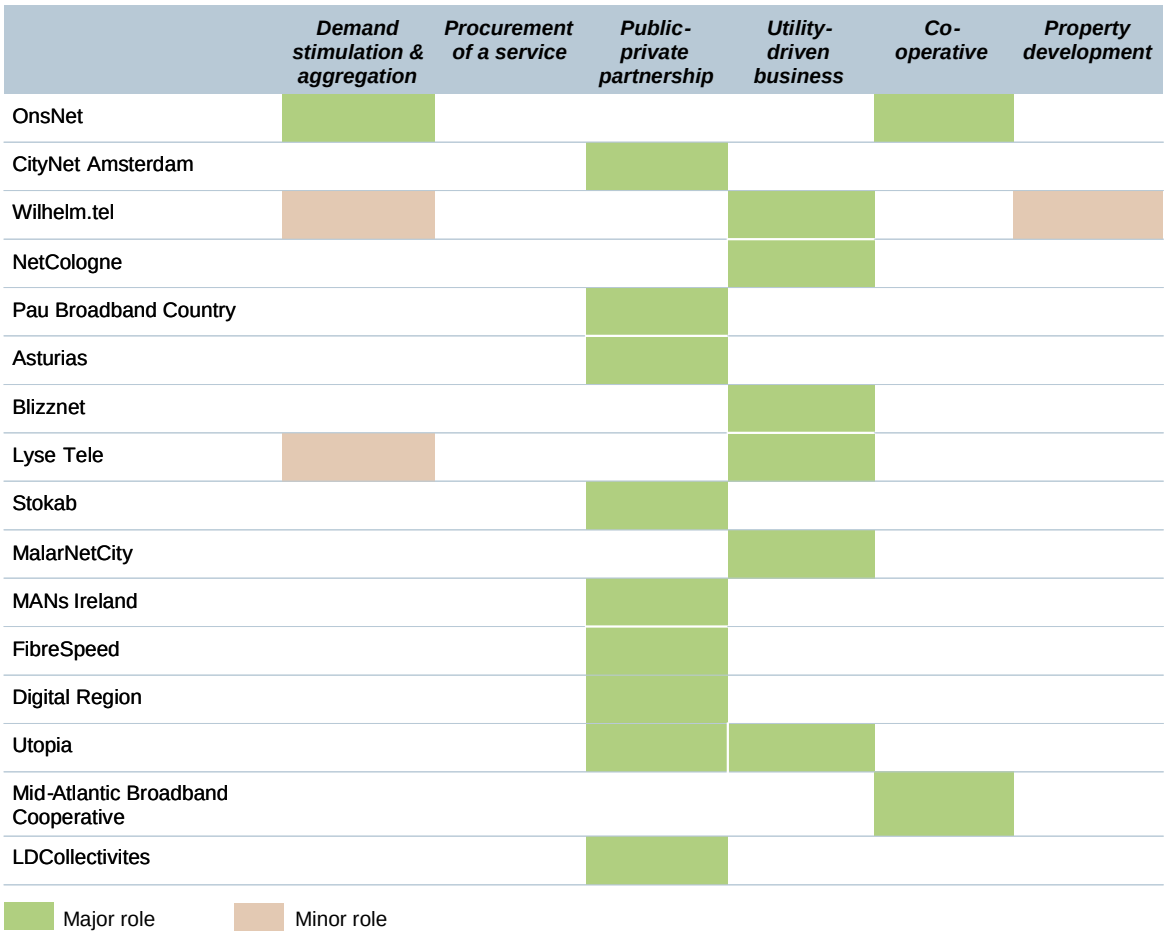

Figure 4.1: Intervention models used in the case studies

5 Critical success factors for efficient and effective interventions

In Section 2, we described the difficulties in defining what efficient and effective means in relation to intervention models, and how we have tackled this problem by considering a range of critical success factors for interventions. On the basis of the evidence gathered and presented in this report, we have classified the critical success factors as follows:

- not pre-empting the market unless there are good grounds to do so
- using the open-access network model
- designing to minimise barriers to adoption
- stimulating and aggregating demand
- anticipating risks via detailed planning
- compliance with state aid rules, and support via other legal frameworks.

Each of these critical success factors is described in turn below.

5.1 Not pre-empting the market unless there are good grounds to do so

Our interviews with stakeholders from the UK included discussions relating to previous interventions in first-generation broadband. These interventions were generally seen as being successful. One critical success factor that was identified related to the correct timing for intervention, particularly with respect of the right balance of supply and demand. This is a particularly difficult issue – in some cases, there is an element of creating new demand by the very fact that a new network has been built and services have been demonstrated to be of interest to end users.

We identified examples of early projects with public support (and purely private projects) that promoted broadband access using wireless technologies (typically Wi-Fi access with leased-line backhaul) in both the West Midlands and the East of England. These initiatives were started at a time when BT's ADSL coverage was not expected to extend significantly into rural areas. However, as demand increased, it became clear that ADSL would be viable in those areas. Since wireless technologies did not offer any clear additional benefits in terms of price, performance or service quality, these initiatives struggled to compete and many were wound up following cashflow problems. This example highlights one of the problems with intervention in a rapidly changing market. If public-sector interventions are deployed in areas where private-sector deployments would have been viable, future private-sector investments may be more limited than they would otherwise have been.

However, the longer time required to deploy next-generation broadband on a large scale makes it even harder to avoid pre-empting demand. The FTTC/VDSL deployment from KPN in the Netherlands is expected to take more than three years to complete (2007–2010), and FTTH deployments will take longer. This long lead time means that there is an increased risk of incorrectly estimating the level of demand. It will be important for public bodies to keep track of

market developments as any intervention proceeds, especially during the planning and design phases, and to adapt the intervention accordingly – including potentially major changes to the funding structure if an intervention becomes more attractive to the private sector. This in itself represents a major procurement challenge, as current EU procurement procedures (including the new competitive dialogue procedure for complex projects of this kind) may not be sufficiently flexible to cater for significant changes in scope brought about by the changing market conditions.

Despite these difficulties, there may be occasions where pre-empting the market is appropriate. For example, the planned intervention in Cornwall is pre-empting the market for two main reasons: the public sector believe that Cornwall is unlikely to have commercial deployments of next-generation broadband in the foreseeable future, and there are EU funds that are available for a limited period. Such an approach carries a risk that the private sector may have delivered next-generation broadband, but in this case we believe the risk of this happening is relatively low.

Concluding comment: *Supply-side interventions should not seek to address a potential digital divide too early, as it may take some time for the full extent of demand to emerge. This may mean that initial estimates of likely coverage from next-generation broadband will be exceeded once demand fully materialises (either naturally or with assistance from demand stimulation and aggregation). However, supply-side stimulation should also consider the lead times for next-generation broadband deployment, which if deployed on a wide scale can typically take three to five years to complete; the availability of EU funds for some regions may prompt an intervention to be designed earlier than otherwise expected.*

5.2 Using the open-access network model

Open-access networks can generally be defined as those that provide services to all interested parties on an equal basis, that is, offering the same products at the same prices (and terms and conditions) to all operators, and provisioned by the same processes.[9]

This model, whereby all service providers can access the network on equal terms, is clearly pro-competition (as illustrated by the multiple service providers using *some* of the open-access networks in our case studies) and is an important aspect of the efficient and effective objective. For this reason, open access is one of the key foundations of EU state-aid guidance, which is discussed in more detail later in Section 5.6. It should be noted that other factors, such as scale, may limit the take-up of the network by multiple service providers, and that open access is not by itself a sufficient condition for creating a network with strong retail competition. This is discussed in more detail in Section 5.3.

[9] Although not an example of a public-sector intervention, Openreach in the UK is in principle an open-access network provider, by virtue of its equivalence obligations. However, the term 'open access' is normally associated with non-incumbent networks. One difference between Openreach and the open access networks we have identified in this report is that Openreach's large capital programmes are signed off by BT Group, whereas the organisations behind most open-access networks operate under less complex financial controls (often by virtue of their size of operations being significantly smaller than those of an incumbent).

The majority of the case studies contained in Annex A are seen to follow the open-access model, with the notable exceptions being Wilhelm.tel, CityNetCologne and Lyse Tele. These three examples illustrate a municipal utility company expanding into the telecoms sector, and are semi-commercial in nature.

It should be noted that our consideration of open-access networks is restricted to the use of infrastructure by service providers. In this report we do not consider the impacts of equality of access to networks at the application or content layer. These issues are often described as 'net neutrality', which has been debated significantly, particular in the USA.

Concluding comment: *Interventions should seek to use an open-access model, as open access networks help to promote competition from multiple service providers, support innovation in products and services, and minimise market distortion. Additionally, open-access networks help to fulfil many of the requirements for state-aid approval by the European Commission.*

5.3 Designing to minimise barriers to adoption

It is also important to ensure that there are no significant barriers to adoption, some of which are discussed below.

Attracting numerous service providers

One sign of an effective intervention is a competitive suite of retail services from multiple providers. Our case studies have shown a wide variety in the number of service providers using interventions, ranging from over 18 using the fibre MANs in Ireland, to no independent service providers using OnsNet in Nuenen (where the only service provider is linked to the network operator).

There are many factors that influence the number of service providers using a network, but we believe that the decision of service providers is primarily commercial, and is influenced by factors such as:

- **Overall scale –** if a network is a large proportion of the total market, then service providers are much more likely to want to use it.
- **Cost of implementation** – an intervention needs to be large enough for the service providers to not suffer adversely from any dis-economies of scale due to fixed costs, such as setting up provisioning systems, as well as customer service systems and processes.
- **Commercial attractiveness of wholesale products** – if an intervention does not have attractive wholesale products (both financially and technically), it may cause a service provider to seek alternatives. In designing wholesale products, it should be recognised that there will often be a trade-off between relatively simple 'white-label' products that require minimal investment from a service provider to use, and more complicated products that allow greater service innovation at the expense of greater investment by the service provider. Where possible, interventions should seek to

offer both types of wholesale services (and within this there may be a range of options, for example covering different points of interconnect/handover).

Although many European broadband markets are competitive, incumbent operators are still extremely important at the retail level. To date, few incumbent operators use open-access networks. However, there are some examples where next-generation broadband operators have incumbents among their customers, as is the case for Swedish operator MälarNetCity and Austrian operator Blizznet, which have TeliaSonera and Telekom Austria respectively as customers. The general lack of use by incumbents may be strategic, and may be affected by the structure of the incumbent (e.g. whether functionally separated). However, if the 'build or buy' decision is strongly in favour of 'buy', then incumbents may elect to use open-access networks provided all aspects of the service (cost, quality, SLAs, etc.) are at a standard that the incumbent requires (i.e. matching what it could achieve itself, or better).

Benefit from economies of scale

There is a possible scenario where a large number of relatively small localised interventions occur, which in combination could cover a significant proportion of the population. However, each intervention on its own could be relatively small scale (e.g. tens of thousands of homes). Our case studies show that this can lead to poor economies of scale that can impact both service providers and end users.

Our case study of OnsNet is an interesting example in this respect. This intervention was unable to attract any independent service providers, and has had to rely upon its own service provider to offer services to end users. Our research suggests that the small scale of OnsNet was a key factor in the decision of service providers not to use the network. This scale issue may have also impacted OnsNet's ability to offer the kind of entertainment services that larger operators are doing via next-generation networks: for example, there is no premium TV content, and no personal video recorder (PVR) or high-definition (HD) services. In addition, there is a lack of business-focused services, which often require additional specialist services from providers that focus on the business market. The high take-up of OnsNet may suggest that consumers are not interested in these issues. However, the community support for the network, and the feeling of local ownership, is probably the key reason for the high level of take-up. It is noteworthy that OnsNet, and other interventions including Wilhelm.tel and Utopia, have all been expanding beyond their original areas, and can therefore be expected to benefit from improved economies of scale in the longer term.

Limited choice of service providers, and high pricing, due to small scale has been observed in the Pau network operated by Axione. For residential services, Pau now only has one residential service provider, Neuf Cegetel, after the second residential service provider fell into financial difficulties. Furthermore, the small scale means that services from Neuf Cegetel attract a EUR5 per month premium when compared to its offers elsewhere in France. We believe that this is due to the higher network costs that Neuf Cegetel incur in Pau. However, there does appear to be healthy competition in

the business market with six service providers offering services – relatively small price premiums are likely to have a lower impact on the business market than the residential market.

Small-scale interventions may also see poor economies of scale in a number of areas relating to deployment and running costs such as:

- higher due diligence costs
- higher costs for network equipment due to the low volumes purchased
- higher support costs (per user) due to smaller call centres and specialist technical support.

One way to avoid diseconomies of scale is to use a common wholesale operator to run many, geographically dispersed open-access networks on behalf of the bodies that own them. This aggregation of open-access networks is a trend that can be seen in the Netherlands where Reggefiber is building many of the small-scale interventions as part of both public- and private-sector projects. The operation of the Irish MANs programme also uses this model successfully, with e|net operating the MANs on behalf of the Irish government – currently 18 different service providers use the MANs. In France, organisations such as Axione and LD Collectivités (see case studies in Annex B) also perform similar roles under the DSP framework. Finally, this model is also being explored in Sweden where local municipal networks are working together under a partnership called CESAR to ensure that they can exploit economies of scale, with one goal to encourage an increase in the number of retail service providers using the networks.

Design decisions that limit the addressable market

The Irish government has completed the first phase of its fibre MANs intervention in towns across the country. These MANs were seen as being important in removing an access bottleneck at a time when broadband availability in the more rural parts of Ireland was very limited. MANs typically run along streets, but importantly they do not connect to individual buildings. To do this requires additional investment. We understand that the additional investment to connect buildings to MANs can be in the range of EUR5000 to EUR10 000. For smaller businesses, it may not be possible for e|net to recover this cost in a one-off connection charge. e|net is attempting to overcome the cost barrier of connecting customers by using wireless technologies to connect smaller business premises to the MANs. This illustrates how the high initial costs may be limiting take-up of services that utilise the infrastructure deployed in an intervention.

Service providers also need to separately arrange for backhaul from the MANs to their own POPs. We believe that there are still a few remaining MANs without backhaul, which means it is difficult for some service providers on the MANs to achieve end-to-end connectivity efficiently.

Detailed network design

- Decisions on the technical design of a network can have a significant impact upon the final retail services offered over the network. For example, the French operator Free (Iliad) does not

offer services on the Pau network due to the additional cost of installing equipment at a large number of locations in the open-access network in Pau. In contrast, Neuf Cegetel does offer services over the network, but charges an additional EUR5 per month for services in Pau when compared to other areas it serves.

- This is only one example of a specific network design causing a service provider not to use a network, but we believe that this is a risk if many small interventions occur. In order to reduce such risk, it will be important for interventions to consult the large retail operators to ensure that the proposed wholesale services are both fit for purpose and at an attractive price. The provision of services via a common wholesale operator (e.g. like e|net in Ireland, and LD Collectivités in France) could help to reduce this risk as it would lead to a common set of wholesale products that could be developed in conjunction with operators.

- The use of common standards and ensuring inter-operability may help to minimise barriers to adoption. Even so, there are still detailed network-configuration choices that need to be made, which may impact the inter-operability with other networks.

Concluding comment: *Interventions should be structured to minimise barriers to adoption for both end users (e.g. low connection charges) and service providers. Barriers to adoption for service providers can be minimised by designing schemes so they are aggregated across regions where possible, so that they have common technical specifications (based upon standards) and wholesale products.*

5.4 Stimulating and aggregating demand

As discussed earlier, experience in the UK first-generation broadband deployment showed that demand stimulation and aggregation was effective in de-risking investment in new broadband infrastructure. This was typically achieved using a combination of initiatives to inform businesses and individuals of the benefits of broadband, along with pre-registration schemes which were eventually superseded by schemes from BT.

Demand registration schemes for next-generation broadband interventions have also been observed in our case study for Wilhelm.tel. After the initial network was set up and the operational results were positive, Wilhelm.tel decided to offer surrounding villages the opportunity to connect to its network if they could aggregate sufficient demand. The first village to be connected was Alveslohe, which consists of only 1000 households. A threshold of 30% of all households was needed for Wilhelm.tel to extend its footprint. More than 50 further villages in the surrounding areas have applied for this scheme. This is an interesting example, particularly as in certain areas there were availability problems with first-generation broadband. A similar approach is also being taken by OnsNet for its expansion plans.

As mentioned earlier, the examples of demand registration from next-generation broadband all include an element of *commitment* from users registering interest. If commitments are required from end users,

it may be necessary for interventions to provide information in advance on services and likely pricing. We believe that this element of commitment will be an important aspect in next-generation broadband schemes, which was not always present in first-generation interventions.

5.4.1 Generating local enthusiasm

In addition to traditional demand-stimulation schemes, there are many positive benefits of enthusing the local population about the benefits of an intervention in next-generation broadband. The two most important of these are high take-up, and the development of innovative (and relevant) services to end users.

As the deployment costs of next-generation broadband are dominated by essentially fixed costs for covering a given area, the economics of any network are positively affected by a high take-up, as illustrated by the profitability of OnsNet. We have also witnessed high local take-up in Wilhem.tel, Pau, CityNet and MälarNetCity, which have all experienced local market shares of over 50%.

Although price and service differentiation are important in obtaining a high customer take-up, there are also less tangible effects due to increased local enthusiasm. Perhaps the best example of this is OnsNet where local ambassadors from the community were recruited to raise awareness and explain the benefits to potential users. These ambassadors came from a variety of areas including the elderly, with many having an engineering background from careers with Phillips in Eindhoven. There was also political support from senior local politicians and the mayor. The strong local support has also helped to foster a strong set of community-focused applications for the network.

From our consultation, we also believe that generating a strong local interest is an important part of the plans for interventions in Walsall and Manchester.

5.4.2 Providing end-user incentives

Another method for stimulating demand is the provision of subsidies tied to end users. In first-generation broadband, these were successful in schemes such as those run by Advantage West Midlands, which provided businesses with a grant towards the connection costs of broadband. However, such schemes introduced in other regions, e.g. by Yorkshire Forward, were made less effective once the market supply changed significantly.

Our case study of MälarNetCity in Sweden (see Annex A) has shown that it is possible to foster take-up by using financial incentives, and innovative financing schemes, for the end user. Here, a large proportion of the connection cost is paid for by the end user; this can be substantial, at an average of around EUR1800. However, end users are also provided with financing from a bank that allows such costs to be repaid over a period rather than as a one-off payment. Perhaps more importantly, there is also a tax refund of around EUR530 that a household can claim. It is also reported that people who have connected to the network have seen their property value increase by

over EUR4000, substantially more than the amount they invested to connect to the network.[10] In blocks of flats, a slightly different approach is taken, where a nominated occupant arranges for the connection to be installed on behalf of all residents.

This novel approach to financing the network, and encouraging take-up, appears to have been successful, as around 83% of homes are connected to the network and are using services provided over it.

Lyse Tele in Norway (see Annex A) takes a different approach. It offers customers the opportunity to reduce the connection cost by around EUR500 by providing plastic ducting and termination equipment for customers to install themselves (by digging across their own property – e.g. front garden – and by attaching the termination box to an internal wall). Take-up of this service has been high with about 80% of subscribers using this 'self-install option', which also decreases the cost for the provider and thereby enables the operator to obtain a better return on investment. In addition, this method seems to reduce churn, as customers feel 'engaged' with the product, and remain loyal to the brand.

The importance of end-user incentives is also highlighted in the OnsNet project in the Nuenen (see Annex A). This was awarded the status of 'Kenniswijk'[11] by the Dutch Ministry of Economics, which resulted in every subscribing household receiving a subsidy of EUR800 (from the Ministry). This enabled OnsNet to provide one year of free service for all subscribers. As discussed earlier, take-up was at about 97% in the first year, falling to about 85% after the initial subscription period ended. In contrast to the success of end-user incentives in the OnsNet project, there were a number of surrounding networks that did not provide such incentives, as they were not available in that area. These interventions failed to achieve such a high take-up, and OnsNet has subsequently expanded into these areas.

Concluding comment: *Demand stimulation and registration schemes are likely to be important in future and ideally should be structured so that they have an element of commitment from users, since this helps support the significant investments required in a new network. To gain this commitment, it may be necessary to provide details of services and prices before networks are built.*

Additionally, our consultations with stakeholders suggested that demand stimulation should be timed so that it is concurrent with an increase in supply, whether from the private sector or via supply stimulation.

Interventions should recognise the importance of both high take-up and the impact that a strong community-based dimension to an intervention can have on a localised intervention. Local interest can also be leveraged by local demand-stimulation initiatives.

10 http://emperor.canarie.ca/pipermail/news/2006/000281.html.

11 Kenniswijk is an initiative of the Dutch General Directorate of Telecommunication and Post (DGTP) of the Ministry of Economics. Kenniswijk is an experimental environment in the Eindhoven area where consumers have access to innovative products and services in the area of computers, (mobile) communication and Internet. The intention is that the developments within the Kenniswijk area are, on average, two years ahead of the rest of the Netherlands in 2005, resulting in a "consumer market of the future".

The use of end-user incentives such as subsidised connection fees or subscription free periods should be considered to help ensure that networks achieve high levels of take-up that will help to improve the financial performance of the network.

5.5 Anticipate risks via detailed planning

Interventions in next-generation broadband will inevitably be long-term interventions, due to the large capital costs that can take many years to recover. The long timescale for interventions means that the public sector must be forward-looking when planning an intervention, so that they can appreciate the full range of risks. Some of these are discussed below.

Technology obsolescence

The choice between different technology solutions for next-generation broadband brings with it the risk of technology obsolescence. For example, there is a trade-off to be made between the significantly lower costs and slower speeds of FTTC solutions and the higher costs and speeds of FTTH solutions. Whilst it may be likely that FTTC solutions provide a greater likelihood of a project breaking even over the lifetime of the project due to the lower costs, there would be a risk that the FTTC network would become obsolete should the market demand an FTTH network. This could result in a significant level of investment being lost.

This problem is highlighted by the commercial deployments taking place in various global markets. In the USA, for example, operators have chosen two different technological solutions: Verizon is pursuing an FTTH strategy, while AT&T is deploying FTTC. The market uncertainty towards the most appropriate technological solution demonstrates the difficulty of this issue for the public sector. This suggests that the best approach to minimising the risk for the public sector is to remain as technology neutral as possible, allowing the market to decide the most appropriate technology while accepting there will always be some risk of technology obsolescence.

There are also similar risks in FTTH networks where there is a choice between the less expensive GPON architecture and a point-to-point network. If a GPON network was built and the market later demanded a point-to-point network, there could be significant additional costs associated with the upgrade.

These technology risks should be addressed in the design phase of any intervention, which could include market testing with potential service providers who would use the network, and considered in conjunction with the different costs associated with each technology.

Changes to market pricing

DETI in Northern Ireland designed an intervention that saw it become the first region to have 100% broadband coverage, achieved via a mixture of ADSL and satellite broadband from BT (as

the retail supplier). The intervention has generally been viewed as a success but there is one area where, in retrospect, it could have been improved.

Within the contract for the services supplied by BT, it was specified that the services would be retailed at a maximum of GBP27 per month. At the time, this was considered to be a reasonable retail price based upon benchmarks. However, as retail prices have fallen over time, there is an increasing view from some people in rural areas that they are being disadvantaged by the higher prices that they are paying as the price for services over satellite has not fallen below GBP27 per month. This situation has arisen due to the fast-changing nature of the highly competitive broadband market and is an illustration of the importance of considering future market developments when designing an intervention. In this type of intervention, a contractual mechanism to ensure that retail prices within the intervention tracked national averages could have been more beneficial to consumers, though this would have involved a greater subsidy from the public sector.

Detailed network design and costing issues

The Utopia project in the USA (see Annex A) had originally planned to use telegraph poles owned by Qwest. However, Utopia were later denied access to these poles: Qwest claimed that Utopia had no right to access its poles, and that it was installing equipment in an unsafe way, thereby causing an outage costing Qwest USD400 000.[12] This led to a significant increase in deployment costs due to damage payments and further 'pole access fees'. The full impact of these increased deployment costs is yet to be seen.

Significant increases in costs have also been observed in Wilhelm.tel where the capital costs are around double those originally forecast. The reasons for these cost increases appear to be related to the network having to be built in one phase rather than gradually expanded. There were also additional costs to support a local TV station.

Both Wilhelm.tel and Utopia highlight the need for robust network costing and detailed due diligence to be carried out in the early stages of any intervention.

Additionally, we have learnt that the fibre MANs in Ireland have had some technical issues relating to the way that fibre joints were constructed. The type of joint that was deployed means that it is difficult to splice additional fibres without interrupting service for other customers. It was highlighted that this technical oversight would have been less likely to occur if the network had been designed by an established telecoms operator.

These examples indicate a risk associated with interventions. During the feasibility stage of Utopia, it may be that there was no due diligence process or, if there was, it was poorly managed: clearly understanding the terms of access to Qwest's poles was critical to the original plan. In the case of the Irish MANs, it may be that the government received poor technical design advice ahead

12 http://deseretnews.com/dn/view/0,1249,600138445,00.html.

of procurement of the passive network build phase, or it may not have fully appreciated what it was purchasing during the evaluation of bids.

Concluding comment: *When designing interventions, careful consideration should be given to potential market developments that may lead to the infrastructure being superseded by other technologies. Contracts should also be structured so that they can react to significant changes in take-up, pricing or wholesale product requirements.*

It is also important to conduct thorough due diligence as part of the project to ensure that the plan is credible and will not be subject to significant delays, increases in costs, or other potential difficulties. Public bodies should ensure that they have access to the necessary skills, either internally or externally, to design interventions and identify any forward-looking risks that could emerge.

5.6 Compliance with state-aid rules, and support via other legal frameworks

Compliance with EU state-aid rules is an important consideration for public-sector interventions, as failure to comply can cause them to be suspended. This is illustrated by Appingedam, in the Netherlands, which was rejected and eventually suspended. This project was subject to a formal complaint from Essent (the second largest cable operator in the Netherlands). The project was rejected as the Commission believed that it would not introduce any significantly new retail services and would replicate existing infrastructure. Because of this, the Commission concluded that the project had a serious risk of market distortion.

Within the UK, a number of projects such as Project ATLAS in Scotland and FibreSpeed in Wales have been approved by the Commission, although the decision on Project ATLAS took some time due to the project being restructured to gain approval. The Digital Region next-generation broadband intervention in South Yorkshire was delayed while compliance with state-aid rules was sought.

Other projects that have been formally approved by the Commission include Red ASTURCÓN, though others have not, including some that are operational (e.g. CityNetCologne). There are also projects that have been presented to the Commission as outside state-aid rules – e.g. the CityNet project in Amsterdam has been structured under the Market Economy Investor principle whereby the City of Amsterdam has invested on market terms (in which case state-aid approval is not relevant).

EU state-aid rules have been designed to encourage well-designed interventions, and most efficient interventions would be expected to comply with them. However, they do not in themselves guarantee that outcome.

In summary, the EU looks for projects that fulfil as many of the following criteria as possible (in reality, the Commission makes a judgement across all of these criteria – no two projects are the same in this respect):

- **Open tender** – bidders should be selected through the usual public-sector procurement routes to minimise the advantages to the direct beneficiary of the aid.

- **Open access** – the network should be operated on a transparent and non-discriminatory basis since this is viewed as pro-competition.

- **Technology neutrality** – bidders should propose the most appropriate technological solution, rather than this being decided *a priori*.

- **Minimisation of infrastructure replication** – the bidder should have the freedom to choose the most efficient way to procure the necessary infrastructure, either by building, buying or leasing it from third parties. This minimises replication and enhances economic efficiency.

- **Minimisation of price distortion** – this is particularly important in markets where urban areas are already supplied by the private sector but rural areas are not. In this case, a public-sector intervention should not provide rural customers (more applicable to business than residential customers) with an advantage over their urban counterparts. The European Commission is also concerned about disproportionately low prices, which may require more aid than the minimum necessary to address the lack of supply. Benchmarking of prices offered by service providers in areas that do not benefit from aid is desirable.

- **Cost allocation, transparency and monitoring** – clear specification of the costs eligible for public funding, accounting separation and ongoing reporting and monitoring help ensure that public funds are being used as envisaged.

- **Guarding against excessive profits** – mechanisms where public funding is expected to reduce as end-user demand increases ensures that the minimum amount of public funds are used.

- **Short duration, small aid amount and intensity** – smaller-scale interventions (in terms of time and scale) are favoured since they have a lesser impact on market distortion.

Certain aspects of the above should encourage efficiency and effectiveness, in particular relating to best use of public monies – the last five items are particularly important here. The process of obtaining state-aid approval can be very time consuming, so it is important that public bodies begin to address any state-aid issues early in the project. In April 2004, the DTI published useful guidance on state-aid issues relating to broadband projects which provides additional information.[13]

The success of OnsNet in attracting subscribers via the subsidies has led to substantial profits of over EUR1 million per annum. These profits currently flow back to the co-operative, rather than towards the government that provided the original subsidy. However, we understand some of the profits will be invested back into the community. Other interventions may wish to consider 'claw-back' mechanisms so that if a project is more financially successful than anticipated, they then use some of the profits to pay back any subsidies. As outlined above, such 'claw-back' mechanisms are encouraged by the European Commission, although this may not be an appropriate mechanism for all projects.

[13] http://www.broadbanduk.org/content/view/107/.

Finally, in France, the DSP legal framework is similar to a private partnership whereby the private partner can bear part of, or all, investment and operating costs. The revenues from these projects can depend upon service performance. Additionally, the contract can be structured so that the financial risk lies with the public sector, the private sector, or a combination of both.

Concluding comment: *It is important for the public sector to design interventions to comply with European state aid rules or any other relevant legal frameworks. Failure to do so could lead to significant delays due to legal challenges and could potentially lead to a project being suspended.*

5.7 Summary of critical success factors

A summary of how the case studies presented in Annex A compare with the critical success factors outlined above is shown below in Table 5.1. The greatest uncertainty relates to assessing whether or not projects have managed to avoid pre-empting the market.

	Not pre-empting the market	*Using the open-access network model*	*Designing to minimise barriers to adoption*	*Stimulating and aggregating demand*	*Anticipating risks via detailed planning*	*Compliance with state-aid rules*
OnsNet	? – too early to judge	YES – but only 1 service provider is active	NO – limited number of service providers	YES – pre-registration scheme was used. High amount of local enthusiasm	YES – several projects to research benefits of next-generation broadband launched	? – no complaints issued
Wilhelm.tel	? – too early to judge	NO	YES – initially relying on existing HFC, now switching to Ethernet	YES – only lately demand schemes for remote locations. Strong brand awareness and market share	YES – the region now enjoys competitive advantage	? – no complaints issued
Irish MANs	Yes – we believe demand has not been enough to justify a commercial deployment	YES – up to 18 providers per MAN	NO – connecting from MAN limits the addressable market	NO – although it does have strong local political support	YES – disadvantaged regions are supposed to benefit from scheme	YES – project received EU support
CityNet Amsterdam	POSSIBLY – also multiple commercial providers	YES – 5 providers online	YES – no apparent issues at the moment	NO – the project relies on customer receptiveness	YES – Amsterdam shall remain one of the main ICT cities in Europe	YES – the European Commission ruled in favour of Citynet's MEIP status after competitor filed law suit
Red ASTURCÓN	? – too early to judge	YES – 2 providers online	YES – no apparent issues at the moment	NO	YES – the region is looking for a new industry focus	YES – the project is eligible for Objective 1 funding
Pau Broadband Country	? – too early to judge	YES – 1 residential service provider, 6 business	NO – inter-connection issues with Free (Iliad)	NO – although it does have strong local political support and take-up seems reasonable	YES – pilot project for entire France	YES – received ERDF
CityNetCologne	? – too early to judge	NO	YES – no apparent issues at the moment	NO – although it does have strong local political support	YES – cost savings through LLU independency from DT	? – no complaints issued

	Not pre-empting the market	*Using the open-access network model*	*Designing to minimise barriers to adoption*	*Stimulating and aggregating demand*	*Anticipating risks via detailed planning*	*Compliance with state-aid rules*
FibreSpeed	Yes – underlying demand not being met by the market	YES	YES – no apparent issues at the moment	NO	YES – trying to bring competitive advantage to the region	YES – the project is eligible for Objective 1 funding
Blizznet	? – too early to judge	YES – 5 providers online	YES – no apparent issues at the moment	NO	YES – cost savings through duct usage	? – no complaints issued
Lyse Tele	? – too early to judge	NO	YES – no apparent issues at the moment	YES – high take-up, pre-registration used to extend the network. Users can dig ducts themselves	YES – trying to bring innovative ideas to the market	? – no complaints issued
Utopia	Yes – no sign of private-sector investments	YES – 4 providers online	YES – no apparent issues at the moment	NO – project stopped information distribution due to increasing scrutiny and financial results	YES – risk sharing through municipal backing	? – under heavy (legal) attack by competitors
Stokab	? – difficult to judge	YES – multiple providers online	YES – no apparent issues at the moment	YES – project is often cited as a prototype next-generation broadband intervention	YES – one of the pioneers in Europe	? – no complaints issued
MälarNetCity	? – difficult to judge	YES – multiple providers online	YES – no apparent issues at the moment	YES – profitable in 2007	YES – ahead of its time in Europe, clear financial user incentives	? – no complaints issued
MBC	Yes	YES – multiple providers online	YES – no apparent issues at the moment	YES – project expects to break even in 2008	YES – co-operative structure brings many services to network	YES – complaints were fared but not launched
LD Collectivités	YES – uses a commercial business model	YES	YES – projects are all connected	YES – demand must be at a certain level before a DSP project will commence	YES – risk sharing through partnerships	YES – some projects even eligible for ERDF

Table 5.1: Summary of critical success factors in the case studies [Source: Analysys Mason]

6 Conclusions and recommendations

6.1 Conclusions

This report set out to answer the following questions:

- Q1: Why might some form of public-sector intervention be necessary in some areas?
- Q2: What local conditions might trigger the need for possible interventions?
- Q3: What form of interventions might be most appropriate?
- Q4: How should such interventions be structured and funded?
- Q5: What should be the criteria for deciding whether public-sector interventions should be considered in a particular area?

We have addressed these questions to the extent possible by considering the evidence base, and by identifying models used and critical success factors to ensure they are as efficient and effective as possible. This was carried out using the methodology outlined in Section 2. In addition, It should also be noted that Q1, Q2 and Q5 also relate strongly to the underlying economics of NGA deployments in certain geographies, which is not covered in this report.

Q1: Why might some form of public-sector intervention be necessary in some areas?

Based upon the current market outlook for next-generation broadband, we believe that it is unlikely that the market will deploy next-generation broadband to all areas of the UK due to the higher costs of deployment in more rural areas. Further, deployment would likely be phased in across the UK over a number of years, meaning the majority of areas would be disadvantaged initially.

The *Economic and Social Value* report suggests that there may be significant social and economic value from the deployment of next-generation broadband. If significant benefits do emerge, individuals and communities not served by next-generation broadband could be progressively disadvantaged over time.

A desire by the public sector to either capture these benefits sooner, or in a more extensive manner through increased coverage, could lead to public-sector interventions.

Q2: What local conditions might trigger the need for possible interventions?

A variety of economic and social drivers, as outlined in Section 3, have triggered public-sector interventions to date. The variety of drivers reflects the varied local economic and market conditions, and policy priorities.

Many public-sector interventions have been driven by the economic development rationale and the desire to pioneer next-generation broadband. However, as the market matures, we believe that distributional policy objectives will become more prevalent as the public sector seeks to address

geographical variations in coverage.

The availability of funding has been observed to be an important consideration for the timing of interventions. Whilst the planned public-sector intervention in Cornwall is partly driven by distributional policy, the timing of the project is also influenced by the availability of time-limited EU funding. The availability of funding is also a consideration in the timing of the South Yorkshire intervention.

Q3: What form of interventions might be most appropriate?

The case studies have identified a wide range of approaches to public-sector interventions in next-generation broadband. This wide range of approaches is in part dictated by the different circumstances behind each intervention.

The evidence base does not identify any single approach as being the most appropriate. However, the evidence base has been used to identify a common set of critical success factors that we believe underpin efficient and effective interventions. We note that successful interventions have often sought to address both demand- and supply-side issues.

In addition to these critical success factors, we have made a number of additional recommendations that are discussed in the next section.

Q4: How should such interventions be structured and funded?

Public-sector interventions should consider how they could be designed to be efficient and effective from the outset. To do this, it is important to have an up-front definition of efficient and effective. In this report, we have defined an efficient and effective model as one that:

- defines clear goals in advance, with minimal political influence in network design
- invests the minimal amount required to achieve its goals
- limits market distortion
- provides competitive services to end users
- is delivered in a timely manner
- involves parties that are stable financially.

To meet these objectives, interventions should follow, as far as possible, the critical success factors identified in this report.

We have not identified any evidence that the source of funding alone impacts the efficiency or effectiveness of an intervention.

Q5: What should be the criteria for deciding whether public-sector intervention should be considered in a particular area?

The criteria for public sector intervention in next-generation broadband will vary depending on the local conditions. It is likely that a combination of the economic and social drivers that we have identified will provide the rationale for future interventions.

As identified in our definition of efficient and effective, it is important for interventions to be clear, consistent and transparent about the drivers for the intervention from the outset.

Where appropriate, public-sector interventions should also consider the need to comply with state-aid guidelines. In the cases where compliance with state-aid guidelines is not required, we believe that there is a role for them to be considered as they still contain important concepts that help to ensure that interventions are efficient and effective.

6.2 Recommendations

To help ensure that interventions are as efficient and effective as possible, we have made the following recommendations:

1. Follow the critical success factors as far as possible

Section 5 sets out the critical success factors that we believe will help to ensure that interventions are designed as efficient and effective as possible.

2. Encourage next-generation broadband deployment in areas of new build, regeneration and redevelopment

It is significantly more efficient to deploy next-generation broadband as part of a new-build development, regeneration or redevelopment when compared to deploying next-generation broadband to existing sites. Public bodies should therefore work with property developers to raise the profile of next-generation broadband networks and encourage deployment of next-generation broadband in such developments.

Areas of the public sector seeking to deploy next-generation broadband to areas of new build, regeneration and redevelopment should seek further information from sources such as the guidance from the Department of Communities and Local Government on Data Ducting Infrastructure for New Homes,[14] and the recent Ofcom consultation on Next-Generation New Build. Public bodies should also consider using Local/Multi-Area Agreements and planning conditions to aid the deployment of next-generation broadband in this area.

The deployment of next-generation broadband to these areas can also be part of a supply and demand stimulation scheme, as it will showcase the

[14] http://www.communities.gov.uk/publications/planningandbuilding/dataductinginfrastructure.

technology to the private sector and allow consumers to see the potential benefits of next-generation broadband.

3. Pilot projects should be co-ordinated with a clear goal

There are a number of interventions that are currently being planned. In some respects, these are pilots and may be seeking to address similar issues. We would recommend that all pilot projects from both the public- and private-sector work together to ensure that there is no duplication and that a full range of issues can be considered.

Such work could either be co-ordinated by a specific body, or could work in conjunction with other industry groups considering next-generation broadband. Such work should also seek to utilise the upcoming European Broadband Portal.[15]

4. Interventions should seek to offer a standard set of wholesale products

It is important that interventions are able to attract multiple retail service providers. To help minimise the costs to service providers that wish to use any networks provided by interventions, we believe it would be helpful if interventions used a common wholesale product set where possible. Ideally, this would be similar to, or the same as, products from the private sector. In this way, service providers should be able to simply add new networks to their offering with minimal additional upfront costs.

It may be appropriate for co-ordination bodies such as that proposed by Ofcom for new build, or NGNuk, the DSL Forum or others, to be involved in designing a common set of wholesale products. The Ofcom consultation document on Next-Generation New Build also recognises the importance of a common set of wholesale products and its potential positive impact upon retail competition.

5. Interventions should consider using the same commercial partners

Following on from Recommendation 4, supply-side interventions should consider the potential for aggregating their networks via a commercial partner, or partners, which operate and maintain the infrastructure. This model has been used in other countries, as outlined earlier in Section 5.3. Such an approach would help create economies of scale. However, the risk of creating a local monopoly needs to be considered. It may therefore be appropriate for more than one commercial organisation to be involved for this purpose.

In addition to the operation and maintenance of networks, interventions should also consider any potential economies of scale from using the same commercial partner(s) during the planning and construction phases of intervention.

This recommendation is consistent with proposals from Ofcom in its

[15] The European Commission are setting up a portal known as the European Broadband Portal to act as a platform for the exchange of good practice and as an inventory of information about developments in broadband, including information about the regulatory framework and the State Aid rules as they impact on public sector investments. The portal will go live in June 2008.

consultation document on Next-Generation New Build.

6. Additional work should be carried out to help provide clarity on the commercial business case

Because of the large investments required for next-generation broadband, commercial investors require a robust business case for those investments. There are two key areas where additional work can be carried out to ensure the private sector has the best-possible information:

- Firstly, on the demand side, there is great uncertainty around the willingness for consumers to pay for the additional services that could be offered over next-generation broadband. Therefore, it may be appropriate for work to be carried out to help establish the potential additional revenues for such services.

- Secondly, there is uncertainty over the costs for deploying next-generation broadband. This work being co-ordinated by the BSG on deployment costs (as part of the Caio review), and the work being carried out by Ofcom on the reuse of existing infrastructure, will address this.

7. Define appropriate metrics for measuring 'success' and measure through the lifetime of the intervention

In researching the case studies, we have found large amounts of contradictory opinion about the success, or otherwise, of some interventions. This includes both financial and non-financial performance. Intervention should therefore define suitable metrics for measuring success, against their rationale and objectives as laid down by the intervention sponsors, and measure performance against these throughout the lifetime of the intervention. This will be particularly important in the first few years, and would aid re-design of the intervention should performance fall short of the original expectations.

Annex A: Case studies

A number of case studies have been conducted to build up an evidence base of interventions. The locations of these are shown below in Figure A.1.

Figure A.1: Location of case studies [Source: Analysys Mason]

A.1 OnsNet, Nuenen, the Netherlands

Overview

In December 2003, the Dutch Ministry of Economy assigned the status of "Information-rich neighbourhood" to the town of Nuenen, near Eindhoven. This provided the town with a financial subsidy, which facilitated the set-up of a next-generation network.

Rationale	OnsNet (literally 'our network') was seen as a test project to explore the wider benefits that could result from bandwidth-intensive services. In order to provide and test these services, the OnsNet co-operative sought partnerships with private and public bodies to investigate how next-generation networks can be used to support other offerings besides triple-play services. The project has been initiated, driven and is very much owned by the community it serves.
Status	The roll-out is complete and practically all of the 7500 households in Nuenen are connected to the network. Services have been offered on the network since 2005.
Network architecture	The network uses a 'double' point-to-point AON network. Next to the first fibre line handling IP traffic, a second fibre line is installed to broadcast the analogue radio and television signals, thereby reducing costs by requiring only one set-top box for all services.
Coverage and take-up	Network coverage encompasses the entire town. In the first year, take-up was 97%, stimulated by a government subsidy that allowed OnsNet to offer a free one-year subscription. After the first year, subscriber numbers remained at over 80%. About 5500 people are receiving high-speed Internet services, 6000 people use telephony services and 5000 have taken up television services via OnsNet. In total, the project generates about EUR4 million of revenue and makes a profit of around EUR1 million.
Services offered	The network offers a symmetric 100Mbit/s connection to its broadband subscribers, as well as telephony and basic television services. A small-scale video-on-demand (VoD) service has also been set up in connection with other OnsNet networks in Eindhoven and the Brabant region. In addition to a one-off fee of EUR20 for membership in the OnsNet corporation (required to access any service over the network), the price of triple-play services is EUR39.39 per month. The e-learning service is priced at EUR4.95 per month. Nuenen is known for being a testing ground for bandwidth-intensive public services: for example, Philips is trialling several e-health applications; Achmea – a major Dutch health insurance company – and Rabobank – one of the main Dutch banking companies – are also involved in the trialling of services in Nuenen.
Competition	Similar to the rest of the Netherlands, there was a high level of competition in the broadband market in Nuenen, even before the project was launched. Three ADSL providers and one cable company were operating in Nuenen. However, none of these providers were willing to operate on the new fibre

network. They deemed Nuenen's scale too small to be financially viable, thereby forcing OnsNet to create its own service provider.

As a result of OnsNet's high take-up rate of 97%, the competitive landscape experienced a dramatic shift as the cable company practically disappeared from the market.

Cost, overall budget

The average cost per household was estimated at about EUR2100 per household connected, which results in an estimated budget spend of EUR15.75 million. Future projects are expected to cost closer to EUR1400 per household due to declines in equipment pricing.

Business model

The project has been planned over a 20-year period. The users are actively involved in ensuring the durability of the project, as their membership fee is used to maintain and operate the network. The network operator provides retail and wholesale services. In addition, many other service operators are included in the project to investigate the use of next-generation broadband for their line of services. These companies include: Philips, Achmea (health insurance company), Rabobank (banking company) and HelptElkander (housing corporation).

Financial and legal structure, liabilities of parties

NEM (the network exploitation company) is a limited liability corporation, responsible for setting up, operating and owning the network. Its shareholders are Reggefiber (infrastructure investment), HelptElkander (housing corporation) and the OnsNet co-operative. As previously mentioned, OnsNet is responsible for offering retail services. Any household wishing to use the Internet services provided through the network has to become a member of the OnsNet co-operative. Through this membership, the household also receives voting rights in the future decisions of OnsNet. For the set-up of the network, every member of OnsNet received a subsidy of EUR800. This subsidy is not available to the areas in which OnsNet is expanding.

Status under European Commission law

The city did not apply for EU funding. No complaints were filed with respect to state aid.

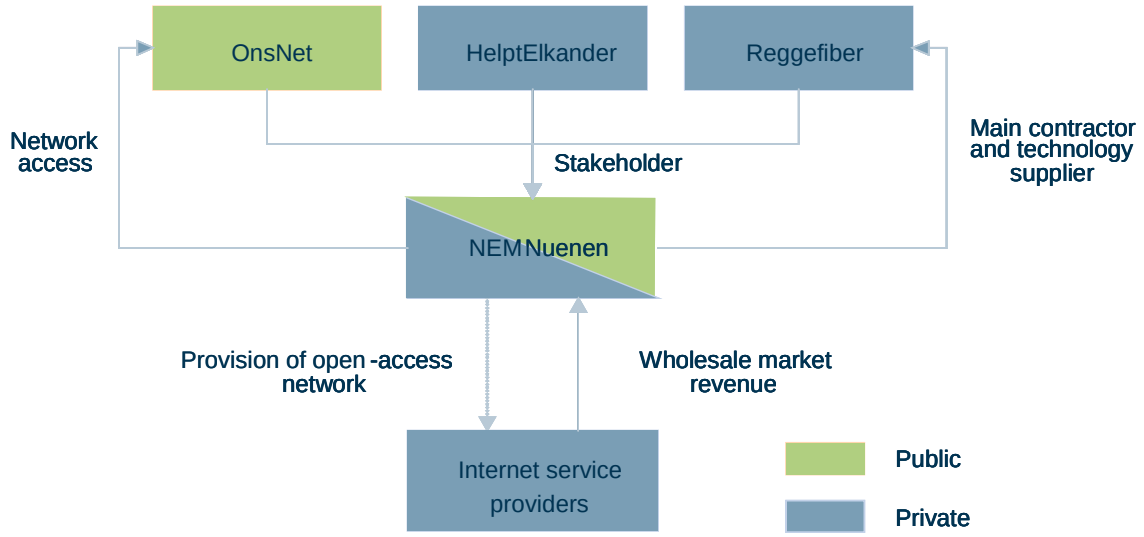

Figure A.2: Legal structure of OnsNet Nuenen [Source: OnsNet, 2007]

A.2 CityNet, Amsterdam, the Netherlands

Overview

In November 2005, the City of Amsterdam announced the launch of a fibre project to provide a citywide, FTTH network. The main aim of the network is to ensure Amsterdam's competitiveness at a European level.

Rationale

There are two main drivers for the project. Firstly, maintaining the city's competitiveness and status as a leader in technological development. The second objective is to create positive 'spillover effects' to ensure that the poorer neighbourhoods in the capital get access to broadband services and are given the chance to take part in this new development. The social aspects of equality and community reflected in Dutch culture are also represented in CityNet.

The network construction is planned over a five-year period. The first phase has already been completed, connecting 10% of the households in Amsterdam and covering Zeeburg, Oost-Watergraafsmeer and Osdorp. It is anticipated that the entire city will be connected by 2010.

The Municipality of Amsterdam is a shareholder of Glasvezelnet Amsterdam BV (GNA), the owner of the network. GNA has leased the infrastructure to bbned, a subsidiary of Telecom Italia, which provides wholesale services over an open-access structure.

Status

The first services were launched in late 2006, and the vast majority of the households in the first stage have already been passed. The remaining stages will be deployed within the next two years, with the project due to be completed by 2010.

Network architecture	CityNet is based on an MPLS core network with an Ethernet FTTH design using a per-service, virtual local area network (VLAN) architecture. Each VLAN is terminated onto a different physical port at the customer premises equipment (CPE), providing logical separation of services (e.g. Internet, video and telephony services).
Coverage and take-up	The first stage involved 40 000 homes passed, representing roughly 10% of all households. By the end of the project, all households and businesses in Amsterdam (420 000) will have been passed by the network.
Services offered	bbned is the network operator and manages an open-access network on a wholesale basis. At the retail level, several service providers, such as qfast, InterNLnet and Alice (another subsidiary of Telecom Italia) are already offering services such as triple-play services including symmetric bandwidths of up to 50Mbit/s for about EUR40–60.
Competition	As elsewhere in the Netherlands, broadband competition in Amsterdam is strong, with the incumbent (KPN) and other LLU providers offering DSL services. Moreover, the cable industry is dominant and cable coverage has been near ubiquitous. All competitors offer a wide range of services and bandwidths. The exact influence of CityNet on the competitive landscape cannot yet be judged due to the fact that only 10% of households are covered. However, the behaviour of service providers indicates that alternative ADSL providers are converting to the CityNet platform. As a result, it is likely that there will be three main competitors in future, all with different infrastructure, as the incumbent KPN continues to pursue plans to rollout its own FTTC/VDSL network and the cable companies do not seem interested in offering a new service via fibre. However, there is a danger that their market shares might tumble similarly to Nuenen, as prices of high-end services provided by CityNet with comparable download speeds are currently EUR25–40 cheaper than the offerings of cable providers.
Cost, overall budget	The estimated cost for the first stage of the project is EUR30 million for the first 40 000 homes, equating to a cost per home passed of EUR750. An equity investment of EUR18 million is split between the partners, and EUR12 million was provided to GNA as commercial loans. The budget for the entire project is estimated at about EUR300 million. We understand that this estimate is based on the costs for the first phase.
Business model	CityNet is not a pilot project as such, but is seeking recognition of the model in low-income neighbourhoods so that the deployment to these 40 000 homes in representative parts of the city will provide a showcase for potential investors. The CityNet project is aimed at satisfying both the

public sector's increasing needs, and the market potential for triple-play services. Estimated wholesale revenue per user is at around EUR25.

Financial and legal structure, liabilities of parties

The network is owned by GNA, a third of which is owned by the Municipality of Amsterdam, a third by five Amsterdam housing corporations, and a third by ING Bank. GNA has commissioned the construction of the network from Draka (a cable company which provides fibre-optic technology and cabling solutions) and BAM (a construction firm, responsible for digging the trenches). The initial service provider, bbned, rents the infrastructure and provides wholesale access to other service providers.

Status under European Commission law, competition neutrality and network openness

Although GNA's shareholders have made their investments under standard commercial terms, one of the cable companies (UPC) challenged the legality of the project, claiming that the financial arrangements constituted state aid. The European Commission rejected this view in a ruling, and determined that the project was carried out under market conditions and that there was significant private investment within the project. The project was accepted under the Market Economy Investor Principle (MEIP) on 11 December 2007.[16]

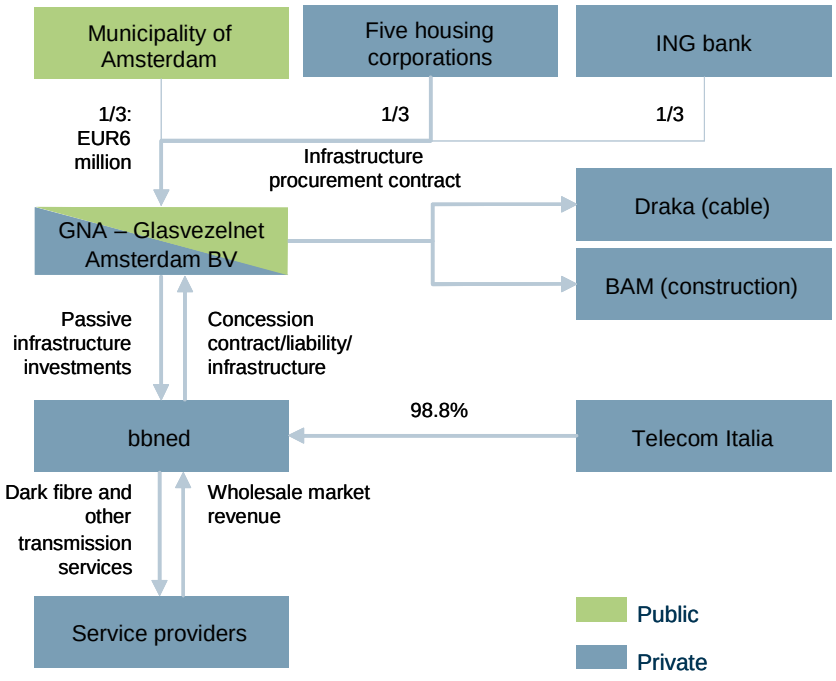

Figure A.3: Legal and financial structure of the CityNet project [Source: News articles, November 2005]

[16] See EC Case 53/2006: http://ec.europa.eu/comm/competition/state_aid/register/ii/by_case_nr_c2006_0030.html#53.

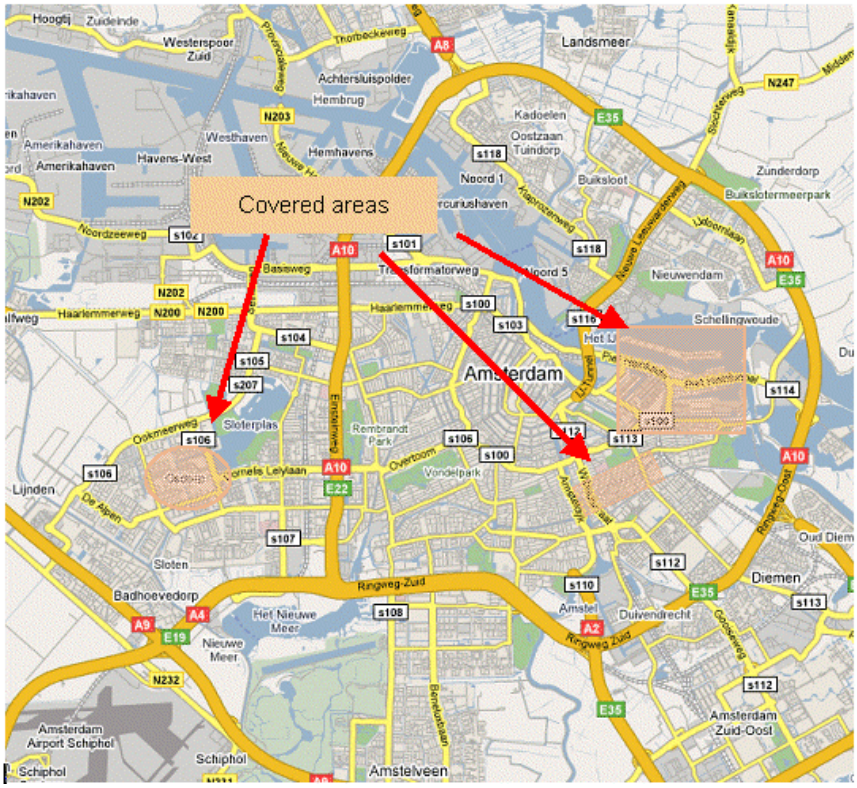

Figure A.4: The three areas covered by the initial phase of the CityNet project [Source: Glasvezelnet, Google Maps]

A.3 Wilhelm.tel, Norderstedt, Germany

Overview

Wilhelm.tel, a subsidiary of the municipality-owned power utility company Stadtwerke Norderstedt, implemented plans for the roll-out of an FTTH network in 1999, and has since provided triple-play services to retail customers. Wilhelm.tel's objective combined the need for new infrastructure deployments with the roll-out of a high-speed network.

After initial financial problems, the company has now initiated several new projects in the surrounding areas, to expand its footprint.

Rationale

The city's existing network infrastructure (used for communications, traffic signals, emergency services) was due for an overhaul and the city wanted to take the opportunity to implement a new, progressive network in a cost-efficient manner.

The project also aimed at increasing the competitiveness of the city by attracting businesses to Norderstedt that currently reside in nearby Hamburg with the next generation of IT infrastructure.

Status

The network has been operational since 2003, and passes all 33 000 households in Norderstedt. Over the last three years, Wilhelm.tel has successively expanded its reach into the surrounding areas, including several parts of Hamburg, where it added more than 70 000 households.

Network architecture

Wilhelm.tel employed a ring technology based on Ethernet to achieve a fast and reliable network. VLAN-solutions were included to allow for a separation of voice, broadband and television services.

Coverage and take-up

While initial take-up was slow, the company now enjoys a steady growth of its customer base. Market shares in Norderstedt are between 60% and 90%, depending on the type of service. In total, the company passes about 100 000 households, and over 70% of these households have subscribed to the television offer.

The installation of the backhaul to Norderstedt enabled nearby villages to request access to the fibre network. Local initiatives allow interested people to sign up for FTTH services in advance. If a certain threshold is reached (usually around 40% of all households), the village will be connected to the network of Wilhelm.tel. This method allows even small villages without prior access to first-generation broadband to subscribe to the network. The project assumes that extensions to places where the network would usually not be economically viable become possible through the positive externality of the network's wider reach.

The availability of high-bandwidth services also seems to have stimulated content production locally, as users in Norderstedt actively produce more online content since the services have launched. However, it is not clear if the content requires high-speed broadband, or if this is a spin-off from the increased interest. The resulting economic benefits derived from the application of this content are unclear at this point, but will become clearer as next-generation services are developed.

Services offered

Wilhelm.tel is currently in the process of upgrading the last mile from HFC to Ethernet. This enables a triple-play service offering, which features download bandwidths of up to 100Mbit/s alongside analogue television and fixed-line telephone services.

Wilhelm.tel's offers are targeted at private and business customers. Prices for private customers peak at EUR39.90 for broadband connections, with bandwidths of 100Mbit/s downstream and 5Mbit/s upstream, including a flat rate for a fixed line. In addition, television services can be acquired for an additional EUR11.

Competition

The main competition for Wilhelm.tel stems from Deutsche Telekom (DT) and alternative DSL providers. In Norderstedt, Wilhelm.tel gained a competitive advantage due to the provision of its triple-play offer.

Within Hamburg, competition is intensifying as three other alternative private operators announced that they would upgrade their networks to support FTTH. DT also offers triple play and VDSL, with speeds of up to 50Mbit/s.

Cost, overall budget

Approximately EUR67 million has been spent to connect households in Norderstedt and the surrounding areas covering parts of Hamburg.

Business model

Wilhelm.tel sells triple-play retail services to residential and business customers. After incurring losses up to twice as high as originally planned in the first four years of operations, Wilhelm.tel broke even in 2004, and has steadily increased its profit margin since then. It now yields a profit of about EUR2 to 3 million a year at a margin of 22%.

There were several reasons for the problems faced by Wilhelm.tel:

- in the telephony division of the company, significantly fewer long-distance calls were made, which led to a decrease in average revenue per user (ARPU).
- customers moved away from the expensive television offer, partly due to technical problems with set-top boxes and partly due to the pessimistic economic outlook around the turn of the millennium
- take-up exceeded expectations and led to higher depreciation and an increase in administrative costs
- at the same time, revenue did not increase accordingly, as customers had subscribed to promotional offers with low initial monthly fees.

Financial and legal structure, liabilities of parties

Wilhelm.tel is a subsidiary of Stadtwerke Norderstedt, the local power utility company which, in turn, is entirely owned by the city of Norderstedt. Stadtwerke funded the entire network roll-out and is financially responsible for the results of Wilhelm.tel.

Status under European Commission law

The city did not apply for any EU funding. No complaints were filed with respect to state aid.

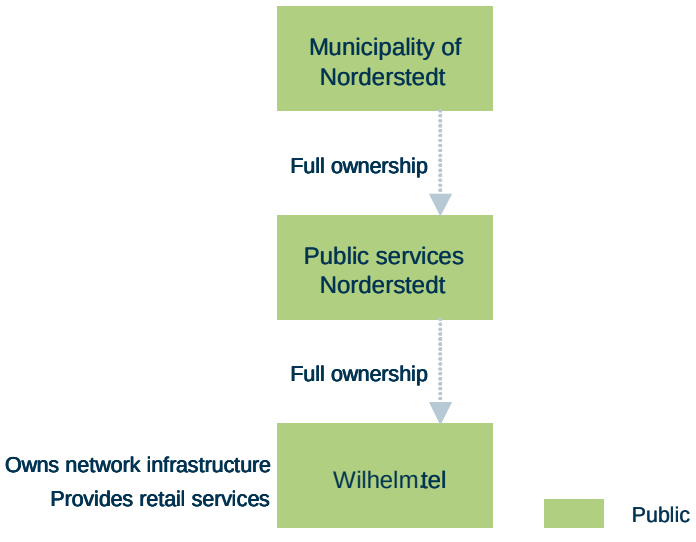

Figure A.5: Legal and financial structure of Wilhelm.tel [Source: Wilhelm.tel, 2008]

A.4 CityNetCologne, Cologne, Germany

Overview

In 2006, NetCologne deployed a next-generation broadband network CityNetCologne in order to increase competition to the incumbent, DT. The network is limited to the densely populated parts of Cologne and will be finished by 2010.

Rationale

Prior to its fibre network plans, NetCologne offered DSL services via LLU to customers in Cologne and the surrounding areas. Based on a fibre network, the company hopes to save up to EUR30 million per year of connection fees, which it would usually pay to DT in the form of interconnection charges.

The roll-out of CityNetCologne is not aiming for ubiquitous coverage, but follows clear market principles.

Status

The work on the network began in 2005. The first customers were connected in December 2006. By 2010 the project aims to have connected a further 100 000 households.

Network architecture

CityNetCologne relies on a combination of FTTB and VDSL2. The project is described as one of the most technically advanced VDSL2 deployments in Europe.

Coverage and take-up

By the end of 2007, 10 000 homes were passed. It is worth noting that detached and semi-detached houses will be excluded from the FTTH offer due to high connection costs.

Services offered

NetCologne offers retail services to business and private customers. For private customers, one of the most attractive packages is a quadruple-play offer, which includes 10Mbit/s bandwidth and five different flat rates within the bundle (for instance, for data services, mobile, fixed-line telephony, etc.). 100Mbit/s services are available for EUR39.90 including a flat rate for telephony services.

Competition

As of March 2008, NetCologne had over 50% market share for broadband services in Cologne. Its biggest competitors are DT – which is also starting to offer VDSL services with speeds of up to 50Mbit/s – and Unity Media – Germany's largest cable operator.

It is not possible to comment on how NetCologne's offer will impact the competitive landscape as the network covers only a very small proportion of the total market.

Cost, overall budget

After initial press releases announced a budget of EUR250 million for a three-year roll-out, the company scaled down its investment plans. It now plans to invest EUR125 million until 2010 to connect more than 100 000 households to the network.

Business model

NetCologne owns, maintains and operates the network, and also offers retail services to its customers. The most important argument for the implementation of the new network is certainly the cost savings resulting from its independence from DT's network. This is estimated at around EUR30 million per year. The company offers services for less than equivalent services offered by incumbent operators.

Financial and legal structure, liabilities of parties

NetCologne is owned by the former utility company GEW Köln AG, which now acts as a holding company due to a difficult financial restructuring. GEW Köln is 100% owned by the city of Cologne. As a result of the restructuring, the city is now also responsible for NetCologne and its holdings.

Status under European Commission law

The city did not apply for any EU funding for this project. No complaints were filed with respect to state aid.

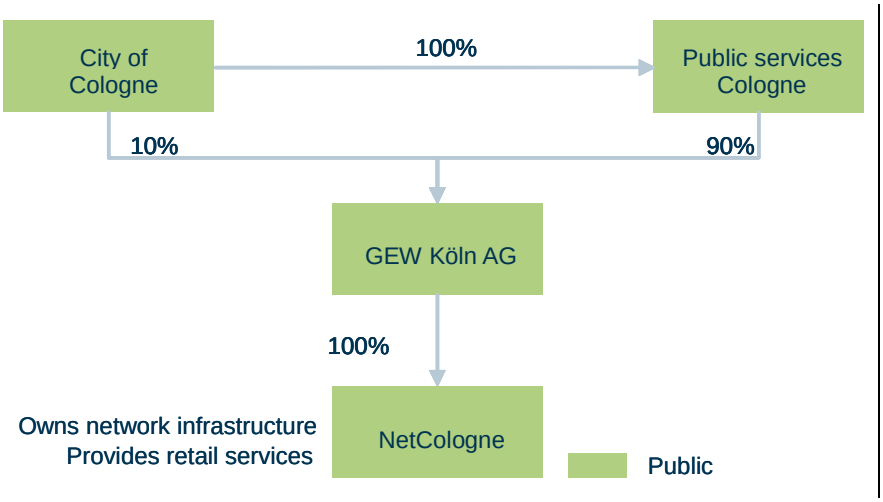

Figure A.6: Legal and financial structure of the NetCologne [Source: Stadtwerke Köln, 2007]

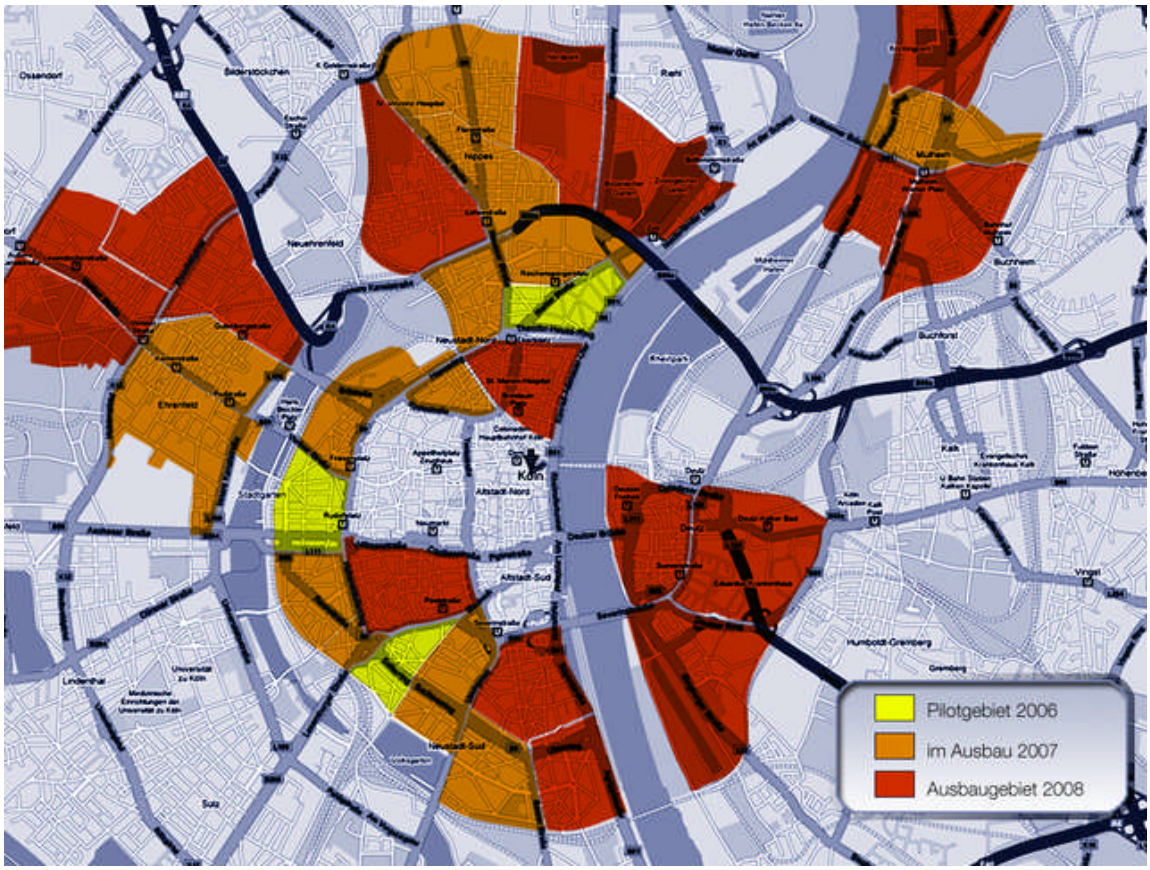

Figure A.7: Coverage of CityNetCologne for 2006–2008 [Source: NetCologne, 2007]

A.5 Pau Broadband Country (PBC), Pau, France

Overview

In 2005, the city of Pau launched a fibre network with the hope of connecting the city (located in the South of France) to the main backhaul, and providing high-speed broadband connections to its inhabitants, therefore stimulating economic development.

Rationale

The initiative is driven by the strong belief that the investment is vital to the economic development of the town, and necessary to create a competitive advantage for the region in the future. Pau perceives its fibre network to be similar to a public utility (such as electricity, streets and fixed landlines).

Status

The connection to the first households was established in 2005. The entire project aims to connect 55 000 households in Pau (representing 80% of the total number of households and businesses in Pau).

Network architecture

PBC built a point-to-point AON network. This solution facilitates co-location, and thereby leads to an open-access network.

Coverage and take-up

The initial three phases from 2004 to 2006 covered about 12 000 households per year. Take-up has been positive, as 5000 customers had subscribed to the FTTH services by December 2007. There is an additional phase planned to connect the remaining households, by 2010/11 at the latest.

Services offered

Axione offers wholesale services on an open-access basis.

Neuf is the only retail provider currently offering high-speed broadband to residential customers in Pau. It offers triple-play services, including symmetric speeds of up to 50Mbit/s.

Kiwi provides wireless services to business (up to 4Mbit/s) and residential (up to 2Mbit/s) customers. For business customers, there are six providers (Colt, Completel, Neuf, Héliantis, Opalyse and THD) offering a range of enterprise solutions such as data and Wi-Fi security, videoconferencing and webhosting in addition to the traditional Internet service.

Competition

Pau is a remote location, and therefore has a less competitive market than larger cities such as Paris. Although PBC is designed as an open-access network to foster competition, only one residential retail operator, Neuf, is active on the network. The second operator on the network at this time, WaLan, stopped serving its customers in July 2007, due to economic reasons. It would appear that WaLan was unable to obtain a sufficiently large customer base to support its business.

In addition, Free, another French service provider that is quite active in fibre, has no intention of entering the market. PBC's topology is based on an active point-to-point technology. However, Free claims that cabinets in Pau are too small to co-locate additional equipment, and too numerous, thereby making the cost of the investment too high.

In contrast to the struggling residential retail segment, competition in the business sector has increased, as six providers offer their services on the network.

Cost, overall budget

A budget of EUR35 million was proposed for the first three phases of the network build. Each of these phases lasted approximately a year, and provided access to 12 000 households. There are no estimates available on the total costs of the project.

Business model

The Communauté d'Agglomération Pau Pyrénées (CAPP) constructed the network for the public domain, and ensures the connection to the major backhaul. It rents the network to the Paloise Society for Very High Speed Broadband (SPTHD) and its neutral operator, Axione. SPTHD and Axione's customers are service providers, to whom they sell bandwidth capacities or

dark fibre. Several operators then provide retail services to private and business customers.

Financial and legal structure, liabilities of parties

The network itself is owned by the city of Pau. The project is both privately and publicly funded. The public funds stem from a number of different sources: about EUR7 million was provided by CAPP; the EU has contributed around EUR8 million via the ERDF; and the Aquitaine region (which encompasses Pau) provided about EUR1 million. The city has contracted the task to operate the network and provide wholesale services to Axione for a period of 15 years.

Status under European Commission law

The Aquitaine region was eligible for Objective 2 support from the EU based on the need for improved infrastructure. Therefore, the PBC profited from the ERDF.

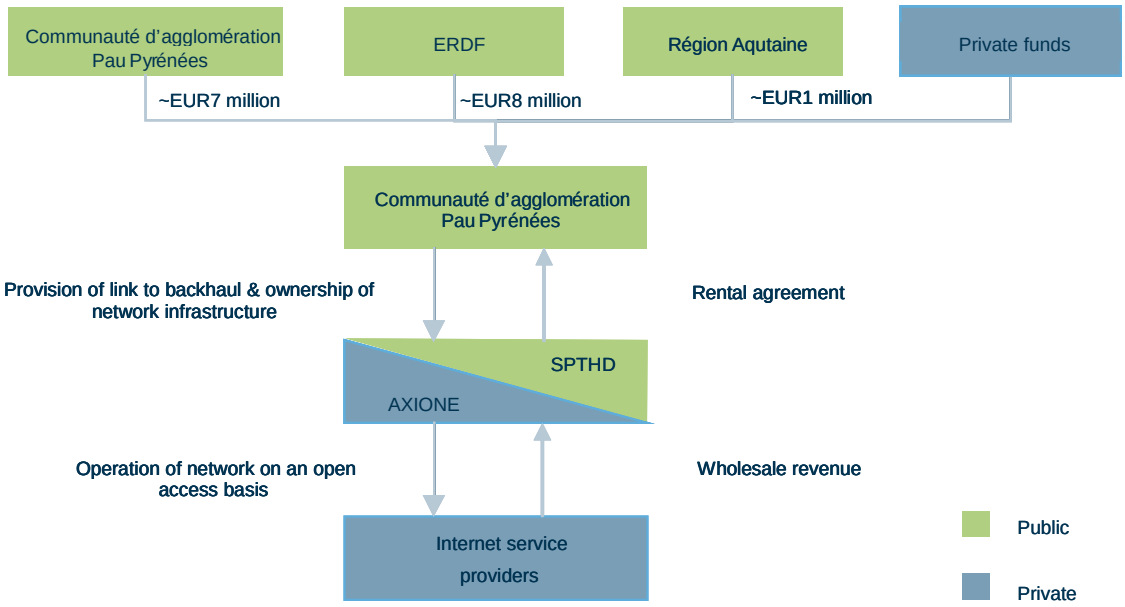

Figure A.8: Legal and financial structure of the Pau Broadband Country [Source: CAPP, 2008]

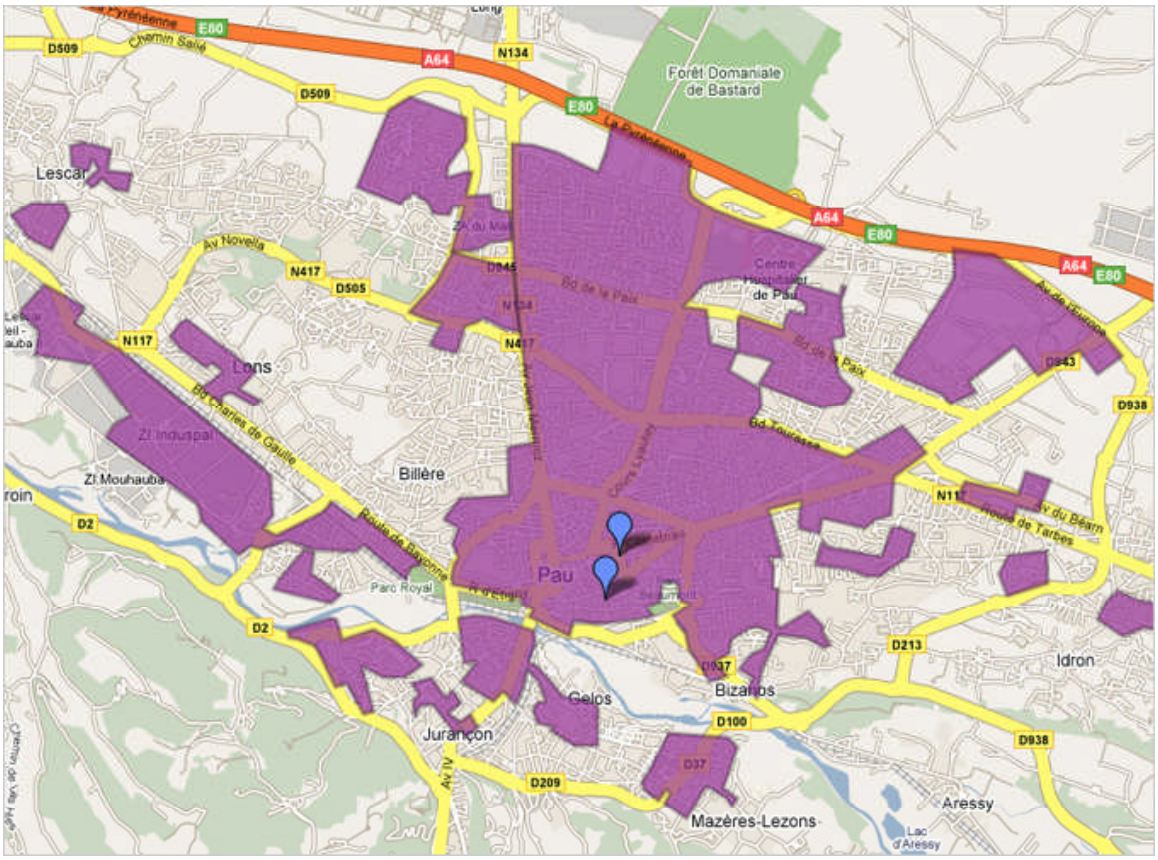

Figure A.9: FTTH coverage of the city of Pau [Source: Free, 2008]

A.6 Red ASTURCÓN (Red Astur de Comunicaciones Ópticas Neutras), Asturias, Spain

Overview

This region-wide project started in 2006 in three cities of Asturias. Its goal is to stimulate economic growth in a region that formerly relied on the steel and mining industry.

Rationale

The Asturias region is an economically disadvantaged region in Spain. The local economy was based on its mining and steelworks industries, but these have suffered significant decline in recent years. In an effort to provide an alternative to the incumbents' ADSL services and to boost the general competitiveness of the region, the regional government launched a project that aims to connect 30 000 households in three valleys to a new open-access infrastructure.

The government hopes to stimulate the creation of services and applications with the introduction of a next-generation broadband network.

Status

The first city was connected to the network in November 2007. Since then, the network has been deployed in 21 cities.

Network architecture	The network will be based on a GPON technology. The network infrastructure is set up so that all service operators share one common interconnection point.
Coverage and take-up	The project aims to pass around 32 000 households by the end of 2008. By the end of 2007, 28 000 households had been passed, and the network had 600 subscribers. The government is aiming for about 7000 subscriptions by the end of 2008.
Services offered	The government officially defined the minimum bandwidth per user to 10Mbit/s. Two service providers are currently active in Asturias; both of them offer retail services to residential and business customers: Adamo offers symmetric 100Mbit/s services for EUR49 as a premium product. Fixed-line services can be added for EUR5. Television packages are not yet available. TeleCable offers bundled triple-play services. Its premium package costs EUR69.75, and includes broadband speeds of 20Mbit/s down and 800kbit/s up, a flat-rate telephony service and a television package.
Competition	The project is intentionally limited to cities in the region with very low levels of broadband competition. Only the incumbent, Telefónica, offers ADSL services, and LLU is rare. In addition, cable penetration is quite high in Asturias, but limited to more populated regions. This led to the development of a network design that aimed to foster competition and stimulate new entry in the market. Two companies, Adamo and TeleCable, are already active on the network. However, it is not yet possible to judge the success of their operations given the short time that they have been commercially active on the network.
Cost, overall budget	As of March 2008, estimated costs of the project had reached EUR21 million. This is already in excess of the original target of EUR18.7 million for the entire project.
Business model	The government of Asturias owns and maintains the network and provides wholesale services to retail service providers. It intends to generate income by leasing lines to the operators and service providers. A fee will be charged per line provisioned (installation fee and monthly charge). Prices will fall in the LLU range, which it is hoped will be competitive with current commercial products. A lack of regulation allows both private and public companies to offer broadband services. The focus of regulation is to build support for new entrants and foster competition. To ensure the quality of services, the amount of subscribers per interface is limited.

Financial and legal structure, liabilities of parties

The government of Asturias owns the network infrastructure. The project aims at financing about 60% of the deployment cost through EU funding. The remaining 40% stems from a complementary plan for the economic regeneration of the mining valleys.

The network will be leased on an open-access basis to service providers. Such operators will have to contribute the necessary investments for network upgrades, gateways and systems.

Status under European Commission law

The Region of Asturias is eligible for Objective 1 funding. About 60% of the project will be funded via the EU.

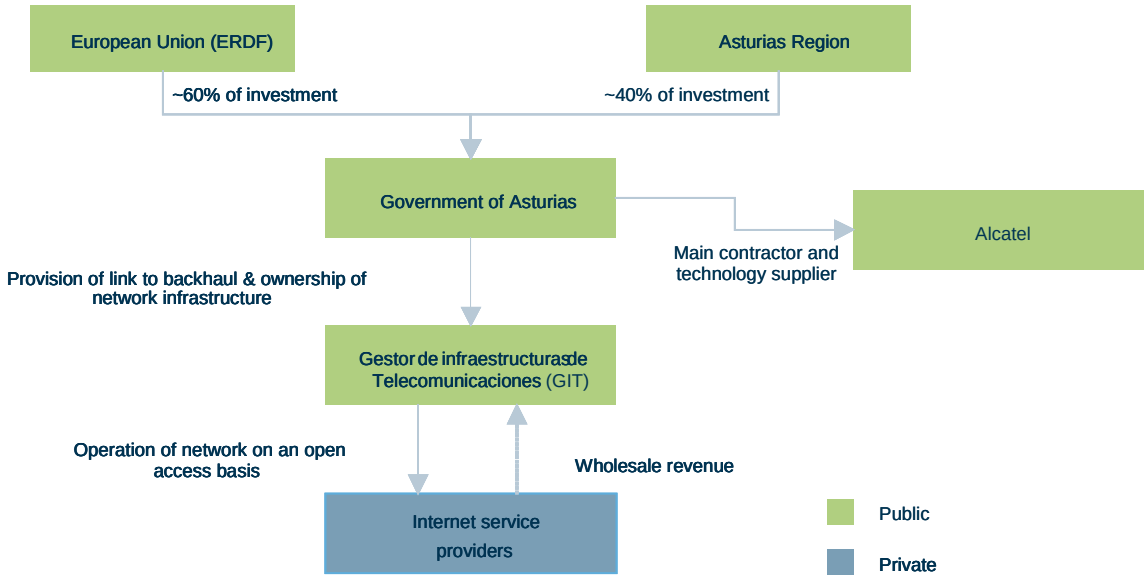

Figure A.10: Legal and financial structure of Red ASTURCÓN [Source: GIT, 2007]

A.7 Blizznet, Vienna, Austria

Overview

In 2006, the City of Vienna started the first phase of a project that, once finished, will provide FTTH to every household in the city. With about one million households to be connected, Blizznet is significantly larger than many other interventions in Europe.

Rationale

The project aims to follow free market principles, and seeks to provide Vienna with an architecture that establishes the capital's position as a link between Eastern and Western Europe as part of an economic development strategy.

The project tries to capitalise as much as possible on existing duct infrastructure and rights of ways, thereby ensuring significant cost savings.

Status	At present, there are 5000 households connected to the network, with continuing construction. Several service providers are active on Blizznet.
Network architecture	The network is supported by Ethernet architecture.
Coverage and take-up	The project has been set up to provide all 970 000 households and 70 000 SMEs with FTTH. However, take-up has been slow as only 15% of the 5000 households passed are connected.
Services offered	Blizznet is solely focused on residential customers at the moment. Five different service providers (aon, TeleTronic, conova, NeoTel, quipcom) offer a range of packages, including triple play, and extra features such as security solutions. Prices are higher than those for other projects, with subscribers paying EUR50 for a symmetric 10Mbit/s connection and a fixed-line flat rate.
Competition	Although the Austrian market looks quite competitive, with a strong cable competitor and an incumbent securing a market share of 46%, prices for Internet access are relatively high. Despite Blizznet's limited market penetration at present, initial evidence points to the fact that the network has the potential to stimulate future competition. Five operators are now active on Blizznet, offering various services to residential customers. The transparency of the network (all offers are visible through a single web portal) may increase price competition.
Cost, overall budget	The first phase aims to connect 50 000 households for about EUR10 million. The company is using the existing infrastructure of the Vienna sewage system to achieve significant cost savings. In addition, there is already a large fibre network in place, together with ducts and rights-of-way, which further add to the cost saving.
Business model	Blizznet operates as a network operator, providing wholesale services on an open-access basis. Five retail providers use the platform to offer their services.
Financial and legal structure, liabilities of parties	Wienstrom, the local power utility company, owns the network and established Blizznet as a subsidiary to operate the network and provide wholesale services. Wienstrom is owned by the city of Vienna.
Status under European Commission law	The city did not apply for EU funding. No complaints were filed with respect to state aid.

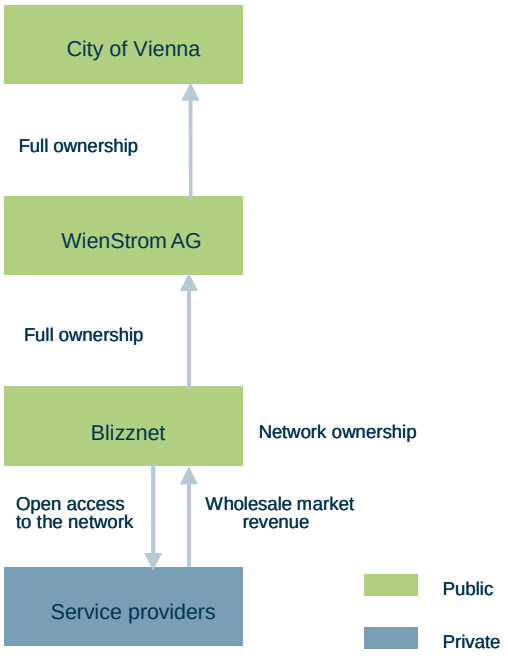

Figure A.11: Legal and financial structure of Blizznet [Source: Blizznet, 2006]

A.8 Lyse Tele, Norway

Overview

Since 2003, Lyse Tele has served residential customers and SMEs within 16 municipalities in southwest Norway. The company was the first to introduce triple play to the Norwegian market, and has experienced strong growth of its business activities in recent years.

Rationale

As a subsidiary of the municipal utility company Lyse Energi, Lyse Tele seeks to leverage Lyse Energi's expertise in digging and laying cable, and aims to capitalise on the existing duct and pipe infrastructure for a cost-efficient roll-out.

The company follows a purely commercial approach to NGA but is backed up by the publicly owned utility company.

Status

The network has been functional since the end of 2002. During the last few years, Lyse Tele has been constantly enlarging its core network and has been seeking partnerships to extend its reach.

Network architecture

Lyse Tele is deploying a Metro Ethernet solution. The company expects this solution to control equipment costs and opex and facilitate bandwidth upgrades.

Coverage and take-up	Lyse Tele and its partners are present across Norway, with a focus on the southwest region. The company itself had over 52 000 customers by the end of 2006, with an additional 18 000 customers signed up for Lyse Tele's services and waiting to be connected to the network. New areas are added to the network via demand registration schemes, where people commit to taking Lyse Tele's services. This minimises the risk of expansion for Lyse Tele by ensuring that sufficient demand is proven prior to expansion.
Services offered	Lyse Tele provides retail triple-play offers to residential customers and also offers service packages to SMEs. As a special offer, customers can acquire a 'do-it-yourself' pack to connect the ducts from the street to the home, which is expected to yield significant cost savings of around EUR500. Take-up of the offer has been immense, with about 80% of all customers signing up for the option. In addition, Lyse Tele offers wholesale services to its strategic partners.
Competition	The Norwegian market is highly competitive, with many providers competing on a regional basis. In 2007, Lyse Tele had a market share of about 5% in the national residential broadband market, making it the sixth biggest player in the market. On a regional level, Lyse Tele claims to have market shares of over 60% in all those regions where it offers its services, which is an unsurprising result given its pre-registration scheme. It will be interesting to observe the future implications of this regional market power.
Cost, overall budget	Since 2002, the company has invested about EUR120 million in the extension of its fibre network and the acquisition of strategic partners.
Business model	Lyse Tele is active in both retail and wholesale sectors. In addition to these services, it has established 32 strategic partnerships with retail customers. One of the results of the partnerships is the Altibox, a set-top box for triple-play services, which is used by all wholesale customers. The Altibox ensures compatibility throughout the network, as well as a cost reduction for residential users.
Financial and legal structure, liabilities of parties	Lyse Tele is the infrastructure owner and also responsible for the operation of the networks. It is a subsidiary of Lyse Energi, which, in turn, is owned by 16 municipalities in southwest Norway.

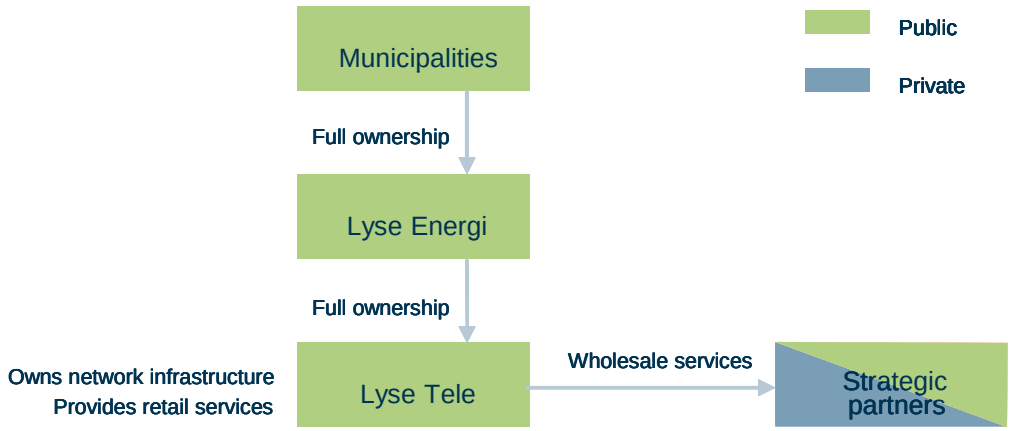

Figure A.12: Financial and legal structure of Lyse Tele [Source: Lyse Tele, 2007]

A.9 Stokab, Stockholm, Sweden

Overview

Stokab was founded in 1994, when the City of Stockholm chartered a company to lay a publicly owned, fibre-optic network throughout the city to provide dark fibre to telecoms operators and other users at cost-based rates. Stokab's core tasks are to build, operate and maintain the fibre-optic communication network in the Stockholm area, and to lease fibre-optic connections. The company also operates the City of Stockholm's internal networks, which serves both administrative purposes and public services in the areas of education, childcare, recreation and culture.

Rationale

Stokab's mandate from the City of Stockholm is based on the parliamentary statement to create an "information society for all",[17] which, in turn, is based on the Swedish broadband availability objective stating that, by 2010, "all permanent housing, business and public operations should have access to broadband services".[18]

The local authorities believed Stokab was a better option than having many operators digging and deploying fibre, as it was a less-disruptive option for citizens, grants common access to resources, provides easy access to the city's ducts and fosters service-based competition.

Status

Stokab finished deploying its initial round of fibre in the course of 2004, and now maintains a profitable network. It has over 450 customers, among them operators, service providers, large companies, property owners and public-sector bodies.

[17] http://www.stokab.se/templates/StandardPage.aspx?id=773.

[18] http://www.pts.se/en-gb/Documents/Reports/Internet/2007/Proposed-Broadband-Strategy-for-Sweden---PTS-ER-20077/.

Stokab is not limited to the provision of fibre and its most recent investments are now directed to a range of different access technologies, such as fixed wireless access (FWA) (WiMAX) or shared cables across residential homes. Most recently, Stokab developed FTTH partnerships with municipal housing corporations, such as Svenska Botsader and Jarfallabingdens Hus.

Network architecture

The Stokab network is providing FTTH relying mainly on AON technology, with a few projects based on PON technology.

Coverage and take-up

FTTH is under construction or has already been established in the entire Stockholm metro area. In addition, 100 more city blocks are planned to be connected in 2007/08 and 100 000 social housing apartments were covered via an FTTH roll-out in 2005. Through the development of partnerships with municipal housing corporations, such as Svenska Botsader and Jarfallabingdens Hus, Stokab seeks to continuously expand its network reach.

Services offered

Over 80 operators and service providers use the network and offer symmetric 100 Mbit/s connections from about EUR30. Stokab is also looking more closely at deploying wireless solutions in the future to help reduce deployment costs.

Competition

The Swedish landscape is generally quite competitive, as a result of the social acceptance and usage of technology in the country. The market is dominated by three companies, of which only Telenor, the second largest company, operates on Stokab (incumbent TeliaSonera and cable provider Com Hem AB are the two other companies).

The large number of different operators using the network illustrates how Stokab can be labelled as an open network that has been successful in attracting competition.

Cost, overall budget

Stokab progressively rolled out its network from 1994 to 2004, and is now in a low investment period. The network officially covers more than 5600km of cable and a total of 1 200 000km of fibre. In 2006, Stokab's approximate tangible assets were estimated at EUR114 million. The company generated wholesale revenues of EUR42.2 million the same year.

Business model

Stokab leases dark fibre and operates as a service operator in an open-access network. It also operates the City of Stockholm's internal networks to serve both administrative purposes and public needs in the areas of education, childcare, recreation and culture.

Financial and legal structure, liabilities of parties

Stokab is owned by Stockholm's Stadshus AC, which, in turn, is owned by the City of Stockholm. It started as a construction company regulated by the Swedish government. The city council is also the main supporter of the project.

Stokab's core tasks are to build, operate and maintain the fibre-optic communication network in the Stockholm area, and to lease fibre-optic connections, from where it gets wholesale market revenue. Its commercial model, which is owned and backed by the government, is operating under the premise of a public service on commercial terms.

Status under European Commission law

As per its mandate from the City of Stockholm, the company provides a network that is open to all service providers on equal terms. It is our understanding that no European Commission notification regarding state aid has been filed, and no specific legal case has arisen.

A.10 MälarNetCity, Vasteras, Sweden

Overview

In 2000, the city of Vasteras decided to commission the deployment of an open-access fibre network to the local utility company MälarEnergi. MälarNetCity was built and operated by MälarEnergi's subsidiary company Mälarenergi Stadsnät, in order to provide citizens with the benefits of next-generation networking.

Rationale

Like many other Swedish projects, MälarNetCity is driven by the sincere conviction that next-generation broadband services are a necessity for every modern town, due to its social and economic benefits. In addition, the founders of MälarNetCity believe that an open-access network will continue to strengthen the competition in the market.

The project aims to operate on a market-driven basis but is supported by the local municipal power utility company.

Status

The network construction was completed in 2007 and covers about 83% of all households in Vasteras. The network has been operational since 2000. MälarNetCity does not supply any retail services. Retail services are provided by most of Sweden's major service providers such as Telia, Tele2, Bredband2, Viasat, Canal Digital and a number of smaller and local suppliers.

Network architecture

The network uses a Gigabit Ethernet Metro Network technology and primarily relies on new build FTTH, including Cat5 cabling in apartment blocks, as well as ADSL2+ connections serving more distant locations. In the future, WiMAX may also be used for certain locations.

Coverage and take-up

The final deployment now encompasses about 50 000 households. Around 65% of households connected have subscribed to one of the services offered over the network.

Services offered

The MälarNetCity hosts an open-access network featuring over 30 service providers. The services offered by these providers range from broadband, telephony and television offers to security, data storage and online gaming. MälarNetCity today has more than 85 different household and company services to choose from.

Prices for a symmetric 100Mbit/s connection are about EUR35. Although not available as a total package, customers could buy an individual triple-play package for about EUR50.

Competition

The MälarNetCity evolved despite an existing competitive landscape. Today, more than 30 operators are working on the network, including the national incumbent (MalarNetCity is one of the few projects in this report to have succeeded in getting the incumbent onboard). All services are marketed through the network's main portal leading to high transparency and a modest price level (a 'naked' symmetric 100Mbit/s service for about EUR30).

Cost, overall budget

Around EUR25 million were spent on the project. However, these calculations exclude the connections to the premises. MälarNetCity distinguishes between two different types of customers to connect households to the network, based on the same rationale used for paying for connecting to water and electricity networks.

Communities purchase a local area network (LAN), which is then rented out to homes. The network is financed by bank loans organised by the community. For standalone customers, the owner tends to arrange individual financing and applies for a loan. On average, the cost for connecting the house is EUR1800. People can then apply for a tax refund of EUR530.

Business model

MälarNetCity provides wholesale services and operates the network on an open-access basis. MälarNetCity expanded its network once 60% or more of the homes in a specific area sign up. MälarNetCity currently generates a small operating profit.

Interestingly, residents connected to the network have seen the value of their property increase as a result, by as much as EUR4000.

Financial and legal structure, liabilities of parties

MälarNetCity is a subsidiary of the local power utility company MälarEnergi. MälarNetCity owns the network infrastructure and is responsible for the operation and maintenance of the network.

Consumers take out loans against their homes to finance the connection.

They are then able to reclaim EUR530 of the infrastructure cost by form of a tax reduction.

Status under European Commission law

The city did not apply for any EU funding. No complaints were filed with respect to state aid.

A.11 Fibre MANs, e|net, Ireland

Overview

e|net runs a set of interconnected local fibre MANs on behalf of the Irish government. The company operates as an independent wholesaler, providing MAN access to a range of telecoms operators and service providers, including Aurora, BT, Chorus, ESB Telecom and eircom.

Rationale

Many cities in Ireland are situated in remote locations, and private incentives for the provision of FTTx networks are very low. In addition, broadband penetration in Ireland is fairly low at around 15%, significantly below the EU average of 22%. It was believed that, in the long run, the underdeveloped broadband infrastructure in the country might constitute a hindrance to the favourable development of the Irish economy. Therefore, the MAN project was set up to provide all Irish towns larger than 1500 inhabitants with a MAN.

The project is divided into three phases. The first phase, in which MANs were rolled out to 27 cities and towns, is now complete. An additional 120 towns will be connected during Phases 2 and 3. The network will be built and owned by the government with contributions from the ERDF (50%) and local communities (10%).

Status

The first phase of the project is complete, with 27 MANs operational. e|net has also launched a campaign to connect 3000 businesses located close to the MANs, encouraging them to drive demand for broadband services in their area.

It was originally planned to cover the remaining 120 towns by the end of 2007. Works have been delayed, however, with the second due to be completed in 2008. Original plans to have some MANs based on wireless technology, mainly because of the reduced cost, but also because of the difficult terrain and the speed of roll-out for a wireless network, have been scaled back. Nevertheless, e|net has deployed a wireless access network in collaboration with Carlow City Council (see below).

e|net generated wholesale revenues of around EUR6 million from the existing MANs in 2007. Additionally, in 2006, the MANs were part of the

infrastructure used to support a EUR10 million contract over ten years between ESB and Vodafone to carry traffic overflow from the operator's mobile network.

Network architecture

The network has a ring topology, thereby limiting the danger of service interruption. This is a 'middle-mile' project, as telecoms companies purchasing the wholesale service from e|net still have to provide their own fixed or wireless local loop infrastructure. Dark fibre is laid in a 4-duct layout, with each duct having 4 sub-ducts and initially, a single 48-filament fibre cable in each sub-duct.

Coverage and take-up

e|net has signed wholesale agreements with many service providers, with up to 18 per MAN (some service providers do not have services on all MANs). It is hard to quantify the exact number of retail customers, but the 27 towns covered by the MANs have a total of 600 000 inhabitants. We believe that take-up has been relatively limited to date due to the following factors:

- there is a relatively large connection cost for installing the final drop to the customer premises; this means that only larger businesses are likely to buy services over the MANs
- e|net is unable to supply an end-to-end service: service providers must also purchase backhaul from the MANs to other networks from another supplier.

One of e|net's customers is Smart Telecom, an alternative operator that once appeared likely to become a strong competitor to eircom. However, in late 2006, Smart encountered financial difficulties and since then has scaled back its ambitions, which may impact e|net in the long term.

Services offered

e|net offers wholesale services to service providers and businesses to connect to the MAN. If a business is within 100 metres of a MAN, it can connect directly via a fibre drop. Otherwise, companies have to check with the service providers whether a connection is feasible.

As an alternative to the fixed MANs, in April 2007 e|net and Carlow City Council deployed a wireless access network for consumers and businesses in Carlow, 12 access points were set up, covering 50% of all businesses and 10% of all households (around 1000 households). Wireless networks offer a more cost-efficient approach to providing broadband access, as customers do not have to physically connect their homes to the network. However, speeds are typically less than for fibre.

Competition

The competitive landscape in Ireland is still developing. Until 2004, when e|net won the contract to operate the MANs, the incumbent (eircom) had a

market share of up to 80%. This share has decreased slightly since, but eircom still has a market share of about 70%.

Recently, however, cable operator UPC has been advancing aggressively in the market, and the fact that the MANs are based on an open-access structure that is already populated by 18 providers indicate that the competitive landscape is developing and that the MANs are an important part of this equation.

Cost, overall budget

The budget for all three phases of the roll-out is EUR170 million, with around EUR80million for Phase 1. The infrastructure consists of fibre, duct, sub-duct and co-location facilities, and covers 27 cities and towns.

Business model

e|net serves the public sector and licensed operators. The company has also recently been involved in deals with property developers such as Birchdale Developments, installing fibre access in new housing developments.

Financial and legal structure, liabilities of parties

e|net has a 15-year concession contract issued by the Ministry for Communications Marine and Natural Resources in June 2004. In addition to government funding, e|net is backed by a EUR12 million fund raised by a combination of ACT Venture Capital, Anglo Irish Bank, Bank of Ireland and private equity.

Status under European Commission law

On 8 March 2006,[19] the European Commission ruled that the MAN project in Ireland constitutes a necessary public intervention, as the high cost of providing this infrastructure to rural towns would prevent the networks from being provided via the market. The public-sector initiative is also justified by the low broadband penetration in Ireland, which was the second lowest in the EU15.

[19] See EC decision N 284 / 2005: http://ec.europa.eu/comm/competition/state_aid/register/ii/by_case_nr_n2005_0270.html#284.

Figure A.13: The MAN networks in Ireland [Source: Department of Communications, Energy and Natural Resources, 2008]

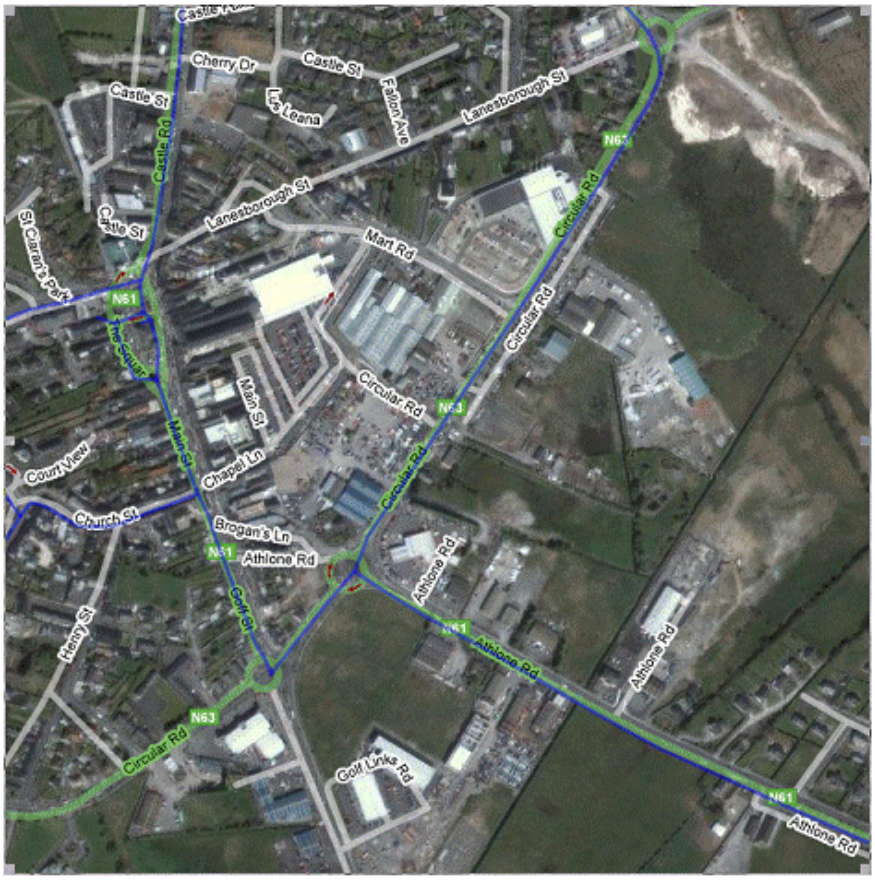

Figure A.14: Example of the Roscommon MAN (blue line) offering fibre connectivity to areas with larger businesses. [Source: e|net, 2008]

A.12 FibreSpeed, Wales, UK

Overview	The FibreSpeed project was launched to enhance the competitiveness of Wales vis-à-vis other regions and to stimulate broadband deployment. The project intended to develop and support competitively priced, next-generation network solutions in 14 business parks in North Wales.
Rationale	FibreSpeed aims to offer symmetrical connections of at least 10Mbit/s to strategic business parks in North Wales, and support the delivery of retail services at prices similar to the most competitive regions in the UK. At the moment, prices in Wales are up to seven times higher than in London. The network has been designed to be future proof, with Gbit/s capability.
Status	On 13 November 2007, Geo, a national fibre specialist, was awarded the contract to become the network operator for the first phase of the FibreSpeed project, covering 14 business parks. Construction is likely to start in 2008. Further projects to cover sites in the West and South are on the agenda of Welsh authorities.
Network architecture	The project aims to create an open-access fibre network capable of supporting Gbit/s services.
Coverage and take-up	The FibreSpeed project targets 14 business parks in Northern Wales.
Services offered	The network operator will provide wholesale services to retail service providers. The network is designed with an open-access network architecture and connects all business parks.
Competition	At the moment, the business parks are only served by leased-line services provided by the incumbent in a regulated pricing environment. However, the cost for these lines is relatively high compared to other products, particularly those from alternative operators. As an alternative, companies can subscribe to satellite services as well as broadband services with low bandwidth. The open access network is meant to stimulate competition but no indications on the number of service providers intending to offer services on the network are yet available.
Cost, overall budget	The cost for the entire project is projected to be EUR39 million.

Business model

The network operator maintains the network and only provides wholesale services. The retail providers will then serve the businesses in the business parks. Due to the early stage of the project, details of specific retail offers are not yet available.

Financial and legal structure, liabilities of parties

The Welsh government will own the network infrastructure. Geo, the network operator, was selected via a procurement process and provided with a long-term project to build and operate a backbone network linking the business parks to a series of local access networks. It will operate solely as a wholesale operator.

Status under European Commission law

The project is eligible for Objective 1 funding, and will therefore be supported through the ERDF from the EU.

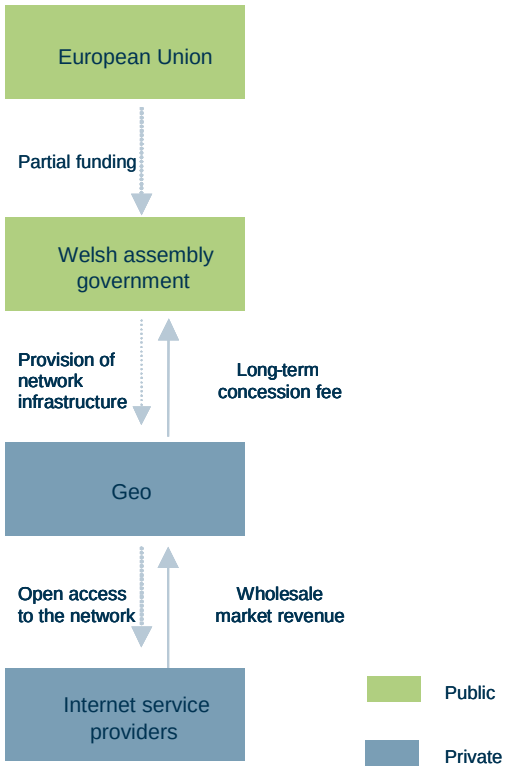

Figure A.15: Legal and financial structure of Project FibreSpeed [Source: Welsh Assembly government, 2007]

A.13 Digital Region, South Yorkshire

Overview

The Digital Region project is set up to bring IP-based services to the region of South Yorkshire and seeks to change the future prospects of the region, both from an economic and a social perspective.

Rationale

The project is driven by three main goals: next-generation broadband is intended to aid economic regeneration for the region, whose main industry, manufacturing, is in decline; in addition, the project seeks to put South Yorkshire on the forefront of next-generation broadband deployment,

	thereby avoiding a social divide; finally, the project wants to enable more efficient delivery of public services.
Status	Thales Communication Systems Ltd. has been selected as the preferred bidder. Detailed negotiations are underway to finalise the procurement process.
Network architecture	The network will support an FTTC/VDSL structure and will offer open-access to service providers.
Coverage and take-up	The project aims to achieve near ubiquitous coverage. It is planned that about 80% of all premises and SMEs will have access to the network within the first three years. The network's reach shall be extended to 97% soon thereafter, at a pace dependent on revenue development.
Services offered	The project is not operational yet so there is no information on services available.
Competition	Competition in the region is limited. The region needed to rely on public intervention to guarantee the provision of first-generation broadband services. Of the 54 exchanges, only very few are enabled (by alternative operators) to support ADSL2+.
Cost, overall budget	No cost estimates are yet available. However, the project is planned over a ten-year period, and with modest demand and ARPU estimations, it is anticipated that it would break even before the end of that period.
Business model	The network operator will provide open access to all interested service providers on a wholesale basis. Moreover, Digital Region plans to provide several interconnection points for alternative network operators. The project will include a clawback mechanism allowing the public sector to extract excess profits from the technology partner.
Financial and legal structure, liabilities of parties	Through public tender, the region will select a technology partner. For a period of ten years, this partner will construct, maintain and operate the network under the conditions agreed with the region of South Yorkshire. We believe that any new assets will be owned by the public sector.
Status under European Commission law	In general, the project can build on a wide range of funding support. It will receive funds from the UK, for which the European Commission has already indicated that no complaints with respect to state aid would be launched. In addition, the project will also benefit from ERDF funds.

A.14 Utopia, Utah, USA

Overview

Utopia (Utah Telecommunication Open Infrastructure Agency) is a government entity resulting from an inter-local agreement between 16 municipalities in Utah, guided by a common set of specific goals regarding competition in broadband services, ubiquitous deployment and the avoidance of redundant connections by building an open-network fibre infrastructure.

Rationale

The project aims to tackle three issues:

In order to address the digital divide in a number of rural areas of the state, Utopia will provide shared high-speed, fibre-based infrastructure over which service providers could run services to households and businesses.

Utopia's relatively small cities felt that they were being bypassed in the roll-out of broadband primarily through DSL, and that they were being provided with a relatively slow service. The creation of an open-access network is sought to stimulate competition in the cities within the Utopia network. Moreover, de-risking the project through municipal backing enables Utopia to obtain interest rates on its loans lower than those possible for large operators, thereby reducing the overall cost of bandwidth to the end user.

Utopia cites resiliency through use of fibre rings as a significant benefit, given the communications outages that some municipalities have encountered with telecoms companies.

Status

Utopia asks each potential city member to show its commitment to the project by providing a financial backstop. The initial roll-out, which began in 2004, was limited to the most viable economic areas within 11 cities that provided the financial commitment. By sequencing the phases in such a way and focusing on the most capital-efficient areas first, the project hopes to then be able to develop coverage of the remaining cities once it creates positive cashflow. It is planned that non-pledging cities should therefore see the roll-out begin by 2012.

Network architecture

The Utopia network employs a fibre-ring topology around the city and within neighbourhoods. The primary city ring is connected to hubs that employ smaller rings. To avoid the overhead of managing IP addressing for service suppliers and subscribers, the network is based on a layer-2 MPLS active electronics architecture.

Coverage and take-up

The project currently plans to cover 16 municipalities in Utah, with a total residential population of 504 000, and 22 850 businesses. Laying of fibre started in 2004, and the network currently covers about 22% of the

residents and business of the 16 municipalities. Take-up in the first two years was planned to be around 40% of homes passed, but as of March 2008 it had only reached 16.4%.

Services offered

The network is operated on an open-access basis, and four service providers (MSTAR, Nuvont, Veracity, Xmission) are currently providing retail services for residential and business customers.

In the residential sector, triple-play services are offered for about EUR64.15 per month, while 'naked broadband', with a maximum of 50Mbit/s symmetric costs about EUR38.50. Utopia is planning on offering reduced rates to its retail providers to boost take-up.

Competition

The open-access network was designed to stimulate entry since competition in the market was limited to two companies, ComCast and Qwest, prior to the Utopia plans.

The competitor's reactions to the new network were very aggressive, as Qwest filed a lawsuit concerning Utopia's use of its telephone poles, and denied access to the poles. These reactions further delayed the project, and significantly increased Utopia's costs. In addition, Utopia is facing a strong reaction from other cable competitors in its roll-out areas, specifically on price.

Given the low take-up of Utopia's services and the decrease in prices, the network seems to have succeeded in its objectives of stimulating competition and reducing prices. However, the healthiness and durability of this competitive situation can only be judged if the future of Utopia becomes clearer, as US operators have a history of immediately reverting back to old service and price levels after a new entrant has been fended off successfully.

Cost, overall budget

The overall budget required to construct networks in the 11 cities backing the project has been estimated at approximately EUR205 million. A 1.5% construction loan is specifically obtained for each build phase and later converted to a 20-year bond with 6% coupon backed by the municipality. If the project fails, the initial 11 municipalities funding the project are liable for the costs.

Business model

The network operator DynamicCity manages the network on behalf of Utopia and sells capacity to service providers on an open-access basis.

Financial and legal structure, liabilities of parties

Utopia is organising the network development as a series of procurements. It owns the network and carries out operations under the terms of the inter-local agreement. The network construction was put out to tender and awarded to Tetra Tech. Electronics. Infrastructure contracts have also been granted to Amino, Riverstone, Allied Telesyn and Provo Video Headend

granted to Amino, Riverstone, Allied Telesyn and Provo Video Headend. The service procurement attributed the service market to DynamicCity, Inc., which now operates the network.

Status relative to State Law, competition neutrality and network openness

There have been no known cases of legal action taken against Utopia, with the exception of Qwest filing a lawsuit during the first half of 2005. The network service contract holder is only allowed to provide wholesale services, while the network is open access and service offers are non-discriminatory.

Utopia works within the remit of the 1967 Interlocal Cooperation Act, which encourages local authorities to work together to achieve economies of scale in the services they provide

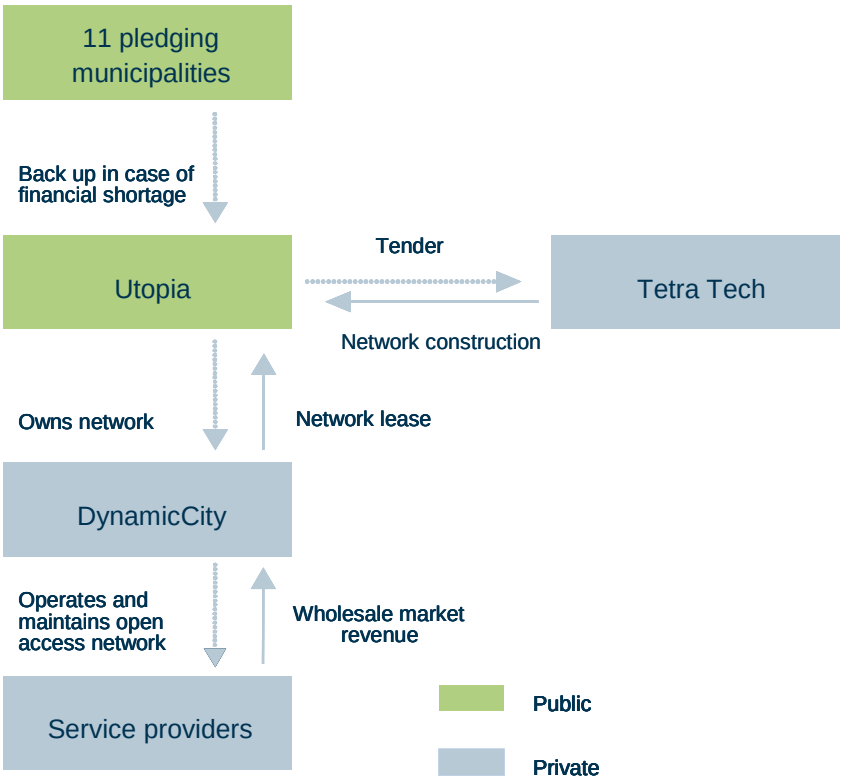

Figure A.16: Financial and legal structure of Utopia [Source: Utopia, 2007]

A.15 Mid-Atlantic Broadband Cooperative, Virginia, USA

Overview

The Mid-Atlantic Broadband Cooperative (MBC) was set-up in 2003. Its aim was to revitalise the regional economy of Southside Virginia through the deployment of a next-generation broadband co-operative.

Rationale

Organised as a non-profit co-operative, the goal of the MBC was to trigger economic development in the region of South Virginia and create a level playing field with other US regions. The network is attempting to foster competition in the more rural areas of Southern Virginia, stimulate

	investment in new technologies and provide opportunities for research and development.
Status	The open-access network consists of a 700-mile backbone, which has been fully operational since September 2006.
Network architecture	The project uses a ring topology supported by a mixture of SONET/SDH and Ethernet technology.
Coverage and take-up	The backbone covers rural areas with a total population of about 600 000. The high amount of network members reflects the successful take-up of services via the MBC network.
Services offered	The network is set up as a co-operative, which means that companies wishing to use the network must become a member of the co-operative. There are four different membership classes, of which one is reserved for founding members. At present, 44 companies are members of the MBC. The MBC itself provides access to dark fibre and backhaul services for network operators. As a result of the improved service through MBC and its large member base, a wide variety of services are offered. For example, residential customers have the choice of a range of television and triple-play offers.
Competition	Competition in rural areas in the USA is generally limited, and MBC has had a clear focus on fostering a competitive landscape. The region of West Virginia suffered from a very limited retail telecoms offer before MBC was created. In addition, backhaul offers were also limited. Today, there are about 50 members within the co-operative, many of whom are providing retail services. In addition, backhaul prices went down by more than 50% and high-capacity services (above 10Mbit/s) are now available.
Cost, overall budget	The total budget amounted to EUR31 million of which about EUR4 million were provided by the US Department of Commerce Economic Development Administration. The remainder of the investment was put forward by the Virginia Tobacco Commission.
Business model	MBC provides wholesale services to a wide range of customers from the private and public sector. Membership fees are differentiated between the different service types. The project has a turnover of around EUR102 million and is aiming to break even in 2008.

Financial and legal structure, liabilities of parties	As MBC is a co-operative, every customer automatically becomes a member with voting rights. Thus, the companies become a partial owner of the network infrastructure. MBC is responsible for the operation and maintenance of the network.
Status relative to State Law, competition neutrality and network openness	The project is based on a solid judicial foundation given its focus on providing open access as well as services to public agencies. Nevertheless, experiences in other US projects showed that incumbent operators could react very aggressively to municipal fibre projects regardless of the supporting evidence base. Thus, the project feared legal challenges from Verizon, although these did not occur as Verizon decided to become part of the co-operative.

A.16 Explanatory comments on the case studies

The following exchange rates were used:

- EUR1 = GBP0.77536
- EUR1 = USD1.55873
- EUR1 = NKR7.93167
- EUR1 = SEK9.47782.

Annex B: LD Collectivités

In contrast to the case studies in Annex A, which are public-sector initiatives, the example in this annex is practically entirely owned by the private sector. However, we feel that LD Collectivités is an important addition to the existing set of case studies, as it shows how many small-scale projects can be aggregated to achieve a national network. Also, it shows how private initiatives can complement public intervention to achieve a solution with added value to the networks but, primarily, to the customers on the network.

It should be noted that there are also other examples of network aggregation such as e|net, which is discussed in Annex A. Other examples which are discussed in the main body of the report include CESAR from Sweden and the NTCA in the USA.

B.1 LD Collectivités, France

Overview

While Pau Broadband Country is an example of DSPs and their local impact, the French market brings about another interesting case study. Several so-called 'collectives' operate on a national level and provide a backhaul connection between individual DSPs, LD Collectivités is a specialist in designing, building and operating next generation networks throughout France. LD Collectivités is currently relying on DSPs to extend network reach, but will be open to PPPs and other forms of co-operation in the future.

Rationale

LD Collectivités is entirely driven by market principles. It sees itself as one of the big players in the current French policy landscape, which favours the emergence of next-generation broadband. There is a particular focus on bringing next-generation broadband to enterprises as, in LD Collectivités' view, these are the main beneficiaries from next-generation broadband.

Although LD Collectivités is not an example of a public intervention, it forms an important case study in that it shows how a large number of smaller public interventions can aggregate to a viable scale for commercial providers to engage with.

Status

LD Collectivités operates 16 DSPs throughout France and also provides connectivity between the different networks.

Network architecture

LD Collectivités mostly relies on a PON network architecture. In more remote regions, it also employs WiMAX solutions.

Coverage and take-up	The network encompasses more than 6500km of fibre, covering about 3250 communities, with more than 9 million inhabitants.
Services offered	Within the different regions, LD Collectivités caters to the specific demand of the consumers and offers a mix of fibre-based, ADSL2+ and WiMAX solutions.
Competition	A multitude of players competes for the right to manage DSPs in France. The biggest competitors at the moment are AXIONE and Covage, which run about 10 DSPs, and the Groupe Altitude (6 DSPs). In addition, there is a multitude of smaller initiatives, including France Telecom who operate 2 DSPs. The benefits to competition in general are that small-scale projects supported by a nationwide backhaul structure are more attractive to service providers than stand-alone small-scale projects. In the different regional initiatives, a mixture of national providers (Free, AOL, Neuf, Completel) and regional players (Option Service Telecom, RMI) operate on the network and provide a competitive push to rural French areas that often have much lower levels of competition than the big French cities.
Cost, overall budget	By March 2008, LD Collectivités had invested more than EUR400 million in the deployment of its network.
Business model	All networks operate on an open-access basis. The networks are often built in economically disadvantaged and remote locations and are therefore co-financed by public funds through the DSPs. LD Collectivités then provides wholesale services on a non-discriminatory basis to all interested service providers.
Financial and legal structure, liabilities of parties	LD Collectivités is 99.98% owned by Neuf Cegetel, a French service provider. As it operates in more remote locations, its investments are riskier than in densely populated areas. LD Collectivités manages parts of this risk through the DSPs and will continue to pursue cooperative models in the future, for example through PPPs.
Status under European Commission law	The DSPs are generally accepted as services of general economic interest by the European Commission and, in some cases, were successfully applying for structural funds.

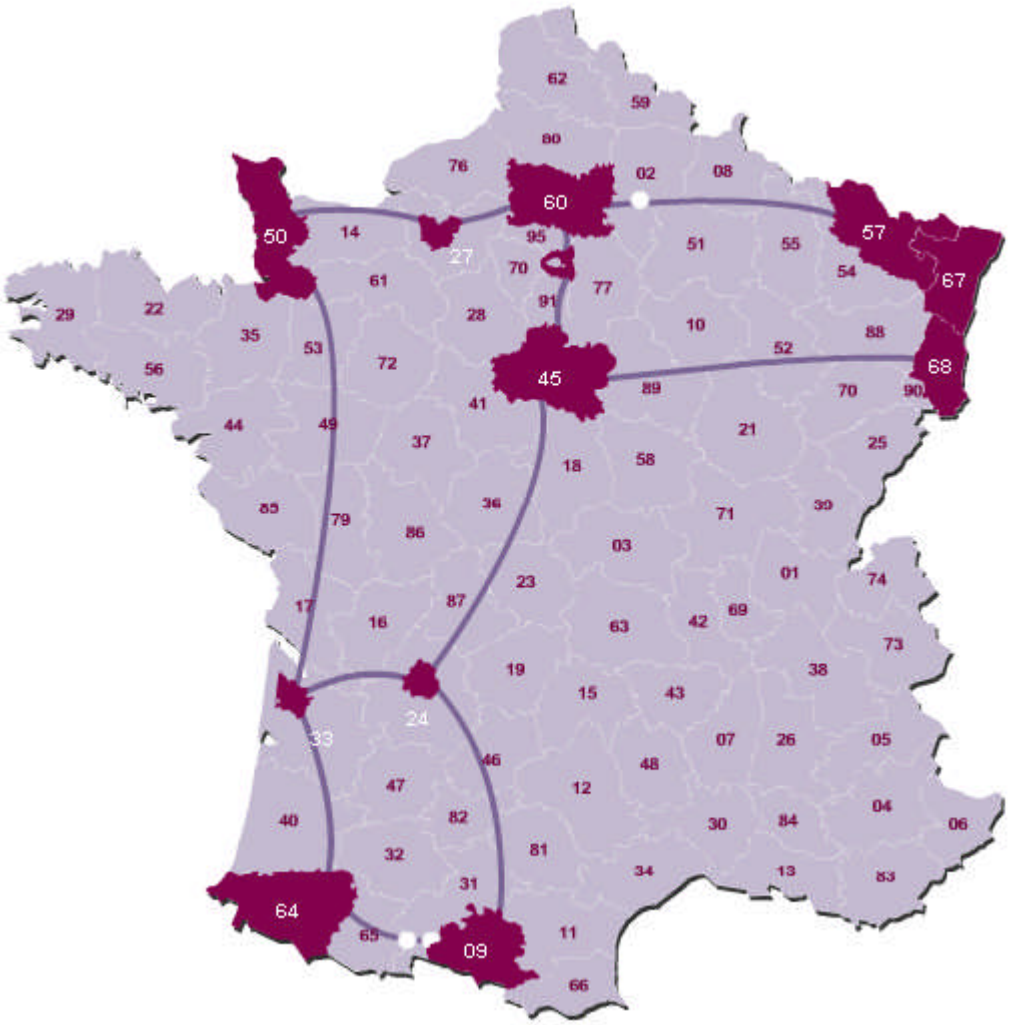

Figure B.1: Network of LD Collectivités [Source: LD Collectivités, 2008]

Annex C: Glossary

Access point:	Connection point in a wireless network
ADSL:	Asymmetric digital subscriber line, a broadband service based on DSL technology
ADSL2+:	An advancement of ADSL technology featuring higher bandwidth capacities
ARPU:	Average Revenue Per Unit/User
AON:	Active Optical Network, the term active refers to the use of electronic equipment between the exchange and the customer premises. An individual strand of fibre is used for dedicated routing of IP traffic.
Backhaul:	The process by which a voice or data communications channel is returned to a central network
Capex:	Capital expenditure, the amount of money a company spends on acquiring fixed assets
CPE:	Customer premises equipment, any equipment that is needed on the customer premises to make a particular telecoms service work
Dark fibre:	Optical fibre provided as raw transmission medium without associated electro-optic termination equipment
Demand-side stimulation:	Public intervention targeted at creating more demand for a good
DSL:	Digital subscriber line, a family of similar technologies that allow ordinary telephone lines to be used for high speed broadband
Ethernet:	A local area network standard used for connecting computers, printers, workstations, terminals, servers, etc.
Ex ante policy:	Policy that is put in place to alter a future market outcome
Ex post policy:	Policy that is put in place to correct an existing market outcome
FTTB:	Fibre-to-the-building (often uses an Ethernet LAN within the building)
FTTC:	Fibre-to-the-cabinet
FTTH:	Fibre-to-the-home
FTTx:	Fibre-to-the-x, generic term for next generation broadband, where x refers to the extent of fibre substitution in the local copper loop
GPON:	Gigabit passive optical network is a point-to-multipoint solution using optical (non-electronic) splitters to reach customer premises. More cost-effective than AON as less fibre and fewer electricity is used

HFC:	Hybrid fibre coaxial, a network that uses optical fibre to reach out from the centre to street level and coaxial cable for the final connection to the customer premises
Interconnection:	The point at which one network hands over traffic to another network. The price and terms and conditions that apply to the handover are also referred to as interconnection
IP:	Internet protocol, the communications standards used by the Internet
IPTV:	Television services based on the use of IP
Layer-2 structure:	Network architecture that routes packages using information from the Data Link Layer
LAN:	Local area network, a network in a building or on a site usually used to connect computers together
LLU:	Local loop unbundling, a regulation that allows competing operators to get access to the (copper) wires an incumbent has between its exchanges and its customers
MAN:	Metropolitan area network, a high-speed network usually covering a city or town that allows high-speed communication between connected customers
MEIP:	Market economy investor principle, referring to a company investing under generally accepted market principles
MPLS:	Multi-protocol label switching, technology for setting labels in packets to improve the speed of packet processing and network performance
Naked service:	Describes the fact that the service in question is provided independently of any other services. Stands in contrast to “bundled” services
Opex:	Operational expenditure, measure of the on-going cost for running a product, business or system
Point-to-point:	Network topology usually used in connection with AON, where every end-point is connected to the exchange by a dedicated strand of fibre
PVR:	Personal video recorder, an interactive TV recording device that is able to time shift, pause and fast forward TV programmes using hard-drive video storage
POP:	Point of presence, a point where a network can exchange traffic
Quadruple play:	Package provided by a service provider that includes four different services (usually broadband, television and fixed-line and mobile telephony)
QoS:	Quality of service, a scheme that limits the loss of data packages and thereby ensures a certain level of quality
SDH:	Synchronous digital hierarchy, an old standard that controls the carrying of traffic on high-capacity links between exchanges

Set-top box:	Device that is connected to a television and turns a digital signal into content
SLA:	Service level agreement, a contract between the service provider and the service receiver defining a measurable level of service
SME:	Small and medium-sized enterprise, describes a company with fewer than 250 employees, an annual turnover below EUR50 million and a balance sheet with a value of less than EUR43 million
SONET:	Synchronous Optical NETwork, the American equivalent to SDH
Supply-side stimulation:	Public intervention targeted at facilitating the production of a good
Triple play:	Package provided by a service provider that includes three services (usually broadband, television and fixed-line telephony)
VDSL:	Very high bit-rate digital subscriber line, a next-generation broadband DSL technology
VDSL2:	The newest and most advanced standard of DSL broadband wireline
VLAN:	Virtual local area network, simulation of a physical LAN with the help of a software-based solution
VOD:	Video on demand, the ability to view video at any time opposed to when the operator chooses to send it
Webhosting:	Hosting of websites on the servers of the service provider
Wi-Fi:	Wireless fidelity, refers to any type of wireless network solution that conforms to IEEE 802.11
WiMAX:	Worldwide interoperability for microwave access, technical solution designed to provide wireless access especially over long distances