Work Package 3
In-Depth Analysis & Good Practise Review

Deliverable 3:

Final report on Satellite Broadband as an option for Regions

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0. Preface

SABER has built into its methodology a validation process whereby the project seeks input from external sources to validate the findings of SABER's research and the usefulness of the deliverables created for their target audience. European Commission services were widely engaged providing feedback on SABER deliverables. A validation panel was created drawing from key contacts of the consortium partners who were well placed to offer a perspective on the deliverables and organisations that expressed an interest in SABER's activities were engaged.

1. Executive Summary

Fast, reliable broadband internet access has political and social implications. Having access to such reliable broadband internet access is essential for citizens throughout the EU in order that they can benefit from online services, and to enable businesses to compete globally. Some areas of Europe have access to faster broadband speeds than other areas, with many rural areas receiving far lower speeds than cities and urban areas. However, more recently with the introduction of broadband satellite services, these disparities are no longer the case, in particular with gaining access to basic broadband services. Commissioner Kroes declared at the "Broadband for All" event in Brussels on 17 October 2013 that: *"Thanks to the extra coverage from satellite broadband, with representation in every EU country, we have achieved our 2013 target of broadband for all"*. This recognition of the essential importance of satellite broadband in delivering the 2013 Digital Agenda for Europe (DAE) is very welcome – basic broadband for 100% of European citizens, but the challenge still remains in ensuring that Satellite Broadband Services as a solution is adopted more widely to ensure that actual broadband penetration increases to allow European citizens and businesses to reap the benefits of broadband.

Satellite broadband is a complementary technology, ideally suited to providing instant access to broadband irrespective of location. Terminals can be installed in the most rugged and remote terrains within a matter of days, allowing new users to immediately take advantage of satellite broadband services.

Satellite broadband can be used to deliver broadband access to everyone in the EU with peak speeds today from 2 Mbit/s up to 20 Mbit/s. Satellite is a viable option for the most remote users and for those in some other not-spots. While the cost of deploying fibre increases incrementally for the final percentage of premises to be connected, the cost of a satellite solution remains constant.

Whilst Commissioner Kroes declared at the 'Broadband for All" event held in Brussels on the 17th October that "thanks to the extra coverage from satellite broadband, with representation in every EU country, the stated objective set out in the Europe 2020 Strategy of delivering basic broadband to all Europeans by 2013 has been achieved". However, a further two objectives set out in the

Europe 2020 Strategy seeks to ensure that by 2020 all Europeans have access to much higher internet speeds of above 30Mbps and 50% or more of European households subscribe to internet connections above 100 Mbps. In this respect, a balance" needs to be found in public policy between the provision of very high-speed services in urban areas and the need to avoid a new digital divide in rural and remote areas.

However satellite broadband, in particular to the general public, is a new and developing service on the market, and as such there is a general lack of awareness amongst the public sector as to its maturity and advantages over conventional approaches (as well as amongst final users): Chapter 3 of this document, Techno-Economic Analysis of the benefits afforded by satellite broadband to deliver the DAE targets of 100% broadband coverage and to drive penetration, is intended to improve this awareness and demonstrate the advantages of including satellite broadband in the mix of technologies supported by public interventions to avoid a new digital divide occurring in the future.

The report highlights that whilst all of the EU's citizens and businesses have access to basic broadband services thanks to satellite services bridging the digital divide, take up of such services remains a challenge with as many as 24% of homes in the EU not having an internet connection.

the report assesses the likely costs of relying on broadband terrestrial solutions only to hit the DA objective. It is widely accepted that fibre solutions, whilst still expensive to deploy, provides a reasonable return on investment when deployed in urban areas and areas where the fibre passes reasonably sized conurbations. However, it is also accepted that the cost of rolling out fibre per subscriber increases considerably when the population density it is seeking to serve decreases. The report also highlights, and gives examples of the average price per connection for fibre-based solutions, and shows enormous variations across countries, regions and areas within the EU. Therefore, as the report highlights, the business case for these investments is still uncertain, posing the threat that, in spite of considerable efforts from the institutions, the un-served or under-served markets for much higher internet speeds are likely to remain significant. The report argues that a more balanced and pragmatic approach, which would be much more realistic and cost effective must include other technologies, such as existing satellite broadband solutions, in an infrastructure mix to economically deliver the bandwidth to those users who are not currently, and are unlikely to be within easy reach or wired terrestrial solutions. In view of the above

considerations, the report suggests that public authorities should consider seriously satellite broadband solutions in their technology mix, because they could have a specific role in providing fast broadband in areas that will unlikely be economic to deliver through fixed lines such as fibre.

For an audience who are less familiar with satellite broadband services, the report provides an overview of the technical and commercial features of satellite broadband in Europe over time. It also provides a perspective of the value chain of the industry, and based on the experiences gathered by the industrial and regional partners of the SABER project sets out in a neutral way the strengths and weaknesses of the technology. The aim is to inform investment and decision makers at the national, regional and local levels to encourage them to include satellite broadband in their investment plans.

An introduction to satellite broadband technology and its evolution since it was first introduced more than 10 years ago to the present day is presented which includes a detailed description of how satellite internet services are provided and outlines five steps to understanding the process. This section of the report also provides a detailed strength and weakness analysis of satellite broadband services and provides feedback on official performance tests undertaken in the U.K. and Germany along with qualitative feedback from users of broadband satellite services from 5 countries (France, Ireland, Norway, U.K. and Spain). The conclusions of the performance tests undertaken in the U.K. and Germany were positive. Both tests concluded that satellite broadband is not as good as fast fibre, however should fibre not be available, satellite broadband services provides a viable alternative to ADSL, demonstrating an equally good performance of internet connectivity and a very good web browsing experience. The feedback from the users was also positive.

With respect to the commercial features of satellite broadband services the report gives an insight into how the two satellite operator partners in SABER, Eutelsat and SES, by far the two largest European operators, have approached the consumer broadband services market. Eutelsat has made an overall investment exceeding 300 million euro in KA-SAT, a powerful new platform delivering high-bandwidth services, commercialised under the "Tooway™" brand name. SES' approach to Ka-band differs from its competitors in the way the capacity is brought into the market. SES did

not invest in an "all Ka-band" satellite, such as Eutelsat. The strategy of SES is to gradually increase the capacity of its Ka-band satellites as and when required.

A state-of-the-art review of the retail offers of satellite-based consumer broadband internet in the countries represented in the SABER project is provided both as neutral reference and as a potential input of the preliminary market analysis for Public Authorities (PAs) aiming to address broadband gaps in their territory. The large database produced by the SABER project partners in May 2013 has been taken in October 2013 as a basis for the Broadband for All website (www.broadbandforall.eu), an initiative of the ESOA supported by the European Commission.

The database of retail offers demonstrates that new satellite technologies can offer high data rate services to large numbers of customers at an acceptable price level. Today's satellite solutions fall behind fibre and wireless technologies in terms of latency, mass throughput, and cost per bit delivered in higher density areas, but they are reliable, are quick to deploy, secure, and offer excellent cost effectiveness in lower density areas.

So far, most European governments have been extensively investing in fibre optic broadband, even where in some cases satellite broadband might serve broadband not-spots faster and more cost effectively. Few European countries have considered effective implementation measures based on satellite broadband in their national broadband plans.

Current State aid guidelines implicitly favour wired solutions which, partly explains why governments have focused on fibre, even though this is sometimes a more expensive or less effective option.
Chapter 4 - Review of non-technological roadblocks and obstacles towards satellite broadband deployment in the EU - of this deliverable analyses a number of issues that have prevented satellite broadband services being considered in past public interventions and from some public tenders and proposes suitable solutions for its inclusion in the future.

The political push of EC bodies towards terrestrial solutions to bridge the digital divide, coupled with the lack of awareness, has generated a situation in which policymakers have so far been

reluctant to provide support to satellite in their broadband deployment plans, despite investments in new, high-capacity systems by the satellite operators.

More recently, however, it has become clear that some European regions are looking to implement alternative and quick solutions for basic broadband to close the present digital divide before considering future superfast broadband links, which may be costly and take a long time to deploy, leaving many people without broadband access to the internet for several years.

In this context, the SABER partners have come together to raise awareness of satellite broadband services, analyse the non-technological roadblocks that appear to obstruct the inclusion of satellite broadband in public authorities broadband plans, and to provide recommended solutions on how these roadblocks can be avoided.

The section begins with an explanation of the non-technological roadblocks and obstacles preventing public authorities from including satellite broadband solutions in their broadband deployment plans. The report explains that a lack of knowledge amongst public administrators about the new developments in satellite broadband solutions and how to implement it makes it difficult for Public Authorities to include satellite based solutions in their broadband schemes.
One reason is that satellite solutions suffer from a negative image derived from old generations of internet access via satellite. Furthermore this misperception has, regrettably often, had a negative impact on EU State Aid decisions on broadband deployment. The report provides examples of such State Aid decisions in Germany, Wales, Spain, and Slovenia and shows that some of the past State Aid schemes approved by the European Commission were based on the assumption that the satellite technology was not sufficiently capable of fulfilling the deployment objectives.

Commissioner Kroes recently confirmed that the “EC takes a technology neutral approach to promote innovation and competition - keeping a close eye on state aid practices to ensure that certain wireless technologies do not suffer undue discrimination. The project partners, in conducting their research has found that this is not always the case with some countries putting to one side the technology neutral principle in their race to the deployment of optical fibre, even in rural and remote areas. The section includes a number of cases of Broadband Calls for Tender and

includes 4 specific explanations on how they have specifically excluded satellite solutions in their tenders.

The section includes a number of recommended solutions for the breakdown of such barriers in the future. These recommendations include the clarification and improvement, by the EC, of their existing rules, which are often designed with terrestrial infrastructure only in mind. In particular, 6 recommendations are presented for the EC's attention. Further recommendations are targeted at addressing the need for a standard and reliable mapping process that can be utilised throughout the EU member states and the need for a standard cost effectiveness analysis for broadband deployment. The section includes a description of what a reliable mapping process should cover and sets out a case for a European Broadband Mapping Initiative which aims at providing a searchable and interactive website that allows users to view broadband availability across every neighbourhood in Europe. The report includes 10 key requirements of the initiative and describes a mapping protocol and integration process for its effective implementation across Europe. The SABER partners fully acknowledge that choosing the best mix of technologies to achieve the broadband objectives set out in Europe 2020 and at the same time limiting the total amount of aid needed to that required (principle of proportionality of public aid) is essential. The report sets out the specific reasons why an ex-ante cost effective analysis of the various solutions is required to help investment decision makers to identify the advantages of each technological solution with respect to its capability to fulfil the needs, e.g., in terms of the total cost and cost effectiveness (value for money), timing of deployment, expected penetration and capacity to meet the needs of the last x%

The SABER partners have highlighted the need for the EU Commission in charge of the Negotiation of the Partnership Agreements and the Operational Programmes or Rural Development Plans to clarify to the Member States the ongoing eligibility of funds, during the next financial period 2014 – 2020 for basic broadband in line with each National Broadband plan and consequently the eligibility of satellite broadband services. The section highlights that a number of EC policy frameworks underlines the importance of the 2020 DAE target (30Mbps for all Europeans) and could create a misinterpretation, for the EU Member States, on the eligible infrastructure that could be financed by European Structural Funds such as ESI. The SABER

partners would therefore welcomes the EC's clarification that whilst broadband access of at least 30Mbps for all Europeans is a priority of the DAE, "it does not prevent European funds from supporting broadband roll out below 30Mbps if the predictable path is towards such target speeds by 2020 is confirmed". In this context the SABER partners would like to encourage investment decision makers to take into consider this clarification from the EC when drawing up their programmes financing broadband plans.

A further barrier outlined in this section is the on-the-spot-check audit procedure foreseen by both EAFRD and ERDF EU Regulations has been in some cases a roadblock for the implementation of satellite broadband solutions as it requires excessive travelling time during the audit and consequently results in higher costs to undertake the audit, sometimes even higher than the grant itself. The SABER partners have set out recommendations in this section for other solutions that consider the use of available and reliable ICT technologies that, whilst providing suitable audit information, avoids the physical on-the-spot-check in general but specifically for satellite broadband solutions implemented in rural and remote locations.

This deliverable has set out a number of non-technological roadblocks as to why satellite broadband solutions have not been more widely adopted by Public Authorities. The SABER partners have identified that the differences in the business and financial models for satellite solutions compared to terrestrial technology and the issues these raised in terms of public support are further reasons why satellite solutions have not been included in Public Authorities broadband plans. The remainder of the deliverable explores the potential for innovation in the business and deployment models adopted by Public Authorities to support the rollout of satellite broadband in their technology mix. The SABER partners propose innovations in the wholesale, public-private partnership and demand aggregation areas that would be applicable for satellite broadband services.

At the wholesale level, the report includes a number of options that could be adopted by the Public Authorities ranging from, subsidising the end user equipment for a number of known subscribers thereby a) reducing the individual costs of the equipment through bulk buying and b) removing the cost barrier to individual citizens and businesses access to the services, to bulk

buying of satellite connectivity at discounted rates, granted by the satellite operator in exchange for a guaranteed number of new connections or a guaranteed level of revenue. The section proposes a number of options that could be adopted by the Public Authority.

Whilst Public Private Partnerships (PPPs) have yet to be used to any notable extent for satellite broadband within Europe, the SABER partners have identifies five broad types of PPP models for broadband which could be considered. The SABER partners suggest in the report that a more appropriate role for PPP in Europe is as a model for the delivery of next-generation satellite broadband capacity and services offering faster (50-100 Mbit/s) speeds to areas beyond the economic reach of terrestrial infrastructures even over the medium to long term. The SABER partners will be exploring this further during the next phase of SABER (WP4).

Finally the section outlines the area of demand aggregation including demand harmonisation and demand stimulation. The SABER partners offer a definition of demand aggregation taken from the Demand Aggregation Manual, Australian Department of Communication, Information Technology and the Arts, "Demand aggregation refers to the process in which consumers pool demand for broadband telecommunications services, across a sector or within a region, as a means of achieving greater purchasing power, reduced investment outlays and improved access to broadband infrastructure." The SABER partners also offer up a number of successful examples of demand aggregation for satellite broadband from outside of Europe, typically from large rural countries including Australia, U.S.A. and Canada where policymakers have centrally defined a dedicated budget and have driven the measures to provide broadband for all.

Given that there are no clear examples of existing large scale demand aggregation schemes in Europe, the SABER partners set out the results of their research under 6 sub sections which seeks to inform EC officials and government officials at the National and Regional levels of the merits of considering large scale, collaborative demand stimulation measures that would be applicable for the realisation of the 30Mbps for all Europeans by 2020 objective. The subsections cover the following areas:

1. Applicability of a Satellite Demand Aggregation Scheme In the EU;
2. A demand aggregation case study for satellite broadband in the BB-MED report;
3. From demand aggregation to demand harmonisation and demand stimulation;
4. Demand harmonisation and demand stimulation in the BDUK Voucher Scheme;

5. Large-scale pilot projects as a measure for demand stimulation; and
6. potentially relevant tools within the 2014-20 programme.

In summary, the demand aggregation, harmonisation and stimulation support actions recommended by SABER encompasses: the development and implementation of tools and mechanisms aiming to favour to cost-effective absorption of European funds for regional development of broadband infrastructure, including satellite solutions; a centrally managed (EU) level technical assistance framework for local PAs or sectoral groups; the implementation of local demand stimulation actions through a EU-managed mechanism such as CEF; and through a specific EU body, such as a DAE Council, with offices and expertise in critical regions to ensure the efficiency of the above recommended support actions, providing recommendations to ensure the local dissemination of the initiative and best practises centrally elaborated at the EU level.

The SABER partners are hopeful that this report will offer Investment decision makers relevant information and knowledge that will encourage and facilitate the inclusion of satellite broadband services into their broadband investment plans and thus enhance the likelihood that the target of 100% of all Europeans having access to broadband in line with the Digital Agenda objectives will be achieved with the inclusion of satellite broadband solutions in public sector interventions.

In order to fully exploit the contribution of satellite broadband to increase broadband penetration and take-up and thereby help achieve the objectives of Europe 2020, there is the need to develop a close partnership between European public institutions and the private satellite industry. The partners of the SABER project would welcome the development of such a close working partnership and hopes that the deliverables from the SABER project can be the catalyst to its achievement.

2. Introduction

This deliverable presents intelligence gathered on satellite broadband in general, and an essential element for delivering the DAE 2013 target of 100% broadband coverage, and the challenges that remain in increasing the take-up of satellite broadband to drive overall broadband penetration. It represents an evolution of an earlier document produced during the previous phase of the SABER project (WP2), the Deliverable 2.4 "Early report on Satellite Broadband as an option for Regions, including non-technological roadblocks and potential for demand aggregation"

This new document is the consolidated result of the contributions of the 24 partner organisations of the SABER project during WP2 and WP3, on the basis of their experiences in national or regional deployment of satellite broadband.

In addition to relying on input from its 24 partner organisations, SABER has built into its methodology a validation process whereby the project seeks input from external sources to validate the findings of SABER's research and the usefulness of the deliverables created for their target audience. A wide range of representatives from the European Commission were engaged in the validation process; feedback on deliverables was provided by individuals from DG CNECT, DG AGRI and DG REGIO which served to ensure that the deliverable content and guidance provided was aligned with European policies and regulations. Feedback from the various DG's was provided through bilateral meetings and discussions, through written submissions and through participation in the four SABER workshops held to date. Representatives from NEREUS (the Network of European Regions Using Space), Eurisy, ESOA (the European Satellite Operators Association) and EIB (the European Investment Bank) were invited to participate on panel discussions throughout the four SABER workshops held to date (Cork, February 2013, Brussels April 2013, Turin June 2013 and Brussels, October 2013) and bilateral meetings to provide input and various perspectives to the debates and discussions which have helped to form the content of SABER's deliverables.

Additionally a validation panel was created by issuing an invitation to key individuals identified by the partners who have an interest in exploring satellite as an option for broadband. Individuals

who had requested copies of the first SABER deliverables were also invited to participate on the validation panel. Efforts were made to ensure the panel was representative of both public authorities and industry players. The validation panel undertook a review of the deliverables, produced during the previous phase of the SABER project (WP2). The validation feedback received was reviewed by the SABER partners; where appropriate updates to content were reflected in this document or in the Deliverable 3.2 "Regional-National-International satellite broadband implementation case studies" which represents an evolution of an early document produced during the previous phase of the SABER project (WP2), the Deliverable 2.3 "Regional / National satellite broadband implementation case studies". Where feedback provided related to future activities it has been referred to the next phase of the SABER project, WP4.

Satellite broadband services, in particular to the general public and businesses, is a new and developing service on the market, and as such there is a general lack of awareness amongst public sector officials as to its maturity and advantages over more conventional approaches. Perceptions about the under performance and prohibited costs of satellite broadband since its first introduction over a decade ago have remained rooted in the mindsets of key decision makers despite significant developments, performance improvements, and cost reductions having taken place.

This deliverable seeks to improve awareness by demonstrating the clear advantages of including satellite broadband in the mix of technologies supported by public interventions to avoid a new digital divide occurring in the future, in particular when action is taken to address the Europe 2020 objective of providing access to at least 30 Mbps services to all Europeans by 2020.

This document therefore makes available to regions in need and other stakeholders across Europe a case, supported by key research, for the inclusion of satellite broadband services in their respective broadband plans.

The report begins with Chapter 3 providing a Techno-Economic analysis of the benefits afforded by satellite broadband to deliver the DAE targets of broadband services for all to what actions have been taken to drive up take-up and overall penetration to benefit European citizens and businesses. This section provides:

- An assessment of the current status and penetration of broadband in the EU;
- An assessment of the likely costs of relying on broadband terrestrial solutions only to hit the 2020 broadband objectives;
- A synthesis of the technical characteristics of satellite broadband service provision which, includes a detailed description of how satellite internet services are provided and outlines five key steps to understanding the process;
- A description of how the two satellite operator partners in SABER, Eutelsat and SES, by far the two largest European operators, have approached the consumer broadband services market thereby providing an insight into the commercial features of satellite broadband services;
- A state-of the review of the current satellite broadband retail offers, in terms of service models, quality of service (QoS) and tariffs;

Section 4 provides a review of non-technological roadblocks and obstacles towards satellite broadband deployment in the EU – the section provides an analysis of a number of issues that have prevented satellite broadband services being considered in past public interventions and from some public tenders and proposes suitable solutions for its inclusion in the future. This section provides:

- An explanation of the non-technological roadblocks and obstacles preventing public authorities from including satellite broadband solutions in their broadband deployment plans;
- A number of recommended solutions for the breakdown of such roadblocks and obstacles in the future;
- An insight into a number of EC policy frameworks that could create a misinterpretation on the eligible infrastructure (excluding satellite broadband services) that could be financed by EU Structural Funds going forward, and highlights the EC's clarification that this is not the case;
- An explanation of the differences in the business and financial models for satellite solutions compared to terrestrial technologies and the issues these raise in terms of gaining public support for satellite broadband solutions;
- An outline of the area of demand aggregation including demand harmonisation and

demand stimulation;

This deliverable concludes with a set of Conclusions and Recommendations targeted at EU, National and Regional officials to encourage them to take on board the findings of the SABER project and thus enhance the likelihood that the objective of 100% of Europeans having access to 30Mbps by 2020 will be achieved with the inclusion of satellite broadband solutions in future public sector interventions

The following annexes are included:

- Annex II contains copies of the completed validation templates;
- Annex III presents an analysis of end users experience of satellite broadband, especially in very challenging conditions.

3. Techno-Economic Analysis of the benefits afforded by satellite broadband to deliver the DAE targets of 100% broadband coverage and drive penetration

3.1 Introduction

It is not the role of the SABER project to recall the importance of broadband deployment to promote social inclusion and competitiveness in the EU.

It is nevertheless clear that having access to a fast and reliable internet service is essential in a modern society as social and economic development relies on communication means (see Figure **1**). "The widespread use of broadband – high speed, always on internet access - is vital to achieving productivity gains in the European economy and maximising the gains to society from e-Health, e-Government and more."

[1]

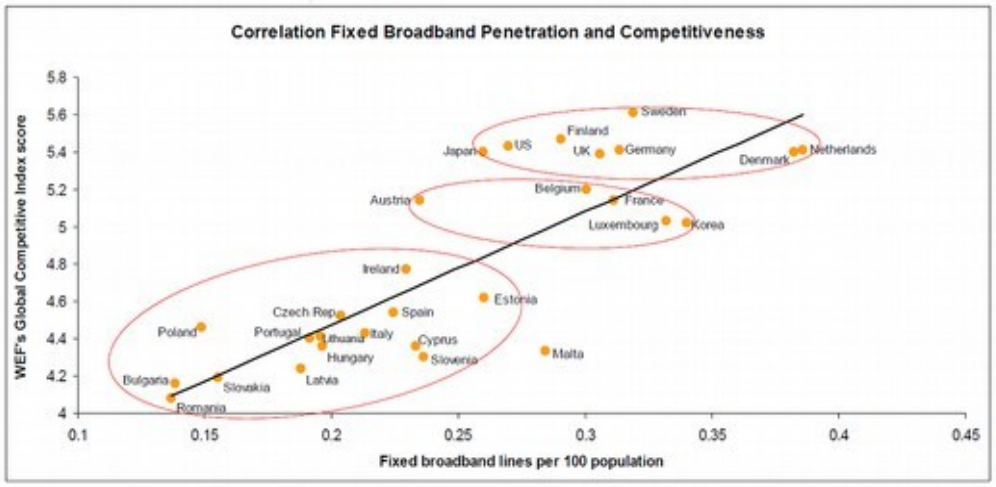


Figure 1: Correlation between penetration of fixed broadband and competitiveness

It is however known that although satellite broadband has delivered the 2013 Digital Agenda for Europe target of broadband for all (e.g. Commissioner Kroes speech to "Broadband for All", Brussels, 17 October 2013), take-up of satellite broadband remains low and as such overall broadband penetration, particularly in those areas where satellite is the only or most viable option, remains too low. Even in areas where fixed line broadband is the preferred long-term option,

[1] Digital Agenda for Europe Scoreboard 2012, European Commission, DG CONNECT, page 46

satellite broadband remains a natural complementary solution to terrestrial solutions to quickly bridge the digital divide in those areas where fixed broadband investment is expensive and/or slow to be delivered.

The last evolutions in satellite technology (high-throughput satellites, HTS) which have led to the new satellite broadband offering have contributed to consolidate the specific role satellites have in providing fairly fast broadband in areas (such as rural and remote areas) that will never be economical to deliver through fixed lines, and also in offering a very strong interim solution to other areas where faster fixed broadband will take longer to rollout.

With satellite technology it is now possible to provide more than the average DSL speed anywhere in Europe.

This section is intended to present the state-of-the-art satellite internet connectivity from a technical and economic point of view. The aim is to aid understanding of the maturity of satellite technology to complement or even replace terrestrial links where user experience, profitability, sustainability and affordability indicate so.

3.2 Broadband Status In EU

The Europe 2020 Strategy, in underlying the importance of accessibility and affordability of broadband for all, has restated the objectives:

1. The entire EU to be covered by broadband by 2013 – on 17 October 2013 at the "Broadband for All" event in Brussels, Commissioner Kroes declared this target had been achieved: "Thanks to the extra coverage from satellite broadband, with representation in every EU country".
2. All Europeans to have access to much higher internet speeds of above 30 Mbps by 2020, with 50% or more of European households subscribing to internet connections above 100 Mbps.

In this respect, "a balance" needs to be found in public policy "between the provision of very high-speed infrastructure in urban areas and the need to avoid a new digital divide in rural areas[2]"

[2]Source: Draft EU Guidelines for the application of state aid rules in relation to the rapid deployment of broadband networks, 2012

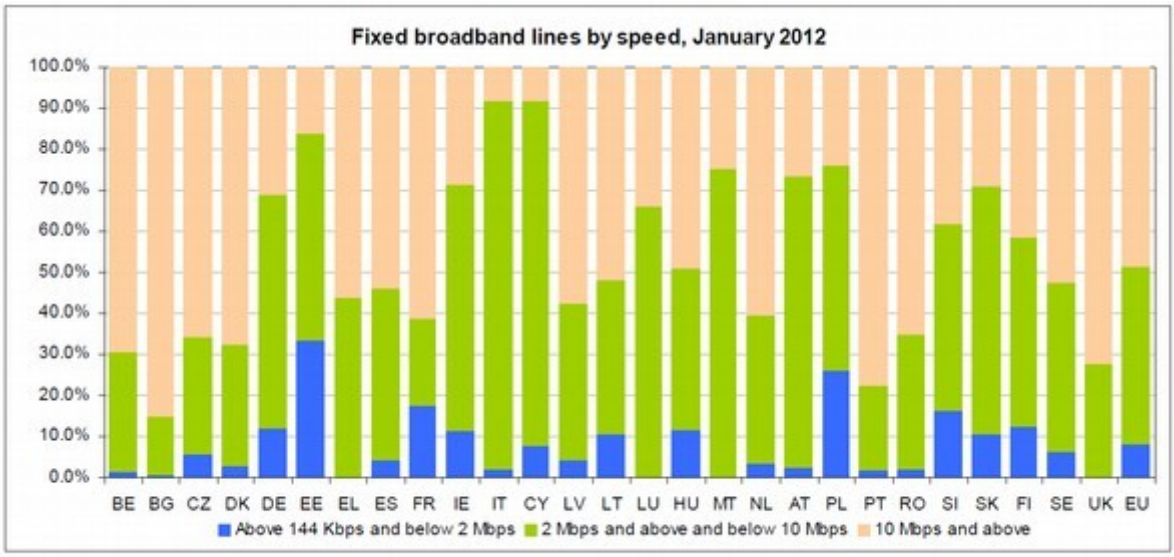


Figure 2: Fixed broadband lines in the EU Member States by speed

3.2.1. Take Up Issues

On the basis of the targets identified by the Digital Agenda for Europe[3], as of 2013 all EU citizens have access to a broadband connection. And according to the objectives set by the Digital Agenda, by 2015 75% of the population should use the Internet regularly. Eurostat data tell us that, as of 2013, 76% of EU families have broadband connection, with considerable disparities at states and regions level: ranging from 88% of regions in Norway to 55% in Greece or Romania.

In the meantime, much has been done to ensure satellite network coverage all over the countries, to reduce as much as possible the digital divide that separates urbanised areas from mainly rural areas. However, if the preconditions for EU citizens access to the Internet are potentially implemented, the Internet equipment and broadband use data portray a well-developed situation in some regions, whilst others are still lagging behind.

It is therefore essential to better analyse the factors that influence the actual Internet access by citizens, to develop eventual targeted actions that, impacting on the aspects that have been identified as more significant, may gradually contribute to correct the trend..

Connectivity and ICT equipment of the territory are recognised as essential prerequisites for the digital growth of the territories, as well as an enabling condition for the development of services. The growth of ICT demand, and consequently of the ICT offer, is presented in the Digital Agenda

[3] http://ec.europa.eu/digital-agenda/en

for Europe as a precondition for digital development and as a key element for the transformation of production services.

The present study aims at offering a key to interpret the main factors that may influence the access to the Internet in EU regions, trying to let numbers speak for themselves: the data sources of this study are various Eurostat and OECD datasets.

This study tries to answer the following question: is there a correlation, or a statistical connection, between the lack of Internet use (or to put it differently the Internet equipment), and a set of variables concerning the population of a specific region (economic, cultural, demographic aspects, …)? If such correlation exists, how strong and relevant is it? And consequently , what are the factors that influence most the Internet adoption in a territory?

Let us begin with an overview of the variables connected to the Internet diffusion, with a reference to an analysis carried out in the framework of the INTERREG IVC ONE project. The partnership developed an indicator that aims at **providing an overview of the real access to internet of households**, as access is the prerequisite for the development and use of services, as well as the development of different forms of digital citizenship, or promote e-inclusion, e-training or e-employment.

The following indicators can be considered as relevant to the analysis, taking into consideration the indicators used according to the literature on the topic to carry out a benchmark at EU level, with particular reference to the Digital Agenda Summary Index[4] and the Innovation Union Scoreboard[5]:

a- Households with access to the Internet at home (INT)

b- Households with broadband access (BB)

c- Individuals regularly using the Internet (FUSE)

d- Individuals who ordered goods or services over the Internet for private use (ONLINE)

e- Individuals who have never used a computer (NUSE)

However, analysing the correlation between the above mentioned indicators, a strong dependency connection between the factors emerges: the first four are characterised by a positive correlation (all four grow in the same direction), while the last indicator has an inversely proportional

[4] http://www.osservatorioict.piemonte.it/it/images/phocadownload/RapportoICT2012.pdf
[5] http://ec.europa.eu/enterprise/policies/innovation/policy/innovation-scoreboard/index_en.htm

correlation to the trend of the first four (if the first four grow, the last one decreases).

As far as the analysis of the factors that are more correlated to the digital divide of a territory are concerned, different statistical analysis methods have been experimented: indeed, various methods are more or less adequate to the phenomena to be analysed, and to the actual values for the selected indicators. It has been noticed that the linear correlation (the increase of a factor is followed by a proportional increase of another factor) analysis methods are less adequate for such a complex reality and phenomenon. Therefore, other methods have been used as well, as they are more adequate to study non-linear correlations, such as clusters, regression trees or canonical correlation analysis.

Attempts have also been made at understanding if the topography of a territory may significantly influence on the characterisation of the variables connected to the digital divide, thus producing different models (corresponding to different population behaviours) according to the different areas (urban, rural, or intermediate).

The emerging picture is multifaceted and quite complex, and results vary according to the used method.

In broad terms, all the methods highlighted, with different degrees of correlation, the more structural indicators for a territory: wealth (GDP ad poverty index) and age of the resident population.

More social and cultural aspects did not emerge quite so strongly: in particular, if some models have found as relevant the data on the number of those employed in qualified activities (R&D), a weaker connection has been identified with the level of education index, as if to signify that the Internet has become a culturally transversal phenomenon, and that the availability of an Internet connection at home follows different pattern as against the stratification connected to the level of education (an example may be people who have a qualified job, and hence have an Internet connection at work, so they may not be particularly interested in having an Internet connection at home).

The variable connected to prices yielded results that surprisingly differed from the initial expectations: only one of the adopted models highlights the relation between digital divide and the price of the Internet connection. The price variable is more relevant in the territorial analysis,

particularly in rural areas, however its importance is always subordinated as against the other elements that were mentioned above.

To try to summarise and give an overview of the EU territories on the basis of the evidence provided by the study, a model has been built to try to represent the position of the various regions on the basis of their digital divide quota (non Internet users) and an overall "disadvantage" index for the regions (resulting from the combination of the 3 factors that resulted as more relevant – poverty index, old-age index and ICT qualified resources). An attempt has also been made to add information on the topology of the regions (rural, urban, or intermediate).

The resulting overview is quite interesting: the regions with a low digital divide (non Internet users) are also regions whose combined score among the three variables is the lowest. And consequently, regions with the highest level of Internet use are the richest, with a younger population and with ICT qualified professional resources. If the territorial classification (Prevalent Rural, Prevalent Urban, Intermediate) is added as well, it emerges that regions with the same territorial typology are concentrated along the graph and record a similar trend: in rural areas the economic and training disadvantage conditions are joined by a high level of digital divide, in regions where the age of the population does not help to improve the situation for any of these factors.

It can thus be said that the attractiveness of the territories – in particular rural territories – leads to a virtuous circle that modifies, or rather diversifies, the characteristics of the resident population (attracting also a younger and more qualified population), that consequently leads to an increase in wealth and reduces the digital divide among regions.

The greater attractiveness of territories is also characterised by a mix of elements, and digital growth is a key elements. The connectivity offer by the different actors, be they public or private, is not sufficient by itself to stimulate individuals to have an internet connection.

The growth of ICT demand most definitely is channelled through an improvement of the social and economic conditions of the population, however it cannot be separated from the provision of services to the population. And, once again, ICT aspects emerge: the offered services, especially in territories with particular morphologic or anthropic conditions, may also have a digital component, helping to feed the virtuous circle that leads to the general growth of the territory.

[6] Source: Digital Scoreboard 2012, Broadband take-up in Europe

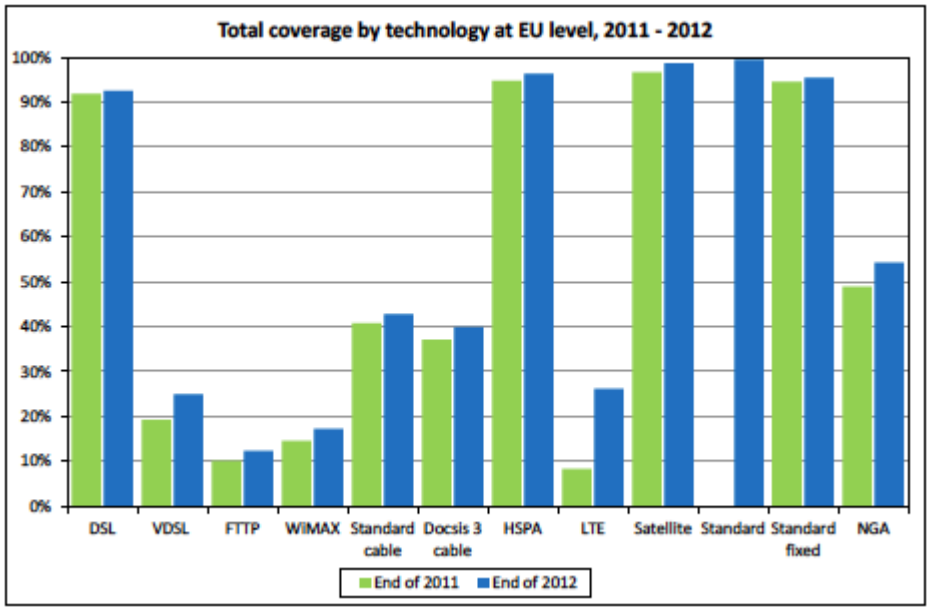


Figure 3: Total coverage by technology at EU level, 2011-2012
(Source:Point Topic)

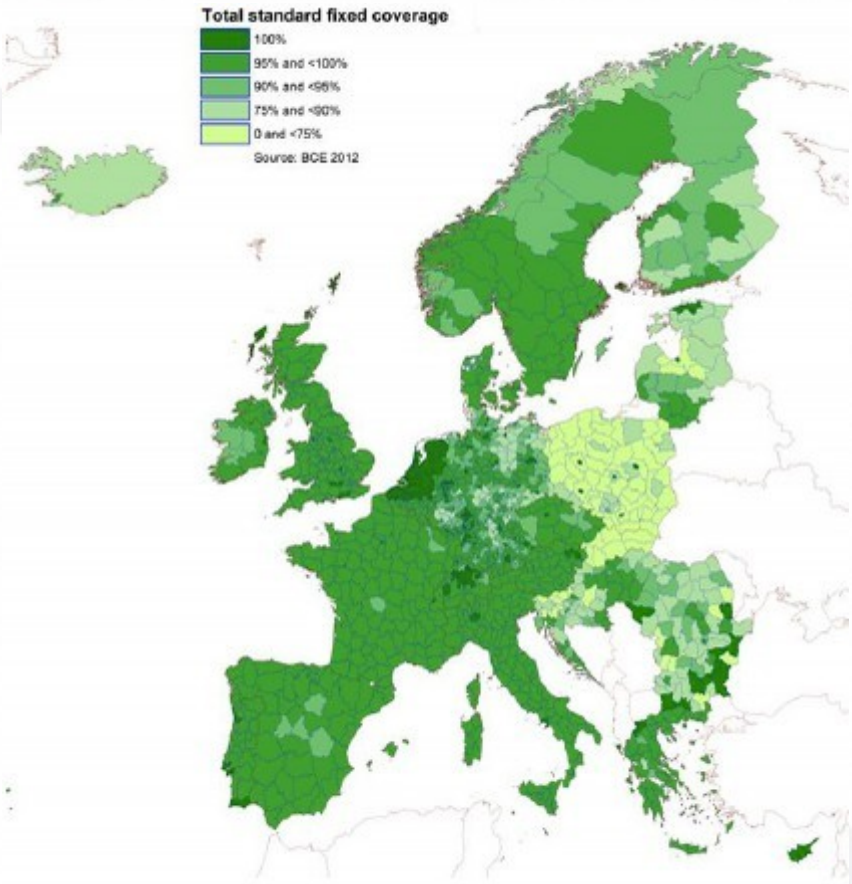


Figure 4: Standard fixed coverage by region, end of 2012

(Source: Point Topic)

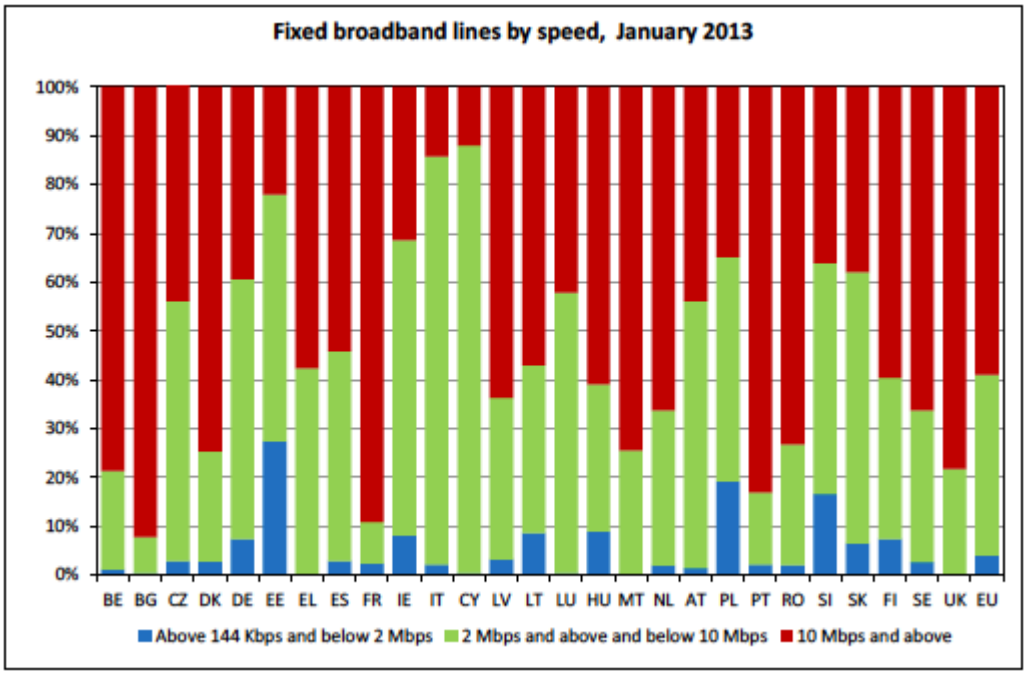


Figure 5: Fixed broadband lines by speed, January 2013

(Source: Communications Committee)

3.3 Relying On Broadband Terrestrial Solution Only?

The EU traditionally promotes a policy which assumes that only fibre connections can deliver the type of connectivity (in terms of speed, symmetry, etc.) which meets domestic user demands, and that mobile or other wireless solutions including satellite will fill in the void where fibre is not available.

The incremental cost of terrestrial infrastructures is driven by civil engineering costs, (which can be as high as 80%), pushing any return on terrestrial infrastructures (fibre based) investments to a horizon of over 25 years even under an optimistic evaluation.

[7]

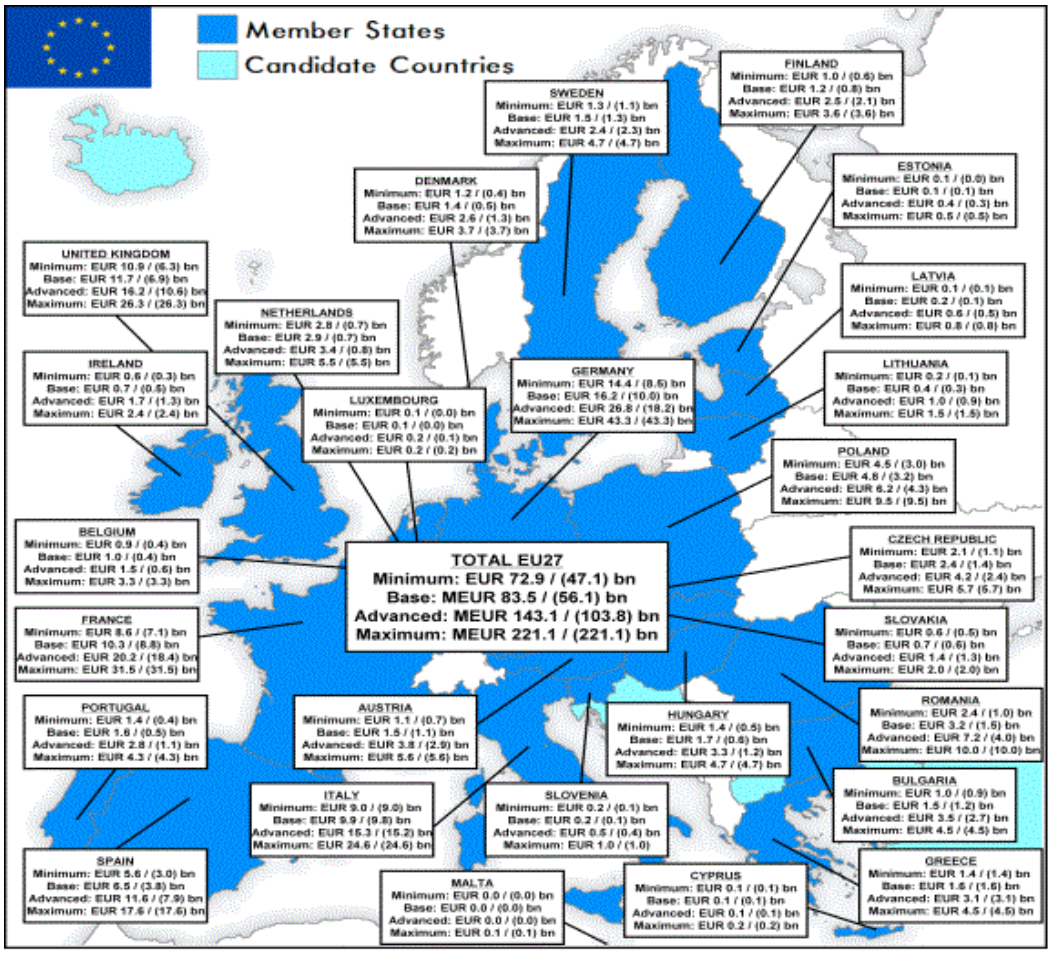


Figure 6: Cost per country to reach EU Digital Agenda targets

[7] "An assessment on the total investment requirement to reach the Digital Agenda broadband targets" P. Koutroumpis, EIB, 2011

The cost of rolling-out fibre increases when the population density decreases. More in general, the average price per connection varies enormously from country to country, from region to region, from area to area as a function of geo-morphological conditions, population density, etc. (see 18)

Location	Funding (EUR million)	Number of households	Cost per household (EUR)
South Yorkshire Digital Region	105	546 000	183
East Peak (UK)	0.50	1502	346
Krško (Slovenia)	6.03	2811	2144
Mozirje (Slovenia)	6.03	2000	3015
Nuenen (the Netherlands)	6.2	7500	1300
Asturias (Spain)	47	51 000	921

Figure 7: Projects in the EU; cost per households

A contribution of the SABER partner RD horizon indicates that, following two Open Calls for a total value 84 M€ in Slovenia, 17 projects were selected to serve 44 municipalities to enable almost 30,000 connections, out of which 9.500 were realised by 31 December 2012.

The average price per connection (enabled) is 2.863 €. This amount, funded through public funds, is particularly high, as it is the case in other EU regions.

In order to guarantee 100% coverage in Europe with terrestrial solutions only, namely through the rollout of backhaul broadband infrastructure in optical fibre to all local exchanges, a high level of capital investment would be necessary.

The fact that broadband penetration is far below the EU targets is mainly due the economic sustainability of existing terrestrial technologies by population density at target Average Return Per User (ARPU).

The business case for these investments is still uncertain, posing the threat that, in spite of considerable efforts from the Institutions, the un-served or under-served markets remain significant.

[8] Analysys-Mason "The socio-economic impact of bandwidth" EC DG INFSO workshop, 21/02/2012

In fact, governments have often invested public funds in fibre optic backhaul broadband infrastructure in rural areas – also due to the European legal guidelines which tended to favour 'wired' networks – but this remains a very expensive option especially for the last few unserved businesses and citizens, despite the fact that ERDF and EAFRD 2007-2013 for broadband infrastructure are still available in some EU countries / regions.

In addition, the approach to support the offer of ADSL through the rollout of backhaul broadband infrastructure has also reached in many cases its technical limits due to the speed limitation imposed by the existing access component (copper pairs too long and twisty, network concentrators between the local exchange and the user premises, etc.).

A more balanced and pragmatic approach, which would be much more realistic and cost effective includes the use of other technologies (such as existing satellites) in an infrastructure mix to economically deliver the necessary bandwidth to those users who are not currently within easy reach of wired terrestrial solutions. This results in a more prudent management of supply and demand for broadband and drives service availability immediately and everywhere, a factor which is more critical than the applied technology.

Considering LTE, an acronym for “Long-Term Evolution”, commonly marketed as 4G LTE, it may provide fixed broadband infrastructures in rural areas and very high per user speeds can be achieved when each base station is backhauled by a fibre network.

Some numbers can help shed light on the relative strengths and weaknesses of this solution. The total download bandwidth is 60 MHz in Europe. The LTE cell size can vary, from tens of kilometres down to few hundred metres. This means that capacity can be concentrated to specific city neighbourhoods or villages, or small regions with LTE. This flexibility represents a great advantage whenever population is concentrated in specific and differentiated areas. On the other hand, connecting the very last isolated households scattered over an entire region may be very tricky using LTE because signal attenuation increases with the square of the cell radius, and because precious dedicated bandwidth needs to be reserved for these “isolated households”.

Moreover, in view of the limited total download bandwidth and of volume limitations of contracts, the delivery of linear TV and other streaming of high definition video through LTE is unlikely[9], and knowing that all forms of video will continue to be approximately 90 percent of global consumer traffic by 2015[10] this represents a non-negligible limitation to the widespread use of LTE as fixed broadband access in rural areas.

Finally, one should not forget that LTE is first and foremost an outstanding and effective technique for mobile broadband communications, with high ROI for telecom operators especially in densely populated areas. Using it in an extensive manner as a replacement to fixed communication in rural areas is somehow a technical and economic challenge.

In view of the above considerations, it is obvious that satellites have a specific role in providing fairly fast broadband in areas that will never be economic to deliver through fixed lines and also offer a very strong interim solution to other areas where faster fixed broadband will take longer to rollout.

In fact, considering the high investment needed to deploy and upgrade terrestrial infrastructures, satellite broadband remains a natural complementary solution, namely a quick and attractive solution for rural areas.

In particular, currently available satellite broadband services offer speeds greater than the so-called "light" ADSL services, limited by their distance from / to the exchange.

3.4 Satellite Broadband In Europe: Technical Features

This section will give an overview of satellite broadband technology evolution over time as well as a perspective of the value chain of the technology. We will then, based on the experiences gathered by the industrial partners and the regions of SABER, address in a neutral fashion, the strengths and the weaknesses of the technology.

3.4.1. Satellite Broadband Product And Service Evolution In Time

In Europe Internet access service based on satellites have existed for more than 10 years. At the early stages it consisted of a unidirectional link in which the forward path was assured by a

[9] "No TV via LTE in Germany?" Broadband TV News – 12 February 2013

[10] http://www.cisco.com/en/US/solutions/collateral/ns341/ns525/ns537/ns705/ns827/white_paper_c11-520862.html

satellite connection and the return path by a terrestrial dial-up connection (analogue with a standard 56K modem). The cost of the service was however high (about 2–3 times higher than a standard terrestrial connection) and the performance somewhat limited.
With the introduction in 2001 of the bidirectional satellite service, this technology became fully independent from terrestrial links including the upload path. However at that time satellites had a total band capacity of few Gbps which made a mass adoption difficult because of the consequently high subscription fees, and, in parallel, terminal equipment was still costly in spite of the type approval (e.g. subscription at 300-600 €/month for 2 Mbps, with a terminal cost of a few thousand euro). Therefore acquisition, installation and operational costs were prohibitive for the consumer market.

3.4.2. Satellite Broadband Today

Today, with specific service offerings for the residential market in multiple frequency bands (mainly Ka and Ku-bands) and more efficient modulation schemes such as Adaptive Coding and Modulation (ACM), satellite operators, such as Eutelsat and SES, serve a larger population of subscribers. They have larger geographical scope and reach a higher number of subscribers and supply connectivity in all covered areas with performance similar or even higher to terrestrial ADSL at a comparable price.

In the last three years the two-way satellite broadband access service has largely improved its capability data rates. In 2010 the high-end SLA allowed downloading speeds up to 5 Mbps and uploading speed up to 1 Mbps. While from 2012, with the introduction of services in Ka band, the performances have jumped up to 20 Mbps in download and up to 6 Mbps in upload, which translates into a better end-user experience.

There are a number of reasons for the move toward the use of Ka band in satellite broadband in Europe – indeed consumer broadband is at present the main target market for Ka-band satellites.
First of all, the Ku-band, the most widely used band over Europe, is in high demand for professional services namely TV broadcasting and became almost saturated. As a result, further expansion is limited. On the contrary, the capacity available in Ka band is larger than in other bands and it is largely unused today.

Figure 8 shows the main characteristics of the frequency bands more frequently used for geostationary satellite communications.

Looking at the typical coverage of satellites working in each band, it is understandable that the large coverage in C band is particularly suited for establishing intercontinental communications while the regional coverage in Ku band is particularly suited for TV distribution (note also that lower frequencies are less subject to atmospheric fade, which impacts service availability).
The size of a Ka-band spot of a satellite beam, of the order of 250-500 km, allows for multiple spot-beam coverage with frequency reuse among non-adjacent spots.

The combined effects of a larger spectrum allowance and of the frequency reuse is that Ka-band satellites offer more capacity at lower cost: powerful Ka-band multi-spot satellites provide throughput tens of times higher than traditional satellites. The higher capacity per satellite translates in a lower cost per bit to the final user.

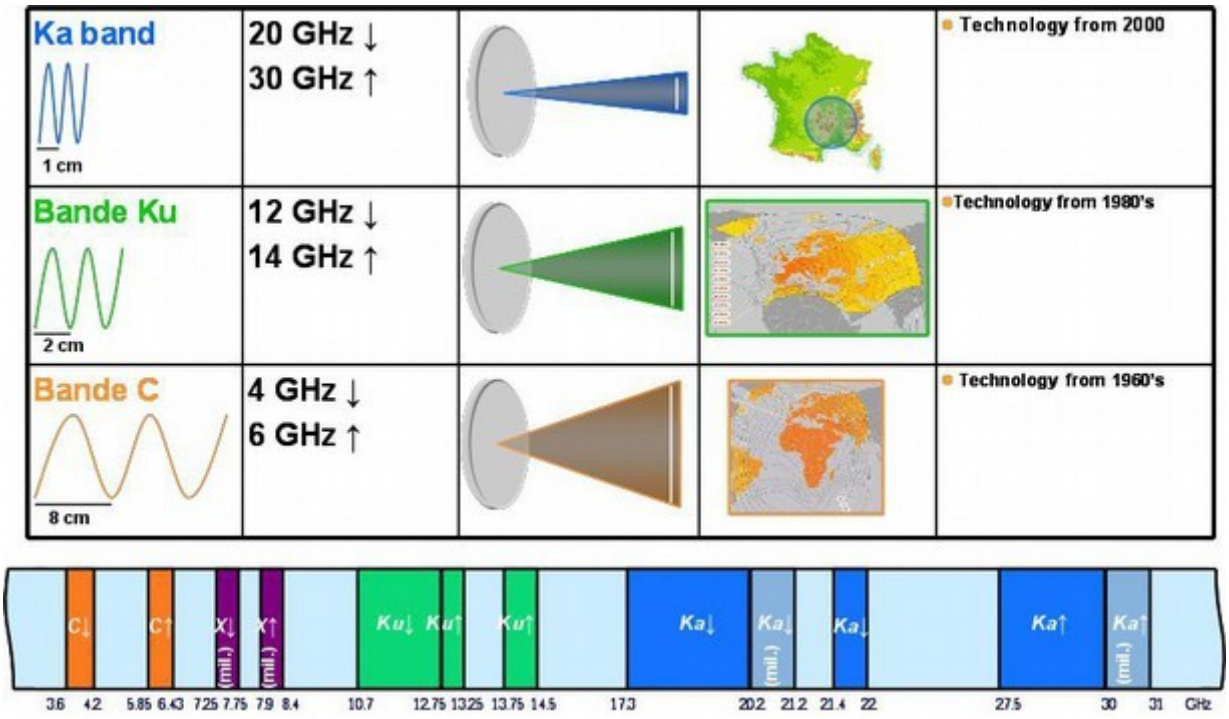


Figure 8: Frequency bands used for geostationary satellite communications

3.4.3. How Does Satellite Internet Work?

Satellite Internet is based on the ability to transmit and receive data from a relatively small satellite dish on Earth and communicate with an orbiting geostationary[11] satellite 35.786 kilometres above Earth's equator.

Due to the large coverage of satellites, satellite-based internet network can provide fast and reliable internet access almost anywhere.

As showed in Figure 6, a satellite link operates in a very simple way despite its high level of technology included in the development, in the deployment and in the maintenance of the component in space. The main components of a satellite system comprises the following (see figure 9):

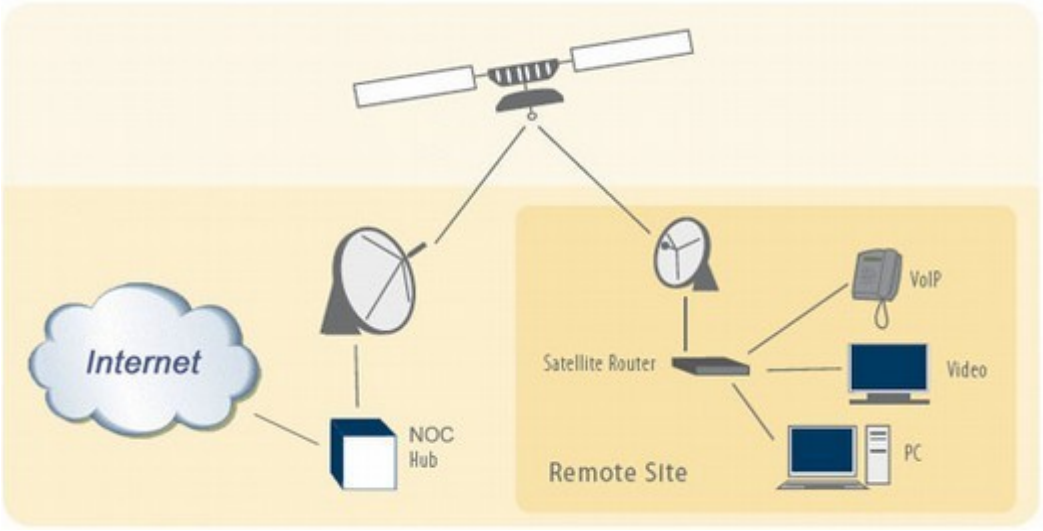


Figure 9: Typical satellite connection diagram

- The Satellite itself

[11]Geostationary means a location in space where you can place a satellite in orbit so that from the ground, the satellite appears stationary. What is happening is that the satellite is actually orbiting the Earth at the same speed the Earth is rotating. The satellite makes a complete orbit around the Earth in 24 hours, or exactly one day. Geostationary satellites are only located at 35786 kilometres directly above the Earth's equator and nowhere else. They are used for a variety of purposes like TV broadcasting and telecommunications.

- The ground-based stations
- At the end-users' premises (see Figure 10):

  The indoor modem: a satellite modem manages data transfers using a communications satellite as a relay. It is connected to the external dish by a coaxial cable carrying the data traffic and powering the external transmission/reception block.

  The outdoor unit: mounted on a rooftop pole or directly to an external wall, it is composed of a parabolic dish (typically ranging from 70 to 120 cm in diameter, depending on application and location) with the two-way transmission/reception block mounted in the focus. The transmitted power is irradiated only towards the satellite and it is limited (1-3 watts), on the basis of the maximum allowable Effective Isotropic Radiated Power (EIRP) of a satellite terminal in order to remain within the type-approval regime.

  In fact the installation of user ground-based stations, also referred to as Customer Premises Equipment (CPE) is exempted from individual licensing, as it fulfils the size and power requirements of the applicable Decision of the European Conference of Postal and Telecommunications Administrations (ECC Decision 06/03) which comprises the policy makers and regulators from 48 countries across Europe.

  The typical cost of the CPE is of the order of a few hundred euros.

Figure 10: Example of end-user ground equipment

- The Network Operator's Teleport:

  The teleport is the central earth station that controls communications across the space link; its Network Operations Centre (NOC) manages the connections to/from remote satellite equipment at end-users' premises interconnecting them to the Internet. The NOC monitors and appropriately adjust power levels and satellite signal performances, manages the network configurations and ensures prompt proactive and reactive central troubleshooting where needed.

  The teleport is connected to the Internet Backbone with high-speed links.

Figure 11: Example of antennas in a teleport

- Five steps to understand the process:
    1. End-user computer is connected to the network, which in turn is connected to the Internet. End user computer sends a request for a transfer of data (for instance by opening a web browser and typing a web address).
    2. The request is sent from the end user PC, through the home network if present, to the indoor satellite modem which modulates the signal and passes it to the satellite dish. The transmission/reception block of the dish converts this signal to an RF signal and sends it at the speed of light to the satellite located in the geostationary orbit.
    3. The satellite in the geo-stationary orbit receives this signal and sends it to the teleport. This illustrates the fact that although the packets of information travel tremendous distances via the space segment, the packets hop fewer networks

(compared with other technologies) due to the large reduction in the number of inter-domain and intra-domain routers, giving an opportunity to minimise latency.

4. The request then goes to the NOC, which retrieves the requested website from the web server, across the backbone.
5. The whole cycle is then reversed and the requested data is available to the user.

Note that the traffic going from the end-user terminal to the backbone is defined as data upload, and the traffic going to the end-user terminal from the Internet backbone is defined as data download

In a nutshell, the satellite operator, with its satellite fleet and its ground infrastructures (teleports) enables broadband internet for all end users connected to the services with simple equipment composed by an antenna and a satellite modem. It is also possible to add digital television and a telephone line to benefit from a Triple-Play service.

Satellites can also be integrated with terrestrial wired and wireless access technologies.

In this case, the satellite link acts as backhaul for a local DSLAM, CMTS or a Wi-Fi access point, and the two-way satellite broadband serves a community, such as an entire village, by means of a single satellite dish or an aggregate of dishes.

The final objective is enabling access to internet for all end users connected to the aggregation point regardless of the last mile technology. In this case, users don't have to install an individual satellite antenna.

3.4.4. Strengths / weaknesses of broadband satellite solutions and users' feedback

Satellite broadband services have some inherent strengths due to the position of geostationary satellites:

- Ubiquity: universal service regardless of geographic location. Satellite communications offer a predictable and stable quality of service everywhere, independent of the distance from the ground infrastructure to the end-user premises[12].
- Cost-effectiveness: the deployment cost is independent of terrain characteristics, population density or right-of-way regulation, etc., hence cost per user is fixed everywhere. It is commonly accepted that satellite technology is the most cost-efficient solution for broadband in areas with a low population density of typically <150 inhabitants/km^2.
- Quick and immediate coverage: deployment of satellite broadband services is simple; the only requirement is to install the user terminal equipment – no need for additional networks infrastructure (the satellites and the teleports are already in operation).
- Independence and resilience to earth/ground events (for instance natural or man-made disaster or social and political events).
- Reliability and security: the satellite suffers from very limited downtimes and service disruptions during its lifespan (typically 15 years for GEO satellites).

Conversely, the satellite-based broadband services have some inherent challenges mainly linked to the physics of satellite communications:

- Latency: due to the distance of the geostationary orbit to Earth, the propagation delay of a signal sent from Earth to a satellite or vice versa is 119.35 milliseconds, and the so-called round-trip delay (teleport->satellite->user terminal → satellite-> teleport) is almost 480 milliseconds.

[12]Also, satellite communications need power at the end user, hence power failure at the end user will affect communications (but this is the case for terrestrial NGA technologies, such as fibre, xDSL, Coax cable; only twisted pair telephony is designed to withstand power failures at the end user) unless back-up power sources are used.

- Apart from a potential impact on interactive voice and video services, which is however less and less noticeable thanks to the improvement in the quality of the signal itself, the more relevant effect is on data, namely on the ping time[13] which could be of the order of 800 ms. This has a regrettable impact on some data services using the Transmission Control Protocol (TCP), as the TCP/IP exhibits poor efficiency over paths that have a large bandwidth x round-trip delay product (due to the mechanism of the window for flow control). While services such as huge file transfers are not sensitive to large propagation delay, calling web pages may sometimes be slow (due to TCP which generates a waste of bandwidth when a link is empty and the transmitter is temporarily stalled while awaiting an acknowledgement). In a nutshell, in some cases TCP/IP prevents users from fully benefiting from the fast download and upload speeds made available by a broadband satellite connection, giving the false impression of a slow connection.
- With the aim of diminishing its impact, the satellite industry has introduced and continues to further develop mechanisms such as pre-fetching content and TCP/IP acceleration.
- Fading Space telecommunication may suffer severe signal weakening due from rain and gas when crossing the atmosphere. However modern technologies such as ACM (Adaptive Coding and Modulation) regularly applied to satellite broadband have mitigated and overcome this effect.
- Bandwidth sharing limitation: spot size (250-500 km diameter) is determined by the carrier wavelength alone and cannot be reduced to increase the bandwidth per user like in terrestrial wireless. On the basis of the overall bandwidth available on a satellite, a trade-off is found in satellite broadband internet between capacity per user, coverage and subscription price.
- Volume limitation: sometimes called the Fair Access Policy (FAP) or Fair Usage Policy (FUP); means that your ISP will put limits on how much you can download over periods of time – which could be a few hours and / or a week. If you exceed that, they will temporarily slow your speed down.

It has to be noted that all the broadband technologies are implicitly or explicitly confronted by volume limitations to prevent network congestions. Mobile data subscriptions are generally

[13]The time it takes the router to get a call back from an internet server.

limited to 1-5 GB and require charging for additional usage. This is not the case with satellite: once the cap is reached, speed decreases but the connection is still on. Volume limitation for terrestrial technology is more and more of concern, where unlimited internet is progressively being removed from commercial offers[14,] to avoid that a few users pick most of the available bandwidth.

Another potential limitation is due to the CPE cost: In satellite broadband, the major investment (the satellites and the related terrestrial segment) have been entirely borne by private investment. The only missing component to supply the user access to internet is the user terminal (antenna + modem). The total costs of the end-user equipment, including installation and activation fees, which is of the order of 500 euro, including VAT, might be an obstacle for a large development of satellite-based Internet users, especially in areas with low purchasing power.

In this respect, the uptake in Australia or in the U.S. where satellite connectivity is highly popular has partially relied on subsidy schemes[15] from local governments for consumer broadband satellite terminals.

These subsidies establish a level playing field among different broadband solutions: in terrestrial technologies, the user access to broadband internet is enabled throughout the support of the deployment of backhaul infrastructure, in satellite technologies throughout the support to the ground equipment.

More in general, informing and educating the customers beforehand about expected performance of the satellite service (especially about the potential differences with the one of fibre-like services) is important to make them understand how a satellite service will be able to fulfil their connectivity need. Obviously real-time applications on which the delay requirements are very stringent, like on-line gaming, it is not always feasible to use a satellite connection considering the

[14]"Deutsche Telekom said that soaring data traffic, which is expected to quadruple by 2016, would force it to impose limits that had been applied only to mobile users. Under a new pricing plan, Deutsche Telekom would slow landline Internet customers to a rate of 384 kilobits a second, once the download limit is reached, which for many consumers would be at 75 gigabytes of downloads per month" Limiting Data Use in Germany, May 12th 2013, New York Times

[15] SABER Deliverable 3.2 Chaper 5.3.1

long round-trip delay. For all other applications with non-stringent delay requirements the satellite service can cover very well all the specifications of a very good quality service.

In a nutshell, the permanent technology development has helped to mitigate and overcome the challenges related to satellite communication and to improve the user experience of satellite broadband. Recent independent tests reported hereafter confirm the positive experience in terms of quality of service perceived by the end-users.

Official Tested Performances, U.K., March 2013

Review of a satellite broadband system in the U.K., March 2013[16]

- *Is satellite broadband any good?*

  The argument for satellite broadband is a compelling one: any building can have fast broadband, so long as you can position a satellite dish so that it can see the sky. And the {system-1} *package takes price out of the equation: you can get up to 20 Mbit/s broadband for just £ 29 a month. Bearing in mind that you don't need a phone line for satellite broadband, that total cost compares well with traditional or fibre broadband.*
  So with satellite anyone can get broadband. But is satellite broadband any good? We took up a subscription with 20 Mbit/s downloads, 6Mpbs uploads and a 10 GBytes a month data limit for £29 a month from {satellite ISP-1} via {system-1} to find out.

- *Setup*

  The first thing you need to know: you need a satellite dish. The dish is bigger than the dish usually provided as part of a Sky TV subscription.
  Installation takes a couple of hours, and the installer needs to pass a thick black cable from the dish and into the house. […]

[16] [PC Advisor, 19-03-2013 http://www.pcadvisor.co.uk/reviews/broadband/3435765/tooway-satellite-broadband-review-is-satellite-broadband-any-good/?olo=rss&tab=verdictTab#top

You need both satellite modem and broadband router - we were given a router for free, but customers usually have to pay for one or use an existing broadband router.
Setup is part of the package, and couldn't be simpler. Once everything is up and running you need only to connect to the satellite broadband router in exactly the same way as you would any connection.

- *Speed tests*

We tested our connection using an independent Speedtest.net.
For comparison we tested our existing Sky Broadband ADSL broadband. Both connections are nominally 'up to 20 Mbit/s', but our ADSL line has always been slow - our house is a long way from the exchange.
We tested both connections using the same fast Lenovo Ultrabook, an iPhone 5 and a Nexus 7. In all cases we carried out tests next to the router being tested, and ran each test several times.
Our Sky Broadband is slow. The house is a long way from the exchange. Speedtest.net measured average download speeds of 3.51 Mbit/s, and upload speeds of 0.67 Mbit/s. The ping was measured at an average of 38ms - this is important, as we will see.
{system-1} smashed Sky in all but the ping test. Average download speeds were a square 8 Mbit/s, uploads 3.08 Mbit/s. But the ping time - the time it takes the router to get a call back from the internet server - was 797 ms.

- *Real-world tests*

  What this means in practice is that downloading and uploading files is unrecognisably better when using the satellite connection. Pulling down a file for work is so much faster.
  But web surfing feels about the same - that slow ping response time means a certain lag when calling web pages that negates some of the benefits of the much faster down - and upload speeds.
  So if mobile media streaming or online gaming is your thing, satellite broadband may not be for you.

- *Is it good value?*

  Those caveats notwithstanding, we think {system-1} is good value. Most ADSL broadband packages require you to pay BT for a phone line, remember, and the data allowance is generous if you use multiple devices in your home. It's not a cheap option, but it is reasonably priced when compared to other options.

- *Who is it* for*?*

  Our experience is that satellite broadband is not as good as a fast fibre or ADSL connection, in most circumstances. Increasingly we are using the web for media streaming, online gaming, video calling and so on. Satellite is not as good as fixed line broadband for these purposes. But that misses the point. If you need internet connectivity and can't get ADSL or fibre broadband, you should look at satellite. If you can see the sky, you can get online. And it won't break the bank.
  It's not cheap, but is reasonably priced. And setup is simple. Most importantly performance is okay. If you can't get online by any other means satellite is a viable option.

Official Tested Performances, Germany, November 2009

Comparison between satellite broadband systems and mobile Internet in Germany, November 2009[17]

Stiftung Warentest made substantial comparative tests between satellite broadband systems (in Ku band at that time) and mobile Internet which significantly helped to shift the Figure of satellite broadband.
Satellite and mobile Internet access have been tested with the following scoring methods: excellent (0.5-1.5), good (1.6-2.5), satisfactory (2.6-3.5), sufficient (3.6-4.5), deficient (4.6-5.5).

The results by category for satellite internet were the following:[18]

- Internet connectivity: very good (1.4)
- Handling: good (2.3)
- Installation: good (2.3)
- Versatility: good (2.5)
- Deficiencies in the general terms and conditions: marginal

In this particular test, Stiftung Warentest, has awarded the service with a global grade of GOOD (1.8). Among the tested parameters it shall be highlighted that the quality of the internet connectivity was awarded with a grade of VERY GOOD (1.4).

[17] Stiftung Warentest, November 2009 edition, (http://www.test.de/Internet-per-Satellit-und-Mobilfunk-Noch-nicht-optimal-1816231-0/)
[18] Satellite SLA tested was 2048 kbit/s from German ISPs Filiago and StarDSL

Satellite Internet		
test Quality Assessment	**100%**	**GOOD (1.8)**
INTERNET CONNECTIONS	**60%**	**very good** (1.4)
Transmission speed		+
Regularity of transmission speed		++
Stability of connections		++
HANDLING	**15%**	**good** (2.3)
Printed directions		++
Electronic directions		++
Daily use		O
INSTALLATION	**15%**	**good** (2.3)
Ordering process		O
Installation on site		+
VERSATILITY	**10%**	**good** (2.5)
DEFFICIENCIES IN GTC	**0%**	**minor**

Figure 12: Satellite Internet test result

The key point of the test was to compare the quality of the internet wireless connections (satellite and mobile internet) in order to better understand an alternative way to an ADSL connection where this kind of service is not offered.

In that respect, and according to the criteria set for the test, the satellite service presented the best performance to overcome the lack of ADSL connectivity: the test showed an equally good performance of internet speed connectivity and a very good web browsing experience (see Figure 13).

Mobile Internet					
Evaluation		T-Mobile we-b'n'walk Connect L	O2 Active Data with Internet Pack L	Vodafone Mobile Connect Flat	E-Plus Base Lap-top Internet Flat [4]
test Quality Assessment	100%	GOOD (2.3)	SATISFACTORY (2.6)	SATISFACTORY (2.8)	SUFFICIENT (3.7)
INTERNET CONNECTIONS	60%	satisfactory (2.8)	satisfactory (2.8)	satisfactory (2.6)	satisfactory (3.4)
Transmission speed		+	+	+	O
Regularity of transmission speed		O	O	O	O
Stability of connections		O	O	O	O
Mobile use		O	O	O	⊖
HANDLING	30%	very good (1.4)	good (1.9)	very good (1.4)	very good (1.5)
Printed directions		++	+	+	++
Electronic directions		+	Omitted	O	+
First installation		+	+	++	++
Daily use		++	+	++	++
VERSATILITY	10%	good (2.0)	satisfactory (3.0)	satisfactory (3.0)	good (2.0)
DEFFICIENCIES IN GTC [3]	0%	very minor	none	notable *)	very notable *)

Figure 13: Mobile internet test results

It is important to highlight that from 2009, the price of satellite-based internet services has substantially dropped and also that the performance at that time was lower than the one currently possible. Consequently, a better result/test score would be expected with the current offers.

The results of the official test corroborate that the new developments have been key to overcome the myths associated with satellite communications such as low speeds or hefty installation.
In this chapter some qualitative feedback from user of broadband satellite are provided.

Feedback on satellite broadband use

Two major elements should be taken into account when reviewing the perception of the users:

a) There is an overrepresentation of mountain refuges (namely French mountain refuges) in the panel, which may have similar experiences and face the same issues (e.g. multiple users per equipment, severe changes in weather conditions).

b) Most of the users of the panel have been using an old technology which has lower performance (e.g. in terms of speed and availability) and higher price when compared to the state-of-the-art solutions.

Fifteen users of satellite internet, from **five** countries (France, Ireland, Norway, United Kingdom and Spain), have been interviewed for this study, both individual and business users.

User	Location	Type of Use	Opinion	Funding
Refuge de Bésines	France	Mostly phone via satellite	Vital for their business	FFCAM
Refuge du Goûter	France	Daily uses, no extra communication	Convenient Tool	FFCAM
Refuge de Temple Ecrins	France	Billing system Communication	Major issues with energy supplies Not always working, speed varies, sometimes not possible to open heavy attachments	FFCAM
Refuge des Ecrins	France	Booking Weather forecast	Time-saving tool Not very fast	FFCAM
Refuge d'en Beys	France	Billing system Communication Booking system to be implemented	Limited connectivity and some weather impacts	Conseil Général of Ariège
Refuge des Cortalets	France	Communication Online booking and billing system	Works well but the dish is unaesthetic which is an issue in a natural area	Public Funding
Refuge d'Avérole	France	Communication Online booking and billing	Major issues with energy supplies	FFCAM
Refuge de Wallon-Marcadau	France	Communication Billing system	Time-saving tool	Private

Refuge de la Dent Parrachée	France	Communication Online Booking Weather Forecast	Real asset for business, safety and security	FFCAM
Ai Bridges	Ireland	Provider for customers	Still not fast enough, and quite expensive, even with own bandwidth	Private
Global Irish Sports	Ireland	Live streaming for customers	Far too slow for his business (quality issues as well)	Private
Svein Skagen	Norway	Daily uses, TV via internet	Good but has issue with receiving some TV channels	Private
Eivind Buckner	Norway	Download/Upload of heavy files Home-work	Good, no difficulties	Private
Beaples Barton Sporting Holidays	United Kingdom	Communication Online booking	Good, service is fast enough	The Rural Development Programme for England
Refugio de Pineta	Spain	Social Networks Online Booking Website	Good, but cuts depending on weather conditions	The Climbing Federation of Aragon

General Trends

Overall, users gave a positive feedback of their experience of satellite internet, being mostly satisfied with their current subscriptions. Internet is a time-saving device, with a real impact on business development. Moreover, in remote areas, internet is a necessary tool for communicating and thus maintaining a social link. This is especially true for the mountain refuges which are far from valleys and towns.

The main issue some users are facing regarding their satellite connection is that of the speed. Not having enough speed prevents them for using various functionalities such as live streaming, VoIP, or even opening heavy attachments. However most of these users have been exploiting old systems which have lower performance when compared to the state-of-the-art solutions.

In any case, it is recommended to manage expectations: prior to subscribing to a satellite internet solution, one has to ensure that the user is well aware of what is included and covered by the chosen offer. Indeed, the user should be able to determine whether the subscription can match his needs or not, especially in terms of speed. This way, users' perception is in line with actual performance. Communication and promotion around satellite internet solutions must thus be very

clear and transparent.
Indeed, users with the same internet offer, in the same type of environment can sometimes provide very different feedback on their equipment. This could be explained by technical issues linked to the installation of the satellite dish for instance (one must make sure that the satellite equipment is properly installed and managed efficiently by the user), or by an inefficient use of the system.
It thus appears important that users are being trained on how satellite internet works and on how to make the most out of its capacities (e.g. linear TV rather than TV via internet).

The majority of users received a grant or a financial aid for the installation of satellite internet. Though they all pay for they own subscription, most of them used funding schemes at the beginning, which facilitated the uptake of the technology. Public authorities financed most of these installations, as well as private bodies, such as the French Association of mountain huts.
Subsidising the installation of satellite internet appears to be an efficient incentive for a better and faster uptake by the users. Indeed, this way, subscribing to satellite internet seems less a heavy investment for users since they only have to pay for their monthly subscriptions. Financial aid should therefore be continued in remote areas whenever it is possible and appropriate.

3.5 Satellite Broadband In Europe: Commercial Features

3.5.1. Approach Of European Satellite Operators To Consumer Broadband

In this section, some information is given on the way the two satellite operator partners in SABER, Eutelsat and SES, by far the two largest European operators, have approached the consumer broadband services market. The strategies of Eutelsat and SES are indeed very different from each other.

Eutelsat has made an overall investment exceeding 300 million euro in KA-SAT, a powerful new platform delivering high-bandwidth services, commercialised under the “Tooway™” brand name.

SES’ approach to Ka-band differs from its competitors in the way the capacity is brought into the market. SES did not invest in an "all Ka-band" satellite, such as Eutelsat.

The strategy of SES is to gradually increase the capacity of its Ka-band satellites as and when required. The gradual introduction of Ka payloads will allow SES to accommodate smooth growth and increase network resilience following market demand.

Eutelsat Ka-Sat, A Satellite Dedicated To High-Speed Internet

The broadband services commercialised by Eutelsat under the Tooway™ brand, in Europe and surrounding areas, exploit the scale economies and efficiencies of the largest single satellite platform in this part of the world, comprised of the Ka-SAT satellite and 10 dedicated ground gateways interconnected by continental-scale fibre ring. As each element of the infrastructure was entirely designed and optimised for broadband applications, this already enables current Tooway™ services to reach nominal speeds of 20Mb/s in download and 6 Mb/s in upload.

KA-SAT is the first European multi-beam, fully Ka-band High-Throughput Satellite (HTS). Weighing a little over 6 tons and a wingspan of almost 40 meters with solar panels, satellite embarks four large antennas with a diameter of 2.60 meters each with 20 feed horns.

Ordered to EADS / Astrium in 2008, the KA-SAT satellite was launched by an ILS Proton launcher in December 2010 before being formally put into operation in March 2011. It is positioned in geostationary orbit at 9 degrees East. It covers Europe, North Africa, and Middle East.

Unlike other satellites designed to cover a large area with a single beam, KA-SAT uses an innovative architecture to target the whole of Europe with 82 spot beams (each spot being connected to an operational transponders) of 250 kilometres in diameter.

Each country is served by several spot beams. France is well covered by 10 beams, 9 Italy, Germany 7, 5 for the UK and Ireland and another 10 for Spain and Portugal.

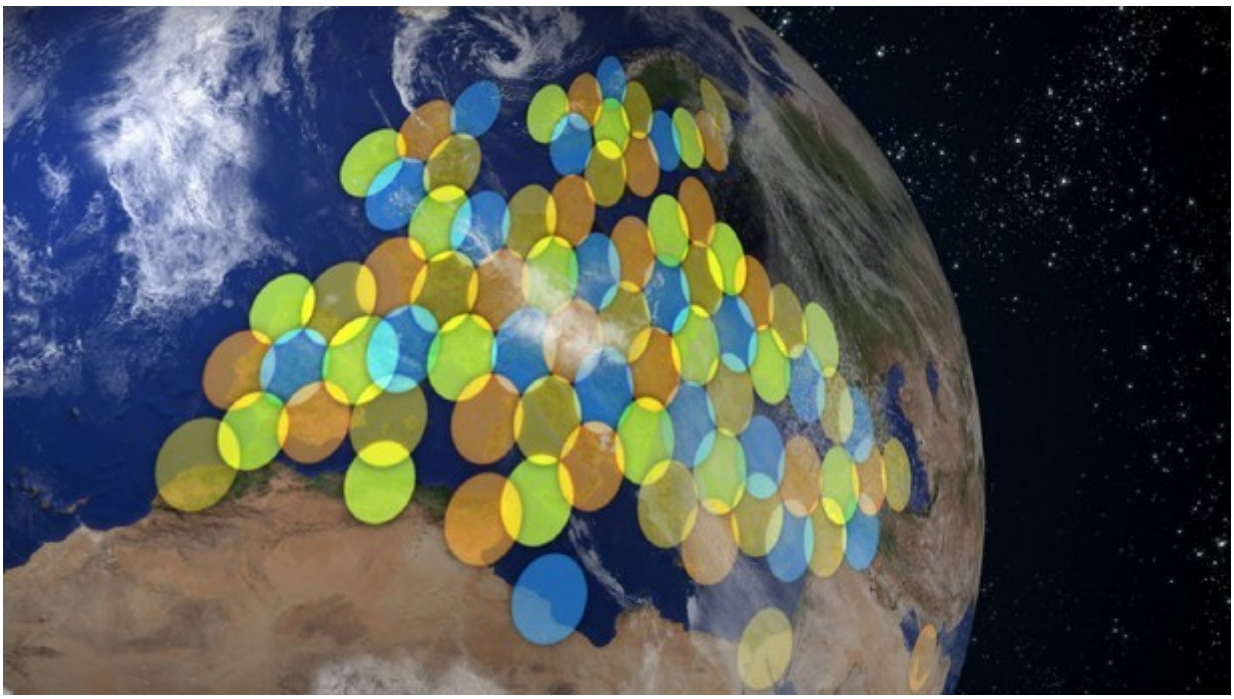


Figure 14: KA-SAT European Coverage

The use of different frequency bands allows overlapping spots for continuous coverage. The frequency reuse factor multiplies the available bandwidth.
The high frequency re-use through multiple spots allows total throughput in excess of 90 Gbps, shared between the downlink and uplink paths, which can be increased further depending upon modulation coding schemes used.

The 82 Ka-band spot beams are connected to a network of ten ground stations (Gateways) scattered throughout Europe.
Each Gateway, equipped with a parable of 9 meters in diameter, manages 10 spots. The ten Gateways, placed in Athens (EL), Berlin (DE), Helsinki (FI), Larnaca (CY), Udine (IT), Madrid, Scanzano (IT), Cork (IE), Turin (IT) and Rambouillet (FR), are interconnected among themselves and to the main control centre in Turin, Italy, through a 20 Gbps fibre optic network. The network is connected to major European POPs.

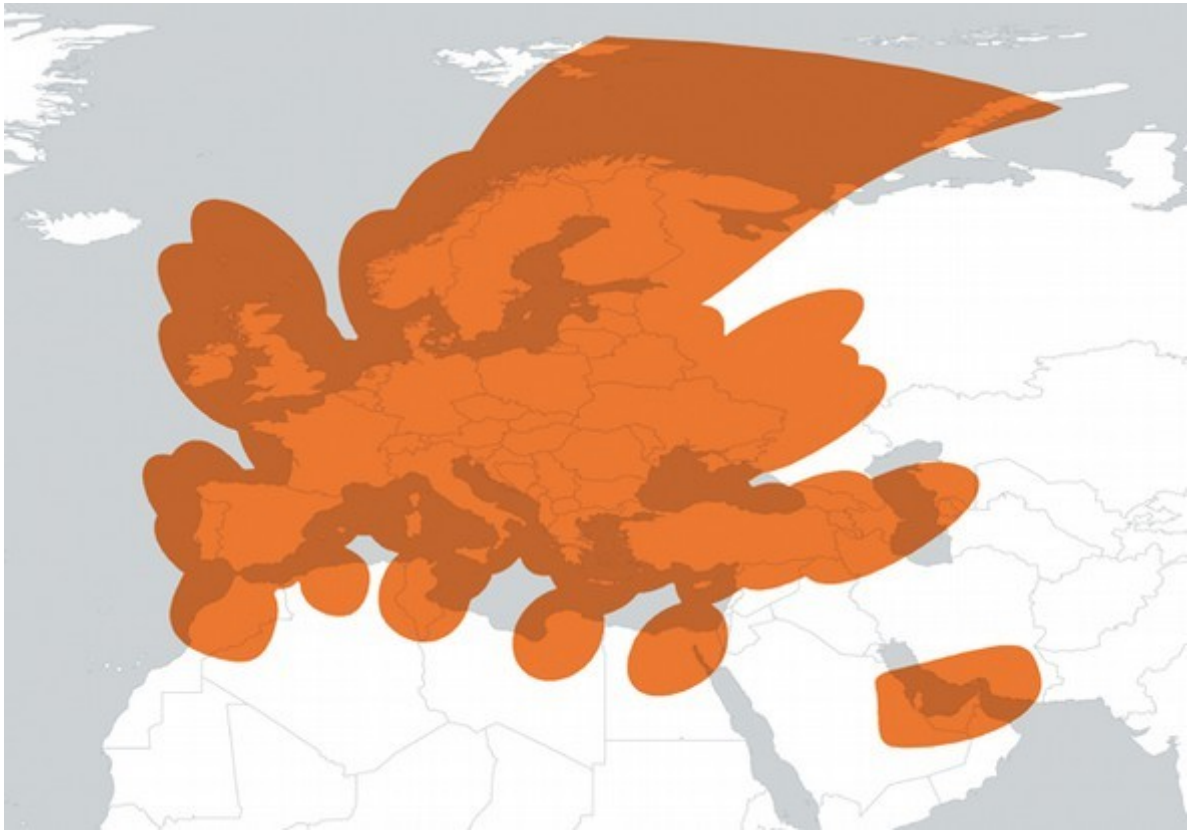


Figure 15: KA-SAT - combined service downlink

SES satellites providing high-speed Internet

The SES broadband service (formerly known as "ASTRA2Connect") was launched in 2007 and is offered in Ku and since early in 2013 also in Ka band. The service is currently powered by satellites located at the 5°, 23.5° and 28.2° East orbital positions.

The strategy of SES is to gradually increase the capacity of its Ka-band satellites. Instead of launching a broadband-dedicated High Throughput Satellite (HTS), SES decided to embark Ka payloads onboard several satellites (ASTRA 2F and 2E, already launched, and ASTRA 2G, scheduled for launch on Q1-2014). The objective is to complement the current pan-European Ku broadband coverage with incremental Ka capacity over selected areas.

Once the ground-based gateway stations necessary for the Ka-band service will be deployed, SES

will have the possibility to provide more than 6Gbit/s of capacity.

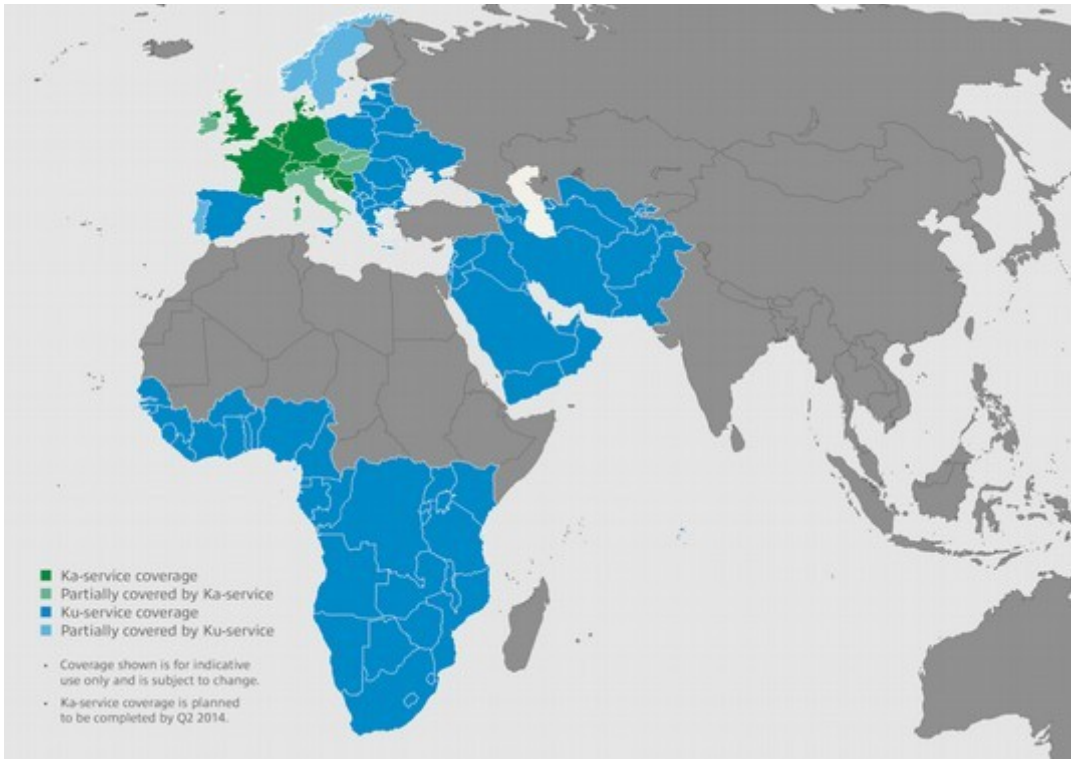


Figure 16: SES Broadband service coverage Ku / Ka bands

3.6 Satellite Broadband Services Currently Available Throughout The Eu: Performance And Prices

3.6.1. Satellite Broadband Value Chain

The satellite broadband value chain is somehow long and complex. Streamlining it, for example by vertical integration such as merging wholesale and retail activities as it happened in the U.S.A. with ViaSat and Wild Blue[19], is hardly achievable in Europe. Indeed, there is no Digital Single Market in the EU, therefore satellite operators have to find local distributors in each of the 28 EU countries' markets, which have their own specific rules and dynamics.

In the satellite broadband value chain, satellite network operators shape and manage the prioritisation of the traffic according to the congestion and the channel condition while the satellite ISPs (Internet Service Providers) manage the end-user, providing the service and related

[19] SABER Deliverable 3.2 – Chapter 5.1.2

activities as installation and first level of assistance. With reference to Figure 17, the six main actors of the Satellite Broadband value chain and their respective roles are the:

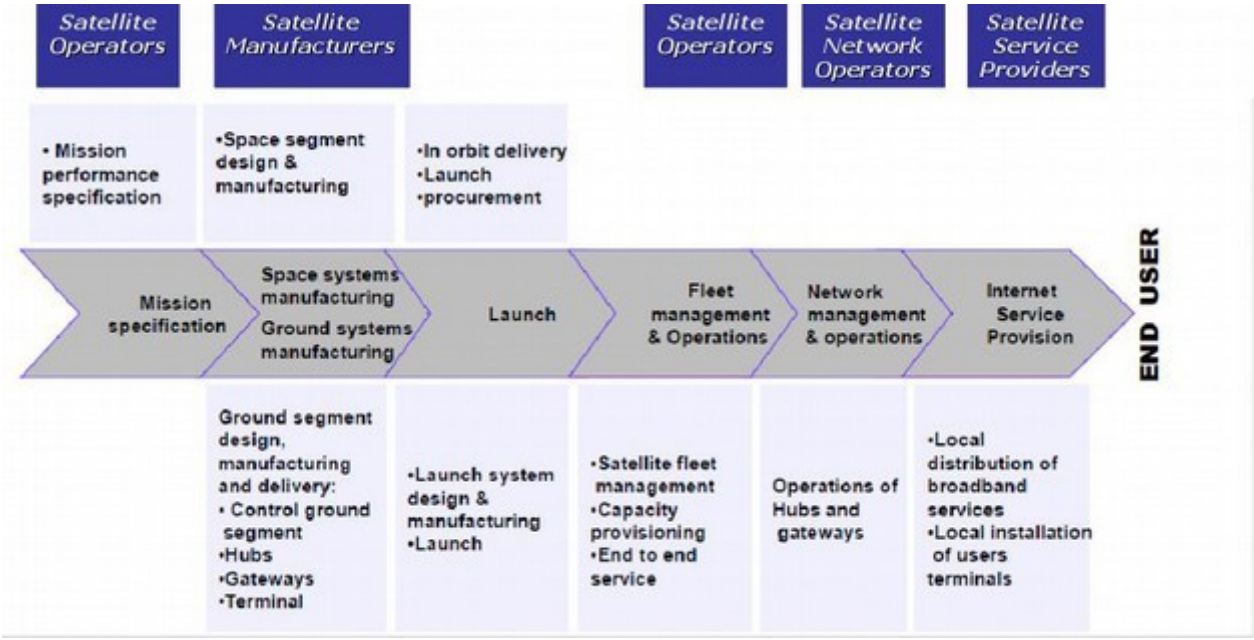


Figure 17: Satellite Broadband Value Chain

- Satellite manufacturers (e.g. Astrium) build satellites, following the demand of their clients, the satellite operators.
- Satellite Operators: (e.g. SES and Eutelsat) finance, own and operate the satellite(s) in geostationary orbit.
- Satellite Network Operators (e.g. Skylogic and SBBS) operate the ground stations (antennas and hubs) with terrestrial internet connectivity and provide network services.
- Satellite Internet Service Providers (ISPs): buy either wholesale capacity or off-the-shelf packages from the satellite network operators, set user charges and service levels (SLA) and sell retail service packages to end-users. ISPs own the user relationship: they are responsible for providing the service to end-users, including the equipment, for ensuring first-level customer support and for billing.
- Customer-Premises Equipment (CPE) manufacturers (e.g. Viasat, Newtec, Gilat): build and provide ISPs with the end-users equipment which consists of a 70cm – 120cm dish

depending on the satellite, the geographical location of the end-user and on the service deployed with radio equipment and the satellite modem. The price of the CPE varies between € 250-600 depending on the service provider.

- End-Users (e.g. Residential, SMEs, Business, Administration).
- As stated in the non-technological roadblocks chapter, satellite operators are not present in the retail market, and no vertical integration exists between the ISPs and the operators (owners of the infrastructures) in Europe. In the case of satellite, open access, a pro-competitive solution, is guaranteed via bitstream, the sole wholesale access product that complies with satellite specific architecture. Satellite operators do not give any exclusive rights to ISPs. Besides, there is no restriction on the ISP market, each ISP offering its own value-added services to the customers.

A notable result of the value chain is the economic sustainability at local level; in fact, the necessity of having a critical mass of knowledgeable persons able to sell and install satellite broadband equipment has positive consequences on the creation of new jobs.

3.6.2. Logistics and installations

With the advent of High Throughput Satellites (HTS) across Europe and low cost consumer grade satellite user terminals, satellite broadband is immediately available for rural and not-connected areas. In order to assist the subscribers over vast and dispersed areas, the Satellite industry needs to support the presence and the effectiveness of installer networks. Logistics and installation are two most important steps in the roll-out of any satellite network. Without either of these being achieved the actual adoption and ultimately the success of the solution will be forcedly limited., whatever the quality of service, speeds, volumes, additional services enabled as VoIP, etc.

The installer in facts is the only physical presence in the clients' home, having direct contact with the subscriber. He is the representative of the satellite operator, of the terminal equipment supplier, and finally of the Service Provider. Moreover, the installer is often acting as a point of sale consultant: in some countries, installers are actually responsible for over 50% of consumer grade services sales; therefore, they must be suitably trained to fulfil this role and correctly represent the industry.

The importance of this activity is further significant when considering that the changeover to

terrestrial digital networks is coming to a close across Western Europe, and satellite Pay TV networks are mature or maturing; as a consequence, the installation industry is keen to play an active role that implies new income streams: with this regard, satellite broadband services indeed represent an additional opportunity for local installers base.

The majority of installation companies across Europe are SMEs that typically started and flourished with the roll-out of satellite pay TV; with the advent of new technology – iLNBs, connected home and TCP LNBs – in the next few years, the industry will have to undergo a wholesale re-training to accommodate the IP centric equipment.

The industry needs to address quality control and training for its distributors so that the end user has a positive experience. The EU could facilitate the industry taking advantage of this opportunity by supporting Pan-European qualification schemes, designed around the needs of closing the digital divide across Europe.

3.6.3. Overview Of The Existing Offer

In this part we present the review of the retail offers of satellite-based consumer broadband internet, in terms of capabilities (e.g. peak speed and performance), service models and tariffing, completed by SABER in May 2013. The benchmark analysis relied on public data from different satellite broadband service providers operating in the European market. The main source of information was the websites of the aforementioned ISP resellers.

This study led to the production of a database on the satellite ISPs offers available in May 2013 in the countries represented in the SABER project (UK, Ireland, Germany, Austria, Switzerland, France, Italy, Poland, Romania, Slovenia, Hungary, Greece, Sweden, Norway and Spain) and can be found in Annex IV - Satellite Internet Access: Retail Offer Database

This initial work has been taken over in October 2013 by the Broadband-for-All website (www.broadbandforall.eu), an initiative of ESOA (the European Satellite Operators Association) supported by the European Commission, which includes continuously updated data (as well as links to the SABER project' activities).

This initiative was launched by the Vice-President of the European Commission, Neelie Kroes, to facilitate access to satellite broadband services through a non-commercial online tool that provides practical information to enable EU citizens to find a local service provider to supply them with immediate broadband connectivity irrespective of their location..

The former database provided by SABER lists every Internet Service Providers by country, and includes approximately 250 broadband retail offers (rows) organised around 6 parameters (columns) - download speed, upload speed, data volume, monthly subscription fees, price of CPE, satellite operators (Eutelsat and SES, members of the SABER project, plus Avanti, Hellas-Sat and Hispasat).

It is still presented in this deliverable, as these parameters are essential to understand the quality of service (QoS) and the value for money of the various satellite broadband commercial offers, namely the impact of speeds and volume on pricing. In fact the cost structure of satellite broadband services is somehow different from the one of terrestrial broadband services.

In particular, the use of the available satellite resources (bandwidth and power) depends more on the volume of exchanged data than on the peak download / upload bitrates. That is why caps are put on the volume of data that can downloaded and uploaded over periods of time – a few hours and / or a week – and when these limits are exceeded, the connection is temporarily slowed down.

As far as bitrates are concerned, the limiting factor resides mainly in the upload, as the speed is determined by the maximum allowable Effective Isotropic Radiated Power (EIRP) of a satellite terminal in order to remain within the type-approval regime.

The SABER database, as well as the Broadband-for-All website, confirms that the launch of

service in Ka-band is driving the prices down while increasing the speeds thus fostering the affordability and the acceptability for the end-user. This breaks the myth that satellite broadband is expensive and speeds are slow.
France, Germany and also UK, present the most attractive and affordable offering, mainly because of the intensive competition among several ISP resellers on the market.

However, the European satellite broadband market remains still negligible if compared with other regions of the world. Indeed, with some 220.000 subscribers in 2013, it represents more or less 16% of the worldwide global base of satellite broadband access subscribers which was estimated at about 1.4 million terminals in 2013. The scattering of the potential users in the European territory and the absence of a single digital market partly justifies the fact that satellite broadband is a niche market in Europe.

Western Europe represents the larger subscriber base; in Central and Eastern Europe the monthly services fees and especially the CPE cost and installation remains a barrier. More in general, there is no doubt that the addressable market of both un-served and underserved households and business in Central and Eastern Europe is important. However, the cost of service combined with the distribution challenge in the market makes this part of the European market challenging for growth of satellite broadband access services.

The widespread introduction of funding schemes, such as those available in some regions of Europe[20], could reduce this barrier, contributing to mitigating the digital divide and promoting the uptake of broadband in un-served or underserved regions.

3.7 Satellite Broadband In Support Of Digital Agenda Goals

Satellite broadband has delivered the EU Digital Agenda for Europe (DAE) for 2013 of basic broadband for 100% of Europeans citizens. However, as a conclusion to this chapter, we argue it is also necessary that satellite broadband is fully included in the EU broadband strategy to increase the take-up of broadband to ensure that all citizens and businesses are able to realise the benefits of broadband and that a new digital divide is not created.

[20] SABER Deliverable 3.2 – Regional / National satellite broadband implementation case studies

The information provided in this chapter confirms that satellite-based technology is an affordable, complementary solution to terrestrial broadband technology to quickly bridge the digital divide in Europe and bring Internet connectivity to the remaining 5%–10% of the European population which is still unserved or underserved – by and large rural and isolated – and which is, by definition, the most difficult and expensive to cover.

Deploying a satellite-based broadband solution may result not only in immediate service provision but also in securing large savings in terms of infrastructure cost in certain rural and scarcely populated areas.

The performance of satellite-based broadband services in terms of users' experience, cost efficiency, speeds, reliability and security is now comparable to that offered by many basic terrestrial broadband services.

The offer made available to the different European markets by satellite operators, such as Eutelsat and SES, are designed for different classes of users: individual households as well as entire villages, SMEs, and the public sector.

In order to fully exploit the contribution of satellite broadband to increase broadband penetration and take-up, there is the need to develop a close partnership between European public institutions and the private satellite industry.

This partnership should target improvements in awareness amongst stakeholders through the dissemination across Europe of updated and comprehensive information about satellite broadband (such as that provided in this document), and also propose plausible solutions to fully include satellite solutions in public procurements and minimise the effects of the obstacles that were identified in European, national and regional rules and regulations (see chapter 4). Finally, the establishment of common approaches towards the procurement of satellite solutions across European regions constitutes a de facto demand aggregation scheme (see chapter 4.5.2) for the possible use of EU funds.

4. Review of non-technological roadblocks and obstacles towards satellite broadband deployment in the EU

This Chapter is the result of the active collaboration of all SABER partners. The information, analysis and recommendations included in the following paragraphs are the outcome of SABER partners' intelligence gathering. Specifically:

1. Research and review of EU State Aid Broadband Guidelines and State aid Broadband EU Decisions.
2. Research and review of ERDF Operational Programs and EAFRD Rural Development Plans
3. Research and review of calls for tenders
4. Research and review of 2014- 2020 CEF and Cohesion Policy EU Regulations
5. Specific discussion on the deliverable subjects in four Workshops (Cork, Turin and Brussels) to iteratively review, and validate the network's findings and good practice case studies.

The final review of the chapter was carried out on the basis of partners' comments, analysis and discussion.

4.1 Introduction

Satellite broadband is a complementary technology for fast, reliable broadband internet access, ideally suited to providing instant solutions for broadband, especially for the most remote and rural users and for those in other not-spots.

As explained in chapter 3.5, the satellite operators have been investing over the last few years in new, innovative satellites and their related ground segment in order to be able to provide high-performance, yet affordable, consumer broadband services. Via the satellites launched by different European operators, Internet broadband services are now provided throughout the EU with download speeds up to 20 Mbps and upload speeds up to 6 Mbps.

In this context it is important to underline that the core network infrastructure necessary to supply satellite broadband services, i.e. the satellites with their related ground segment, as a result of significant private investment by satellite operators, is already in place, as recognised by the Scoreboard 2012 of the Digital Agenda for Europe.

This wide coverage means that while the cost of deploying terrestrial infrastructures (e.g. fibre backhaul) may increase incrementally for the final percentage of premises to be connected, the cost of providing a broadband satellite connection remains constant and not dependent on the geographic location of the user or their distance from nearby infrastructure.
In areas with scattered un-served users, satellite is often the most cost-effective solution, as the only missing network element needed in order to establish a broadband connection is the customer premise equipment.
The installation and activation at the user premises, even in the most rugged and remote terrains, can be undertaken in just a matter of days. Thus new users, irrespective of their location, can immediately take advantage of broadband services.

In this respect satellite broadband can complement terrestrial solutions in driving the penetration and take-up of broadband by citizens and businesses in underserved areas.

Providing broadband services over satellite to the general public is a new and developing market sector. Hence the new satellite broadband solutions, need to be better known (as observed in the DAE Scoreboard 2013) in order to be fully exploited.

Often, decision-makers at national and regional level may not be aware that satellite solutions exist, or that they are efficient, accessible and affordable. The satellite industry is a small industry, with limited marketing reach when compared to major telecoms operators and manufacturers. However the industry does work hard to inform decision makers of the developments taking place in the industry and their relevance to narrowing the digital divide.

Governments have been extensively investing in optical fibre in the backhaul; satellite broadband can offer an effective solution to address broadband not-spots not reached by any other terrestrial access.
Some EU Member States have considered satellite broadband implementation measures in the context of their national broadband plans (for more information see deliverable 2.3 Regional / national satellite broadband implementation case studies)

However the decisional practice shows that some of the past State Aid schemes approved by the European Commission (see examples in the next section 4.2 Non-Technological Roadblocks And Obstacles) were based on the assumption that satellite technology was not sufficiently appropriate to fulfil the deployment objectives.

In addition, current legal State Aid Broadband guidelines[21] tend to implicitly encourage the deployment of 'wired' infrastructures, which might explain why governments have decided to go down this route, even though it can be an expensive option.
In some cases, satellite broadband has not been given due consideration in public interventions to enable a faster rate of broadband penetration.

In the past some recurrent, non-technological roadblocks have prevented the submission of satellite-based solutions to some public tenders (sometimes because of the different architecture of terrestrial and satellite networks, despite both being able to deliver the same service).
The political focus of the EC towards terrestrial wireless and wired solutions to bridge the Digital Divide has generated situations in which it is very hard for satellite operators to take business decisions to further support the marketing and commercial investments needed to deliver broadband services in the EU.

More recently, however, it has become clear that some regions would prefer medium-speed broadband immediately rather than interminably awaiting for future superfast broadband links.
In this context, the SABER partners have come together to raise awareness about satellite broadband, analyse the non-technological roadblocks towards satellite communication deployment, provide recommended solutions and disseminate information throughout European regions on the benefits of satellite based solutions.

The main obstacles to satellite broadband deployment identified in public broadband strategies and presented in this Chapter are predominantly as a result of:

1.1 Lack of awareness at a Public Authority level.

[21] EU Guidelines for the application of state aid rules in relation to the rapid deployment of broadband networks

2.1 Inadequate / not technologically neutral treatment of satellite broadband solutions within rules and regulations, calls for tender (perception of non-level playing field with other technologies).

4.2 Non-Technological Roadblocks And Obstacles

4.2.1. Lack Of Awareness At Public Authority Level

The lack of awareness about the new developments in satellite broadband solutions makes it difficult for Public Authorities to include satellite based solutions in their broadband schemes. One of the major reasons is that satellite solutions suffer from a negative image derived from old generations of Internet via satellite (services too expensive, performance perceived as not satisfying needs and limited competition).
Unfortunately, even in very recent studies, this image is perpetuated despite the fact that current services are efficient, accessible and affordable, as demonstrated in chapter 3.6.3 Overview Of The Existing Offer.

In the recent past, this misperception has regrettably often, had a negative impact on EU State aid decisions on broadband deployment. The decisional practice shows that some of the past State Aid schemes approved by the European Commission were based on the assumption that the satellite technology was not sufficiently capable to fulfil the deployment objectives.

As illustrated in the following section, some of the statements submitted by national authorities in the context of the State aid notification were incorrect, misleading or out-of-date (e.g. about the prices and speeds of satellite broadband). The EC assessment and approval of such State aid schemes was therefore based on erroneous facts as to the capabilities of satellite technologies.

See, for example, what stated in the DAE Scoreboard 2013[22]: “Countries with the lowest coverage are Slovakia, Estonia and Slovenia; of which Slovakia and Slovenia are fully covered by satellite broadband.” And the relative footnote: “The reason for presenting broadband coverage also with and without satellite technology is that currently the take-up of satellite broadband is marginal,

[22]DAE Scoreboard 2013

which may partly be caused by the novelty of high-speed KA-band satellite technology." In fact in those EU Member States, satellite broadband in not eligible for funding.

Some typical examples of such misperceptions are provided below. The statements contained in these examples are reviewed in this section and the misperceptions highlighted.

The WIK report, 2011

One of the most recent examples is the "Study on the Implementation of the existing Broadband Guidelines[23]: commissioned by the European Commission Directorate-General for Competition (DG Comp) to WIK Consult GmbH in order to prepare the latest revision of the "EU Guidelines for the application of state aid rules in relation to the rapid deployment of broadband networks" (hereinafter referred as the "State Aid Guidelines for Broadband").

This study was presented to representatives of the Member States, the European Commission and BEREC in November 2011, during the multilateral meeting "Revision of the State Aid Broadband Guidelines" in Brussels.
Published in December 2011, the WIK study draws conclusions using old data on satellite broadband and without considering the most recent developments in satellite technologies. European Satellite Operators were not given the opportunity to input to the study.

The study also reports incorrect assumptions on satellite broadband made by public authorities without challenging them.

A few excerpts from the WIK report are reported below to illustrate some misperceptions:

1. "The provision of broadband services in rural areas in Baden-Württemberg (or parts of these communities) that do not have affordable access to this kind of telecommunications services apart from expensive satellite or leased line broadband solutions"
2. Technology neutrality posed a problem as the subsidised solution should guarantee a reliable, fast and secure network. Therefore, broadband satellite technologies were treated in a special way as from the perspective of the Lombard authorities these services are still lacking the

[23] WIK-Consult: COMP/2011/006 Study on the Implementation of the existing Broadband Guidelines, - Final Report, 7 December 2011

necessary speed and other performance criteria in order to fulfil the broadband requirements set by the authorities. Download and upload speed via satellite are not perceived to be satisfying. Note that "the main objective of the project is to expand the existing ADSL broadband coverage with a minimum of 2 Mbps to 99.7% of the population in Lombardy."

3. Ensuring technology neutrality might cause a challenge for the public authorities. Depending on the intended type of broadband access to be provided there may be technological solutions which are in principle not suitable to deliver the requested performance. Against this background the Italian authorities for example limited the role of satellite technology in the Lombard case to a niche contribution to broadband coverage.
4. Satellite broadband offerings in all likelihood are considerably higher-priced as regular broadband services.
5. Furthermore, broadband satellite equipment requires sometimes substantial infrastructure installations and costs (satellite dish) at the consumer premises.
6. The end-user has to buy specific hardware for satellite based internet access which may cost up to several hundred Euros.
7. It is also assumed that broadband satellite technologies tend to establish de facto monopolistic structures and to limit open access.

The House of Commons Report - Wales - 2012[24]

"Satellite transmissions may be affected by weather conditions or local obstructions including foliage and trees, and the cost of installing and running satellite broadband could be expensive compared with other types of broadband."

State Aid to rural broadband - Sweden - 2010[25]

"Broadband through the fixed telephone network dominates in rural areas. However, this network is being partly eliminated as old and obsolete parts of it result in excessive operating costs by which approximately 50.000 households will be affected until 2015. The vast majority will be able to obtain wireless or satellite services through the market, but there is a risk that the number of businesses and households lacking access to high-capacity broadband may increase."

[24]Broadband services in Wales, First report of session 2012-2013, Welsh Affairs Committee, September 2012}
[25]State aid to broadband within the framework of the rural development program - 25/03/2010 C (2010)1916 State aid N 30/2010 – Sweden

"According to the Swedish authorities, currently satellite broadband offers do not provide adequate services on these areas for several main reasons:

- due to Sweden's geographical location, the overall satellite coverage is not optimal in all rural areas;
- as with other radio based solutions, deep forests and valleys make it difficult to achieve good coverage in all areas,
- the price plans are not commercial attractive, some 4,5 € per Mb consumed traffic or 1 € per minute connected,
- bandwidth does not reach requirements for decent broadband (2 Mbps),
- asymmetric connections make uplink slow and create long response time, i.e. limit available services."

State Aid to rural broadband – Asturias, Spain – 2009[26]

"The Spanish authorities state that the persisting lack of broadband availability in the rural areas of Asturias is due to the geographical characteristics of the region which have caused private investments to be insufficient. In particular, due to the mountainous nature of the territory, even when the telecommunication infrastructure exists, its distance from the users' premises is so large that adequate service cannot be ensured. As for mobile connectivity, the Spanish authorities identified certain rural areas in which coverage does not go above 25%. State subsidised satellite access has been made available only in some of the localities targeted by the measure (based on current market prices, satellite broadband is not considered as an affordable option, as the very low take up rate proves.), but the performance level is deemed unsatisfactory by the Spanish authorities (due in particular to the maximum download speed not going above 512 kbps)."

Broadband Network Development Strategy, Slovenia, 2008[27] (still in force)

"Satellite connections disadvantages:

1. High costs for the end user.
2. Low transmission speed in the direction from the user"

4.2.2. Inadequate / Not Technologically Neutral Treatment Of Satellites (NO Level Playing Field With Other Technologies)

The Framework Directive 2002/21/EC of the European Parliament and of the Council of 7 March 2002 on a common regulatory framework for electronic communications networks and services sets the principles of technology and service neutrality as a rule. Exceptions are possible where properly justified, or to promote social, regional or territorial cohesion or avoid inefficient use of spectrum (for service neutrality).

In this respect, Commissioner Kroes more recently confirmed "The EC takes a technologically neutral approach to promote innovation and competition […] keeping a close eye on state aid

[26]Excerpt from Broadband in Rural Areas of Asturias - 14/12/2009 C (2009)10259 State aid N 323/2009

[27]Broadband Network Development Strategy in the Republic of Slovenia, 2008, Government of the Republic of Slovenia

practices to ensure that certain wireless technologies do not suffer undue discrimination"1

However, some countries have occasionally put aside, without any justification of exceptions, the technological neutrality principle in their race to the deployment of optical fibre, even in rural and remote areas.

Indeed, this ex ante predetermination of a specific technology might comprise the achievement of 100% connectivity in support of the Commission's goal of a Connected Continent. Any reference to unnecessary and/or discriminatory technical requirements that, by disadvantaging satellite, might lead to the non-respect of the principle of the cost-effective use of the public funds, i.e. might eventually contribute to a misspending of public funds.

Broadband Calls For Tender: Cases Of Satellites Exclusion

Another major non-technological roadblock for satellite broadband is the way the Calls for Tender /Proposal for the procurement of broadband internet solutions and services are drawn up.

Many Calls for Tender/Proposal are conceived without taking into consideration the characteristics and features of satellite broadband, thus excluding *a priori* the opportunity for satellite ISPs to participate in the procurement process.

Indeed the low level of participation of satellite ISP in past public Calls for Tender / Proposal was observed also by the European Commission that stated: "Based on the feedback that we receive from the Member States, we understand that satellite operators rarely participate in broadband tender procedures"[28]

The most frequent recurrent non-technological roadblocks that make ISPs unable to apply for public calls are:

- Satellite network architecture not taken into account.
- Bundling service objectives with unnecessary infrastructure requirements.
- Non-observance of the Technology Neutrality principle.
- Supposed lack of open access in satellite broadband

Each of the four non-technological roadblocks are discussed in more detail below:

[28]DG COMP / DG INFSO - HT.3095 - Revision of the State aid Broadband Guidelines – Reply to ESOA letter dated 26/03/2012 on concerns and recommendations in the context of the EC revision of the broadband guidelines, 26/03/2012. Airbus D&S, Eutelsat and SES are members of ESOA (the European Satellite Operators' Association)

a) Satellite network architecture not taken into account

The following statements are commonly included in calls for tender:

- The technology neutrality is guaranteed in this tender.
- The performance provided by broadband infrastructure will be taken into consideration regardless of the adopted technology.
- A model of technology-neutral network (see example in figure 16) is defined, in order to identify the key points of the network relevant to the assessment of the proposed architecture.
- The definition of a network model that respects the neutrality of technology makes it possible to identify points of logical evaluation of the sizing and performance measurement.

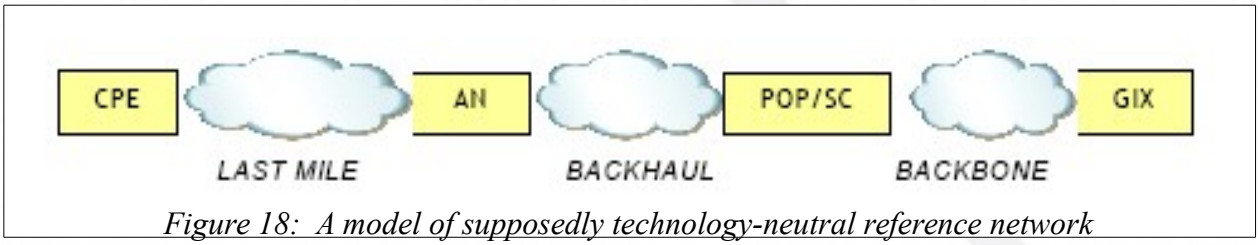


Figure 18: A model of supposedly technology-neutral reference network

However calls for tender designed in this way are unable to make a comparative performance assessment of satellite-based solutions, thus implicitly excluding them from bidding. In fact, with reference to figure 18, it should be noted that:

In satellite networks, there is no architectural separation into backhaul and last mile.

Figure 19: Satellite broadband network reference architecture

Therefore procedures that ignore the satellite network architecture are usually not consistent with the principle of technology neutrality.

Unfortunately this issue was not addressed and consequently not resolved by the revision of State Aid Broadband Guidelines published in January 2013. Therefore the risk that future grants or procurement processes for broadband are not based on genuine technology neutrality (to the detriment of satellite solution) is still present.

One significant example of this non technological roadblock is the State Aid Memorandum – Support for setting up broadband networks in the underserved areas. - Romania – May 2011[29]
In spite of the claim of technology neutrality, the "indicative broadband infrastructure model" (see figure 18) proposed is not applicable to satellite networks for the reason explained above

[29]Concept Paper of the Ministry of Communications and Information Society - Intermediate Body for the Promotion of the Information Society - Romania - State aid Memorandum - Priority Axis 3 - ICT for Private and Public Sectors - Support for setting up broadband networks in the underserved areas. May 2011

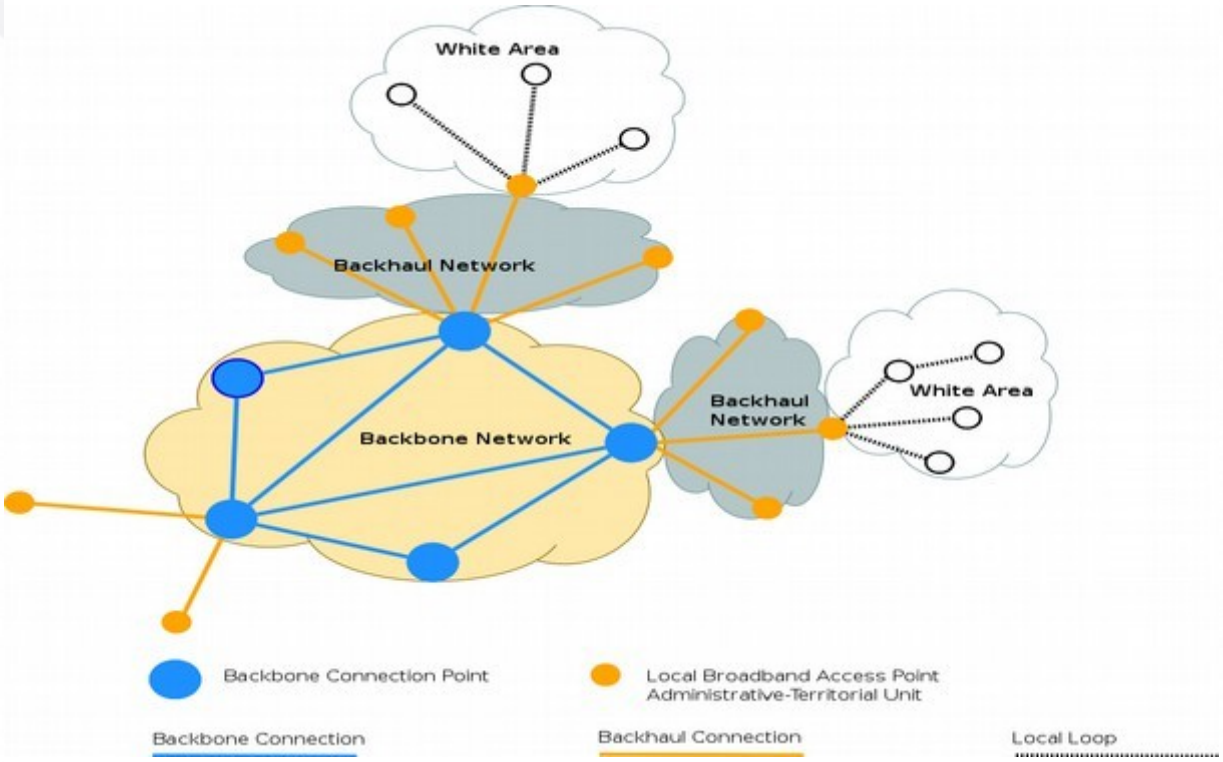


Figure 20: Network elements

"Backbone" means the main high capacity, high reliability, low latency data routes between large, strategically interconnected networks and core routers in the internet;

"Backbone connection point" means the connection point between the backbone and the backhaul;

"Local Broadband Access Points" (LBAPs) will comprise the buildings and related physical structures, as well as the telecommunications equipment housed within. It is likely that every administrative-territorial unit will have a LBAP;

"Backhaul network (distribution)" is defined as the intermediate network links between the backbone and the access sections of the network, consisting in connections of the individual LBAPs to backbone, via broadband links. In the area of the intervention of this project, the backhaul consists of the intermediate links extending from the existing backbone network to the newly constructed LBAPs or among the newly constructed LBAPs, including the equipment in the LBAP and equipment for the backbone insertion points;

"Local loop (last mile)" means the physical circuit connecting the customer premises to a distribution frame or equvalent facility/aggregation point (LBAP).

b) Bundling service objectives with unnecessary infrastructure requirements

Another typical non-technological roadblock for satellite broadband is somehow related to the principle of territoriality foreseen in the regional (ERDF) and agricultural (EAFRD) funds.
In fact, depending on its interpretation, this principle can restrict the technology solutions eligible to grants to terrestrial wired and wireless ones only.
The most significant example is the Polish Operational Programme Innovative Economy (OPIE) 2007-2013, January 2009, measure 8.4. The text on the objective: "Ensuring Internet access at the 'last mile' level", includes the following requirements:

- "[…]. creating a possibility of direct provision of access to Internet service at the so called 'last mile' […]."
- "projects based on co-financing construction of a dedicated tele-information infrastructure between the nearest or most effective point of Internet distribution and target group(s)"

However, restriction of technical solutions to 'construction' and 'nearest point of Internet distribution' is adding unnecessary infrastructural constraints to the service requirement and the actual objective of bids, and is also in contradiction with the EU principle of "Use of existing infrastructure" applicable to State Aids.
As a result, projects submitted by ISPs that proposed satellite broadband access were rejected on pretext of "Satellite networks do not contribute to the creation of a public terrestrial infrastructure" and "Connection must be established between the nearest or most effective point of Internet distribution and the end user".

c) Non-observance of the Technology Neutrality principle

In spite of the commonly-accepted principle of technology neutrality in public procurements. there have been instances where a different treatment was given to different technologies within calls for tender.
The most significant example is again the Polish OPIE mentioned above. Some reviewed technical criteria for the call, published in October 2012, included the following award criterion: "The various technologies are assigned the following maximum number of points:"

Network implemented in fibre optic technology (FTTH)	*35*
Network implemented in fibre optic and copper technology (FTTC, FTTB)	*30*
Cable television networks made of coaxial cables	*25*
Networks implemented in copper technology	*20*
Radio systems in protected band	*7*
Radio systems in unprotected band	*5*
Data network on Power Line, or satellite systems	*5*

This award criterion contrary to the principles of technology neutrality as it scores the technology rather than the capability of the solutions provided. As a result, no satellite bid was selected among the various proposals – although broadband internet service in line with the objective of the call (direct provision of access to broadband Internet service at the so called "last mile" level) – can be provided also via satellite in an effective way in Poland.

d) Supposed lack of open access in satellite broadband

The lack of knowledge and understanding of the value chain for satellite broadband, namely of the difference between wholesale and retail, is at the origin of another non-technological roadblock based on the pro-competitive concept of open access, that has to be applied in broadband procurement in compliance with the Telecom Package Directives and the State Aid Guidelines for Broadband.

For instance, in this regard, the previously mentioned WIK report states that: "It seems that one of the reasons why satellite operators do not usually participate in such tenders is that aid beneficiaries have to provide open access to the subsidised network, and satellite operators are not ready to do that by disclosing the existing access protocols".

However, as explained in the chapter 3.6.1:

Satellite operators are not present in the retail market, and no vertical integration exists in the European satellite market between the service providers and the operators (owners of the infrastructures)

This alleged lack of open access is sometimes used to exclude satellite broadband from the eligible solutions in State Aid decisions and Call for Tenders / Proposals.

In reality, open access in the satellite service provision is guaranteed via 'bitstream', the sole wholesale access product that complies with the specific network architecture of the satellite solutions[30].

Bitstream refers to the provision of transmission capacity to service providers which offer their own value-added services to their customers. Therefore "satellite ensures open access via an active infrastructure" [31].

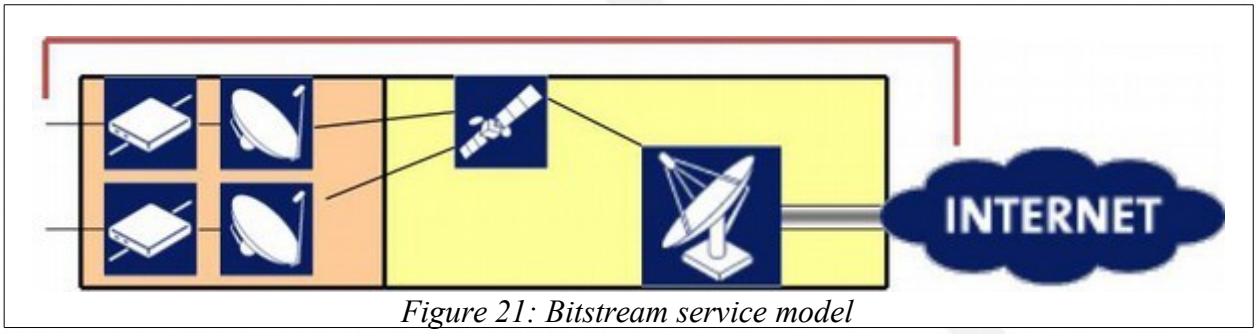


Figure 21: Bitstream service model

In addition, measures supporting the deployment of broadband satellite solutions introduce less competition distortion than the measures supporting terrestrial networks: the aid, if any, is provided for customer premise equipment (satellite ground equipment / terminals), and the beneficiaries are the end users (households, SMEs and Public Authorities) and not the satellite operators. Indirect beneficiaries are the satellite ISPs which sell, install and maintain the CPEs.

Finally, the information provided in 3.6.3 shows that competition exists in every EU country among the satellite operators (at different orbital positions) as well as among satellite ISPs working at the same orbital position.

4.3 Recommended solutions

The preliminary analysis developed in this chapter has identified non-technological roadblocks towards satellite broadband deployment, even in the European areas that have no prospect of being efficiently and cost-effectively served with terrestrial solutions.

[30]Draft EU Guidelines for the application of state aid rules in relation to the rapid deployment of broadband networks, 2012

[31]Guide to broadband investment, Analysys Mason, September 2011

These roadblocks often prevent the use of EU funds and public funds in calls for tender / calls for proposal or other public procurement schemes for satellite based solutions in some countries.

The introduction of plausible adaptations and improvements – intended to better include satellite-based solutions among the ones supported by EU funds for the achievement of 100% EU broadband penetration – to this current, anti-competitive situation, require the pro-active assistance and support of the EC.

There is a need to clarify and improve, ideally through a minimum set of common, clear guidelines to be drawn up by the EC for the attention of the various public stakeholders in EU Member States and Regions, many of the existing rules which are often designed with terrestrial infrastructures in mind. In particular:

- ***The principle of technology neutrality (level playing field between the various technologies) should be genuinely implemented.***
- ***An ex-ante cost-effective analysis of the various solutions for broadband connectivity should be mandatory, as the competitive tender procedure alone does not guarantee the choice of the most efficient and cost-effective solution***
- ***A proper consideration should be given to the specificities of the satellite network architecture (e.g. no separation between backhaul and access).***
- ***Satellites should be explicitly recognised as existing infrastructure, and as such potentially able to significantly reduce the investments costs in certain areas.***
- ***The clear eligibility of the satellite equipment to public funding should be re-stated.***
- ***Due consideration should be given by the EC to update the various broadband and State Aid guidelines to reflect the observations outlined in this deliverable.***

4.3.1. Absence of mapping and cost-benefit analysis

The need for a reliable mapping process

In order to achieve the EU broadband objectives of the Digital Agenda for Europe, reliable and valid data on existing infrastructures, broadband services already offered, etc. is fundamental. Such data can support planning and decision making processes as well as inform citizens and authorities on the current broadband situation.

Mapping activity has to deal with many different aspects, including infrastructure, broadband service availability, broadband demand, investment and funding and others.

The most relevant aspects for SABER partnership are existing infrastructures and available broadband services

Overall, a suitable mapping of broadband infrastructures and other related data will help to identify gaps of broadband coverage and penetration in the EU, to identify suitable areas of investment, and to cut investment costs. Additionally, it will avoid duplication of financing as subsidies can be allocated to areas truly affected by market failure.

Mapping is not simply a methodology but a process that shall be accepted and implemented by each individual region.

Studies carried out in recent years have been mainly based on the data provided by broadband network operators, but those operators are often reluctant to disclose to government whether it offers service to some regions, how much it costs, and other parameters of availability. Lobbying firms and not-for-profit organisations geared up to battle for funding since there could be lucrative government contracts in the future.

Despite the politics behind the mapping efforts, the statements by cable and telephone companies could undermine choices for consumers. When studies were done properly, broadband speed and availability were below those reported by similar “official” efforts.

The lack of a standard process for mapping

Broadband and infrastructure mapping in general is a very heterogeneous field with different approaches of mapping as well as diverse challenges regarding regulations and data security aspects both within the EU and within Member States. Providing appropriate data and ensuring data accuracy vis-à-vis pre-defined levels of detail are crucial to set up a reliable and useable broadband and infrastructure mapping.

Both in EU Member States and elsewhere, broadband-related mapping initiatives have already been established to some extent. Notwithstanding their overall aim to support effectively the deployment of high-speed broadband Internet, the initiatives reflect a range of different methodologies, data and implementation.

Currently there is a lack of a European-wide accepted guideline for mapping where satellite is definitely among the available options.

As an example, if we consider the *technology combinations* in the **Broadband coverage in Europe in 2011** (Research Report, for the SMART 0027/2011 Project), the combinations which are provided by the project are: "*Standard Broadband*", comprising the net coverage of all the fixed-line technologies capable of providing at least 2 Mbps downstream (DSL, FTTP, WiMAX and Standard Cable); and "*Access Broadband*" which represents the fixed-line technologies capable of at least 30Mbps (VDSL, FTTP and DOCSIS 3.0 cable). Note that **satellite technology is absent from both combinations!**

As with other thematic maps, there are no standard procedures for mapping broadband information. Rather, different studies have been done using different geographic and data rate parameters. Geometric units such as *census tracts* as well *as zip codes* have been used.

Although the term *broadband* has a clear technical meaning, it has been used for marketing and policy purposes to generally apply to relatively high-data-rate (and thus more expensive) Internet access, while technology changes over time.

In June 2013 the European Commission – Directorate-General for Communications Networks, Content and Technology – has commissioned a study focusing on a review of current broadband mapping initiatives in the EU and the development of appropriate methodologies (SMART 2012/0022). The following picture shows the approach proposed in that study.

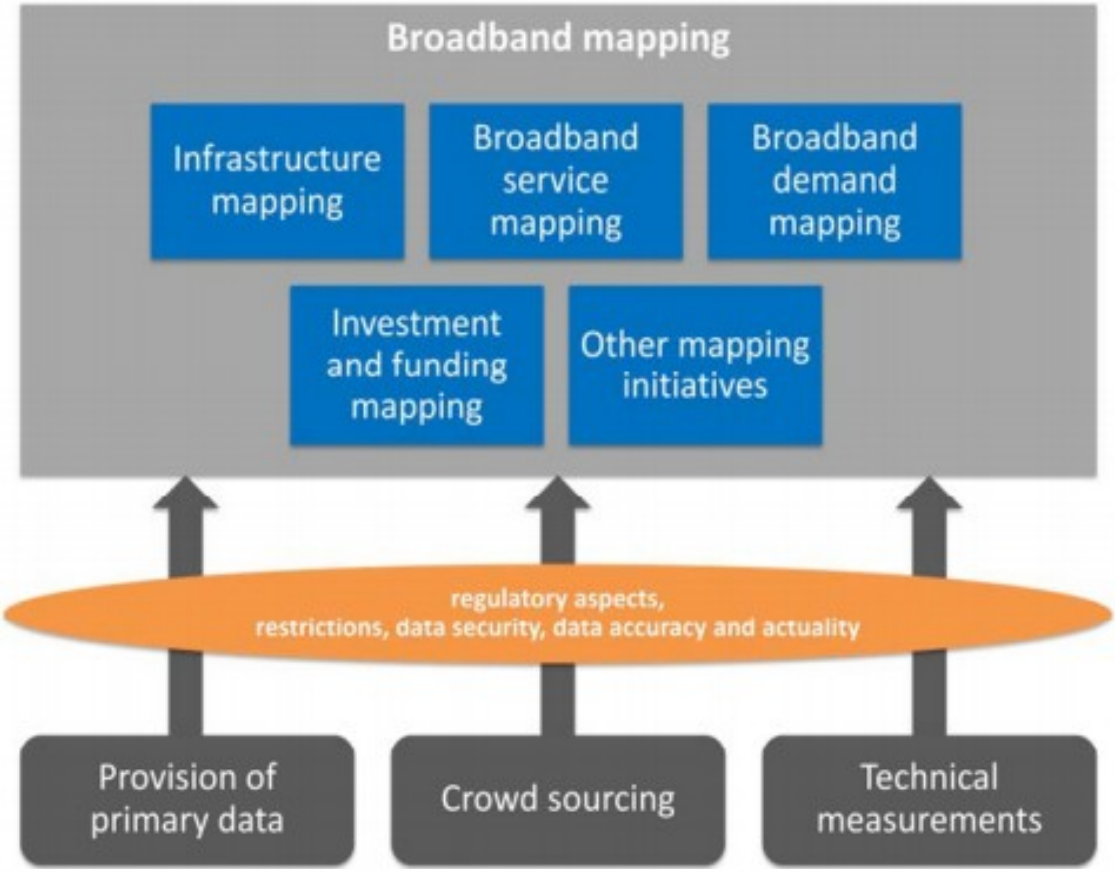


Figure 22 - Types of and sources of data for broadband mapping [www.broadbandmapping.eu]

The need for a European Broadband Mapping Initiative

All the needs mentioned above can be addressed by developing a European Broadband Map (EBM), which aims at providing a searchable and interactive website that allows users to view broadband availability across every neighbourhood in Europe. The EBM should be updated at most every six months to keep track of all the recent improvements in broadband connectivity.

The broadband data used to populate the European Broadband Map shall arrive, at a National level, from National Agencies that shall be involved to gather data on the availability, speed, and location of broadband services, as well as the broadband services that community institutions, such as schools, libraries and hospitals, use.

The initiative shall comprise the definition of a **comprehensive broadband dataset** as well as a data review and validation process to ensure data integrity.

The initiative is an ongoing, collaborative data collection, review and revision process that involves the **combined efforts of local, state and regional governments, broadband providers, private contractors, community anchor and academic institutions, and many community members across the country**.

Since broadband providers can submit data in a variety of formats, there is a need for technical assistance to support the efforts of smaller providers to participate in this effort, including analysis and verification methods, from drive testing wireless broadband service across their highways to meeting with community leaders to receive feedback.

Key requirements of a European Broadband Mapping Initiative

- Accurately portraying broadband availability and unavailability.
- Preserving provider competitive advantage and confidentiality.

- Coordinating provider data through a neutral third party.
- Addressing the issue with the **selection of data (taxonomy) and their normalisation**, because they come from many different sources: here a fundamental role can be played at a European level, for example the abovementioned study.
- Promoting wide use of **social communication, social networks and viral communication for gathering data about broadband availability**: a relevant *example is from Galicia (*http://cobertura-pdbl.xunta.es/).
- Providing guidelines to all the stakeholders to allow for efficient data collection.
- Agreeing on standard rules and guidelines to **layer / merge data of different scopes**: *global, local, from operators, from citizens, other.*
- Defining a **standard process for continuous update of maps**: *here a fundamental role can be played by Digital Agenda Agencies at a national level.*
- Agreeing on a mapping protocol, including the most appropriate scale for data collection, analysis and display.
- Agreeing on a speed tier protocol.

Mapping protocol and the Integration Process

To summarise, the scope of the mapping protocol is to provide the relevant authorities with the most comprehensive and accurate assemblage of broadband availability. This effort must be accomplished by integrating provider data on speed and availability from the address level.

Supplied Data Specification broadband providers submit to a third-party location-based reference(s) (e.g., discrete addresses or map-based service area delineations) for available broadband services. Each provider can be coded by the highest available speed tier offered. Each speed tier represents a combined upstream and downstream speed.

The data provided from different sources shall be integrated into a single dataset using a **commonly accepted Data Model**. The integration process may include comparison to other government and third-party datasets. Comparisons with other existing datasets help to identify the extent to which the data collected under this effort matches availability and speed information that have been collected elsewhere. Multiple matches can help solidify confidence in a given result.

However, note that, since data of this granularity has never been collected before, non-matches do not indicate that the information is inaccurate.

4.3.2. Cost effectiveness analysis for broadband deployment

The Digital Agenda for Europe (DAE) underlines the importance of fast, reliable broadband internet for social and economic growth, highlighting the key-enabling role that basic and very high speed broadband have to play if Europe wants to succeed in its ambitions.

Thanks to satellite broadband, the entire European Union territory is 100% covered, in line with the EU target fixed by the Digital Agenda for 2013 (basic broadband for all). However, as previously stated, the actual penetration of broadband internet in Europe remains very low.

This low penetration is among others the result of the current European and national broadband strategies focused on Public Aid (grants) predominantly for the deployment of fibre-based, and/or sometimes mobile/wireless, terrestrial networks even in un-served areas.

These strategies tend to support only the supply side and do not fully take into account the principle of the use of existing infrastructure. Unfortunately, this approach often fails to meet the needs of those citizens in remote locations willing to access broadband services, the so called “last x%”.

In addition, this approach is often lacking a transparent comparison of all the available technological solutions in terms of their capability to provide the required services.

There are event cases in which satellite broadband is not taken into account among the possible solutions on the basis of pre-concepts of their performance and costs without any proof of evidence. This, of course, goes against the principle of technology neutrality.

More in general, satellite broadband is penalised in Public Aid measures because the choice is made by EU Public Authorities on the basis of technologically-driven criteria, often established having in mind the terrestrial networks: satellite network having a completely different

architecture, different characteristics and behaviours, their performance and capabilities are compared in an unfavourable and unfair framework. This constitutes an improper application of the principle of technology neutrality.

Presently, Public Authorities in the EU are supposed to select the best economic offer for broadband connectivity, which subsidies are award to, just through a competitive tender process (see "EU Guidelines for the application of State aid rules in relation to the rapid deployment of broadband networks")[].

In fact, this approach cannot always guarantee a fair choice of the most efficient and cost-effective solution, and therefore the Public Aid (and the minimum duration) is kept at the minimum necessary, unless an *ex-ante* cost-effectiveness analysis of the various solutions is carried out.
Therefore a cost effectiveness analysis could help Member States to identify the advantages of each technological solution with respect to its capability to fulfil the needs, e.g. in terms of:

- **total cost and cost effectiveness (value for money);**
- **timing of the deployment;**
- **expected penetration;**
- **capacity to meet the needs of the "last x %" as well**

Choosing the best mix of technologies to achieve the political objectives of broadband in due time and limiting the total amount of aid needed (principle of proportionality of public aid) is essential.

In fact, decisions about subsidies should not be based just on the cost of making a service available to the users in a target area, but also on the time needed for actual deployment and on the real added-value brought to the users.

Finally the cost effectiveness analysis could help to identify the benefits of the use of satellite-based solutions in both the access part (i.e. for user access to the broadband Internet) and the core of the network (i.e. for off-loading and preventing potential network congestions mainly due to linear video) and the contexts in which satellite-based solutions are the most cost-effective choice

to fulfil the expressed needs.

Cost effectiveness analysis suggested elements:

- Making explicit the expected objectives on the basis of service specifications and time horizon for the different technologies (or a suitable mix where appropriate).
- Setting indicators vs. expected objectives for the success of the use of Public Aid on the basis of 3 scenarios:
  - high expectations
  - mid expectations
  - low expectations
- Providing frameworks for a fair comparison of the costs related to different solutions reasonably meeting the same objectives.
- Setting indicators on direct outcomes (e.g. increase penetration rate; increase number of subscribers per different categories of users (households, Public Administrations, SMEs) and applications (e.g. teleworking, e-commerce, e-gov transactions, ICT in local schools, e-health services, etc.).
- Proposing improvements based on the cost effectiveness analysis within the competitive selection process.

Moreover, the cost effectiveness analysis needs to consider the following issues:

- Economic sustainability of broadband service provisioning beyond the subsidy: maintenance costs of each solution shall be taken into account, as they might anyway lead to a negative balance for the ISPs in case of insufficient take-up, particularly in rural areas.
- Peculiarities of each broadband technology, including mixed architectures.
- Compliance of the different broadband solutions with the current EU legislation for Public Aids.
- User demand and willingness-to-pay for different types and levels of broadband service.
- Differentiation of needs per category of users (households, Public Administrations, SMEs).

4.4 Barriers and hidden obstacles encountered in deploying satellite solutions

4.4.1. Overall considerations over Cohesion Policy and EAFRD 2007-2013 and recommendations for 2014–20 Framework

Cohesion policy framework 2007-2013

The Digital Agenda for Europe (DAE) sets 3 major targets for broadband: (a) by the end of 2013, basic broadband available to all Europeans, (b) access to Internet speeds of above 30 Mbps for all Europeans by 2020, and (c) Internet Speed above 100 Mbps for 50% or more of Europeans by 2020.

To reach those targets, DAE included, in Pillar IV (Fast and Ultrafast Internet access), action 46 (funding of high-speed broadband) to reinforce and rationalise Broadband investments through EU instruments by 2013 (mainly Cohesion Policy Funds) and by 2020 through the Connecting Europe Facility (CEF), Horizon 2020 and the European Structural and Investment Funds (ESI). The relevance of ICT sector, and broadband in particular, in the 2014–20 programme is so high to be the fourth European Concentration thematic objective for economic Growth and Job Creation.

This is particularly important in consideration of the fact that, even though Satellite broadband allowed achieving, from 2011, the DAE 2013 100% basic broadband coverage across Europe, the European broadband penetration is still low and therefore the benefits of broadband take-up envisioned by the DAE have yet to be fully realised. One of the reasons, apart from the one highlighted in the COHESION POLICY: STRATEGIC REPORT 2013 in terms of severe delays in broadband investments with a project selection rate at 58 % of the total ERDF budget because of the lengthy approval process, is the minimal inclusion of satellite broadband in ERDF and EAFRD financing. Even though satellite broadband dramatically improved service performance and costs and having the ubiquity and immediate deployment characteristics, it is worth mentioning that a strategic, cost effective broadband approach, based on a mix of technologies, that includes satellite, could have efficiently incremented the rate of interventions, funds absorption and consequently European GDP. Despite a strong awareness raising activity by satellite operators to Public Administration at all levels, “satellite take-up is not yet widespread in

rural areas"[32], as a result of not being included as a possible solution within their specific broadband plans.

Cohesion policy framework 2014–20

Cohesion policy framework 2014–20, with the budget reduction of the Connecting Europe Facility, is more and more fundamental to reach the DAE Targets.

That is why the EU Commission proposed:

- to include the ICT sector as the fourth Concentration thematic objective for ERDF;
- to make the funds of ICT infrastructure eligible to ERDF also in more developed and transition regions;
- to underline the importance of 2020 DAE target (30Mbit/s for all and 100Mbit/s for 50% of the European population) for Member States' future broadband investments.

While the first and the second bullet points are coherent with the overall European Policy, the third one could create misinterpretation, for the EU Member States, on the eligible infrastructure that could be financed by the ESI funds 2014-2020 (at speeds higher than 30Mbps).

In other words, the fact that broadband access of at least 30 Mbps for all is a priority of the Digital Agenda for Europe, "does not prevent ESI Funds from supporting broadband roll out below 30 Mbps if the predictable path towards such target speed by 2020 is confirmed"[33].

In this context it is important to underline that the DAE targets are political targets and that ESI interventions in broadband networks need to be in line with national and/or regional Broadband plans[34].

[32]DAE Scoreboard 2013 - Key performance target 1a: the entire EU to be covered by broadband by 2013.

[33] Letter from DG-Regio to ESOA 23/12/2013 answering the lettr sent from ESOA rto Commissioner Han. Airbus D&S, Eutelsat and SES are members of ESOA.

[34]See the Communication from the Commission (COM(2010) 472 final) of 20 September 2010 on European Broadband: investing in digitally driven growth.
In this Communication the Commission asks Member States to align their National Broadband Plans to DAE targets. Not being compulsory, some Member States decided on different timelines (See SABER Deliverable 3.2)

Apart from this evidence, unfortunately, the EU ESI Funds[35] legislation and Commission guidance documents for the programming period 2014-2020, are not clear on the opportunity to allow Member States to finance both basic and high speed broadband within the EU funds budget 2014-2020. In particular:

The REGULATION (EU) No 1303/2013 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 17 December 2013 explains the assessment of:

- Ex ante conditionalities (definition in article 19) where the "fulfilment shall be limited to the criteria laid down in the Fund-specific rules and in Part II of Annex XI.". Even though there is no mention of speed, in the mentioned Annex XI and in the EU Commission specific document "Guideline on ex ante conditionality's part 2", there is a clear definition of NGN as networks with speed of at least 30Mbps1. This without mentioning the opportunity to finance also basic broadband, could create confusion for the EU Member States in consideration of the fact that "applicable ex ante conditions means a concrete and precisely pre-defined critical factor, which is a prerequisite for and has a direct and genuine link to and direct impact on the effective and efficient achievement of the specific objective for an investment priority or a Union priority";

The REGULATIONS (EU) No 1301/2013, and 1305/2013 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 17 December 2013 included, in the corresponding Annexes clear statements on the indicators at the basis for monitoring, evaluation and review of performances end ex ante conditionalities criteria:

- **ANNEX I: COMMON OUTPUT INDICATORS FOR ERDF SUPPORT UNDER THE INVESTMENT FOR GROWTH AND JOBS GOAL (ARTICLE 6 Regulation 1302/2013) states "*Additional households with*** broadband access of at least 30 Mbps", this indicator could be *mis*understood by Member States as criteria for eligibility. Including satellite broadband would enable those areas with no connectivity today to have access to services of 20 Mbps, a big step forward from no connectivity and an excellent service proposition, which will evolve to higher speeds in the near future.
- **ANNEX V: EX ANTE CONDITIONALITIES FOR RURAL DEVELOPMENT (EU Regulation 1305/2013) states that, for the thematic Objective TO 2:** Enhancing access to, and use and quality of, information and communication technologies (Broadband tar-

[35]http://ec.europa.eu/regional_policy/what/future/index_en.cfm#3

get), only mentions NGN infrastructures. As for the **COMMUNICATION FROM THE COMMISSION EU Guidelines for the application of State aid rules in relation to the rapid deployment of broadband networks** (2013/C 25/01) Next generation networks rely wholly or partly on optical elements. The result is the automatic non eligibility of Satellite Broadband.

SABER partners recommend the EU Commission in charge of the Negotiation of the Partnership Agreements and the Operational Programmes or Rural Development Plans to clarify to the Member States the ongoing eligibility of funds, during the next financial period, for basic broadband in line with each National Broadband plan and consequently satellite broadband user equipment. SABER partners believe that such a clarification is vital to ensure consistency with the DAE Targets as an instrument of Growth and Jobs.

4.4.2. On the Spot Check Audit procedure

One of the main features of Satellite broadband access is its ubiquity. This is why it is the most cost effective solution to connect citizens residing in areas where morphologic conditions make either impractical or economically unviable the set up of terrestrial or other wireless facilities.
This characteristic, if considered from an auditing perspective by the Managing Authorities, can impact a high number of end users subject to on-the-spot check audit procedure.
Public SABER partners raised the issue that the on-the-spot-check audit procedure, foreseen by both EAFRD and ERDF EU Regulations, especially for satellite broadband, has been in some cases a roadblock for the implementation of this solution, as it requires excessive travelling time during the audit and consequently results in higher costs to undertake the audit (sometimes higher than the grant).

In particular, SABER partners underlined that on the spot check rules are particularly strict in EAFRD; requiring very rigorous tracking of actual defrayal on equipment/individual installations. This is usually not a problem for large earth stations but presents a significant cost when required for a large number of individual satellite dish installations in rural and remote areas.

In general, “the costs of tasks related to control (at national and regional level, excluding the costs of the Commission) are estimated around 2% of the total funding administered in the period 2007-

2013. These costs are related to the following areas of control: 1% is derived from national coordination and programme preparation, 82% relate to programme management, 4% to certification and 13% to audit.[36]"

Within the EU Commission proposals to reduce the costs of control in the Cohesion Policy framework period 2014-2020, SABER Partners recommend other solutions that consider the use of available and reliable ICT technologies useful to avoid the on the spot check audit in general and especially for satellite broadband.

Apart from a general solution that could foresee an on-the-spot-check procedures exemption for grants lower than 500 euro (low risk of fraud because of low grant) the technological solutions that could substitute the physical control in both Cohesion Policy Funds and EAFRD are[37]:

- Use of geo-referenced photos of the ground equipment installed (modem and antenna) along with the print out of the speed test (countersigned by the end-user).
- Declaration of the satellite operator that effectively provides the service to the specific end user.

4.4.3. Alternative approaches in business and deployment models for satellite broadband in public procurement

"Satellite performance has improved, helping to cover the 4.5% of population not covered by fixed basic broadband. The Commission is now focused on getting better take-up of satellite where this can bridge remaining gaps".

Digital Agenda for Europe Scoreboard (June 2013)

The European Commission recognises that satellite can help to bridge the digital divide. Nonetheless, currently satellite broadband is not considered and adopted enough in public initiatives. This is partly because of a lack of awareness amongst Public Authorities (PAs) on the

[36]The draft of the REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL laying down common provisions on the European Regional Development Fund, the European Social Fund, the Cohesion Fund, the European Agricultural Fund for Rural Development and the European Maritime and Fisheries Fund covered by the Common Strategic Framework and laying down general provisions on the European Regional Development Fund, the European Social Fund and the Cohesion Fund and repealing Council Regulation (EC) No 1083/2006 - Brussels, 22.4.2013 COM(2013) 246 final - 2011/0276 (COD)

[37]Those technological solutions were discussed with and supported by DG CONNECT officials.

subject as discussed in chapter 4.2.1. However, another reason is the differences in the business and financing models of satellite compared to terrestrial technology and the issues this raises in terms of public support. These issues are explored further in the remainder of this chapter.

Demand stimulation, subsidising the eligible subscriber's terminal by means of voucher (or alternatively throughout calls for tender), has proven so far the most consolidated and successful approach put in place by PAs to take advantage of the satellite solution in Europe, differently from other geographic areas; this finding descends from the analysis of best cases of the past years held by SABER are presented in the Deliverable 3.2 "Regional-National-International satellite broadband implementation case studies". The guidelines for putting in place procurement process based on voucher schemes or calls for tender are presented in the SABER Deliverable 2.2 "Early Guidelines on Satellite Services Procurement".

Indeed further models are of interest and worth discussion in consideration of their successful adoption with other technologies, infrastructures or geographic areas:

This chapter therefore explores the potential for innovation in the business and deployment models adopted by PAs to support the rollout of satellite broadband, including wholesale, public–private partnership, and demand aggregation.

Introduction

One important reason why PAs (e.g. municipalities and regions) are rightfully involved in broadband deployment is that terrestrial-based broadband deployment is a highly local process. This stems from the need of a local network to be built on the ground, which implies right-of-way and digging permits, construction or lease of antenna and local node sites, compliance with local town planning, coordination with other utilities, local geographical and socio-demographic knowledge, etc.

Another important consideration is that even a small region or large municipality will typically be able to aggregate large numbers of end-users, hence achieving a certain critical mass to ensure the necessary economies of scale for network deployment, management and operation.

For satellite-based broadband, on the other hand, neither of the considerations above holds (for

further details, please refer to the technical and techno-economic comparisons between satellite and terrestrial broadband in chapter 3):

- It does not need a local backbone network connecting the last mile loop to the national and international network.
- Its competitive advantage against terrestrial solutions is that it can cover a number of users scattered over a relatively large area (regional, macro-regional or even national), meaning that deployment cost is independent of end-user location. In this respect, it is particularly suited for large and extremely sparsely populated areas.

As a consequence, for any particular local area, the number of users suited to a satellite broadband solution may be relatively small, thereby failing to secure economies of scale in purchasing services, and potentially making collective procurement uneconomic for either the PA and/or the providers. Whereas across larger geographies (national or supranational, e.g. European level), benefits from collective procurement can be realised together with a more strategic approach to the rollout of broadband, as the case studies of large countries outside Europe demonstrate.

Therefore there is potential for local Public Authorities to identify the end users that are best suited for satellite coverage but to use the national or supranational level for investments in satellite broadband to ensure critical mass in the numbers of connections involved. This would also leverage the better technical know-how and market knowledge available at higher government levels. Unfortunately there are no real examples of schemes of this nature currently in place in Europe. This is partly due to the limited knowledge and awareness of satellite broadband and to the fact that the main focus of broadband strategy in most of Europe has been around faster speeds through investment in fibre. However, there is also an additional issue relevant to European funding, which is typically managed and delivered at regional (or sometimes sub-regional) level, making supra-regional cooperation difficult to achieve in practice.

The type of intervention required for satellite broadband is also different from that of fixed line broadband, where the focus is on investment in infrastructure. For satellite broadband, the backbone infrastructure already exists in the form of satellites and teleports (notwithstanding the ongoing need to increase and improve this capacity). Rather investment happens at the level of the end user in terms of customer premises equipment (CPE) in order to enable the take-up and

exploitation of satellite broadband services. Alongside issues around perceptions and awareness, the initial upfront cost of this CPE is a barrier to take-up for some users. As a result, where PAs have looked to support satellite broadband, they have typically focused on capital subsidies for this CPE, for example through voucher schemes or framework contracts.

4.5 Business and deployment models

4.5.1. Wholesale to Public Authorities

Wholesale and retail activities are usually separated in the EU satellite broadband market, as mentioned in chapter 3.6.1 and unlike the case of the USA[38].

As shown in Figure 17 satellite operators sell capacity to satellite ISPs, who in turn provide the connectivity and the related services, such as installation and first-level assistance, to the end-users.

In the European framework, PAs can reduce or remove the major cost barrier to citizens' access to satellite broadband by subsidising the end user equipment (i.e. the one-off purchase and installation of the satellite terminal).

In addition, local PAs may sometimes aspire to further support their citizens by trying to obtain lower subscription fees than the standard ones available in the market for satellite services from the satellite operator(s). The deal consists of a bulk buying by the PA of satellite connectivity at discounted rates, granted by the satellite operator in exchange of a guaranteed number of new connections or a guaranteed level of revenue for this connectivity.

The broadband services to the end-users are still supplied by one or more satellite ISPs (though this could potentially be a subsidiary of the satellite operator itself), but these services are provided by ISPs acting as franchisees on the transmission resources pre-negotiated by the PA.

The above can be termed "wholesale to Public Authorities", and has similarities to indefeasible rights of use (IRU) contracts that are commonly used for access to submarine and fibre optic networks.[39]

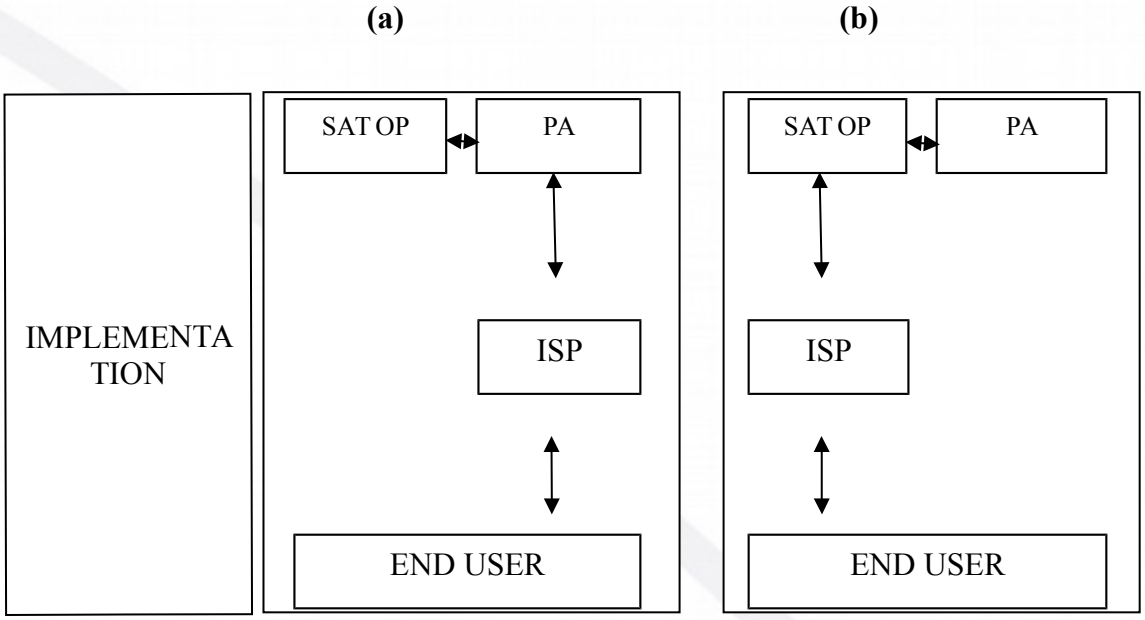
[38] SABER Deliverable 3.2 – Chapter 5.1

[39] An IRU in the case of dark fibre means the exclusive, unrestricted, and indefeasible right to use one, a pair, or more strands of fibre of a fibre cable for any legal purpose. The wholesale purchase of dark fibres has normally been accomplished by means of IRUs. Fibre owners offer IRUs for up to 20 years for unrestricted use, with 10–25 years

The contractual agreement would involve three actors: the PA, the satellite operator, and the ISP(s). In cases of sales of very significant amounts of connectivity, a capacity broker might act as an intermediary between the PA and the satellite operator.

- In figure (a): The PA procures satellite connectivity from the satellite operator. The PA then grants – possibly through a call for tender – a franchise to ISPs, who in turn supply services to the end users.
- In figure (b): The PA not only procures the satellite connectivity from the satellite operator, but also negotiates, within the same contract, the services to the end users to be provided by the contracted ISPs. This procurement can also be undertaken through a call for tender.

corresponding to a typical lifetime of optical fibre systems.



Currently, two types of bulk buying are suitable for PAs (or an entity that acts on their behalf, such as the French '*délégation de service publique*').

Bulk buying individual satellite connections ("packaged services")

PAs purchase from satellite operators a bundle of individual subscriptions to satellite Internet access services already available on the existing market, potentially negotiating a discounted rate. These services are then supplied through an ISP to a number of final users pre-identified by the Public Authority.

The offer of the satellite operator to the PA is a sort of "package", covering a pre-determined number of subscriptions at a discounted rate.

This type of initiative of the PA lowers the final users' subscription fees. However the PA has no say on the specifications of the service delivered to the users.

Buying satellite capacity carrying an aggregate of individual satellite connections

PAs purchase from satellite operators an aggregated transmission resource (i.e. satellite capacity) and select/appoint one or more ISPs to provide individual satellite internet access services operated over such capacity to a number of final users pre-identified by the PA.

This type of initiative allows a higher degree of freedom for the PA in defining the configuration and the quality of service (QoS) delivered to the citizens, such as guaranteed or best-efforts

connections, data capping if any, and alike – this obviously requiring a higher level of expertise from PA side.

Both approach 1) and 2) represent an operating expenditure (OPEX) for the PA. However public grants, especially European funding, such as ERDF and EAFRD, are often intended (and limited) to subsidise of capital expenditure (CAPEX).

Only when a PA purchases an entire transponder[40] from a satellite operator, which constitutes a physical unit in a satellite for the entire lifetime of the satellite, would a type of CAPEX financial model be possible. The capacity of the transponder can be exploited as in the case of buying a generic capacity (type 2 above). Considering type 2 in general as a CAPEX, although arguably equivalent to buying a dark fibre, is more intricate from a legal standpoint in the absence of a purchase of a physical unit such as a transponder.

As a conclusion, the wholesale approach – which represents both a form of demand aggregation (see more on demand aggregation below) and the underwriting of risk by PAs – can allow PAs to secure satellite resources to fight digital divide in their own domains, reduce subscription fees for satellite internet access services to users, tailor QoS to local needs, and so on.

However the economic benefits have to be weighed against the increased complexity at the contractual and operational level (namely between the PA and the satellite operators and/or ISPs), and therefore higher transaction costs and liabilities, which may mitigate the cost savings achieved.

Moreover, European funding, especially ERDF and EAFRD, is often managed at a regional or sub-regional level. As a consequence, the number of connections that a regional or sub-regional PA can guarantee to a satellite operator is often not of a scale that would enable significant discounts to be gathered through aggregation – for example, 1,000 connections (and the number could be even lower for small communities) is roughly an order of magnitude lower than that required to secure a discount over standard market prices.

The situation might of course be considerably different if the negotiation with satellite operators

[40] "transponder" is a unit, composed by a transmitter and a receiver, which forms an independent communications channel between the receiving and the transmitting antenna of a satellite. A transponder operates like a magnifier: it gathers signals over a range of uplink frequencies, amplifies them, and re-transmits them on a different set of downlink frequencies to receivers on Earth

was carried out at national or even pan-European level, where demand aggregation would lead to a far larger number of individual connections, and consequently to more significant opportunities for discounts.

4.5.2. Public–Private Partnership (PPP)

Public–private partnerships (PPPs) have yet to be used to any notable extent for satellite broadband within Europe, though have been widely used in other related areas, particularly space/satellite and satellite telecommunications sectors, fixed broadband rollout, and other types of infrastructure.

A PPP is a long-term contract and/or consortium between the public and private sector to provide a public service or project, with the private sector assuming substantial financial, technical and/or operational risk in the project. In some types of PPP, the cost of using the service is borne exclusively by the users of the service and not by the taxpayer. In other types, such as a private finance initiative (PFI), capital investment is made by the private sector on the basis of a contract with government to provide agreed services, and the cost of providing the service is borne wholly or in part by the government.

The European Investment Bank (EIB) defines a PPP as an arrangement where "the public and private sectors collaborate to deliver public infrastructure projects."[41]

PPPs are typically put in place to harness the expertise and efficiencies of the private sector and/or to avoid public sector borrowing. PPPs progressively gained importance in Europe in the last twenty years, though two-thirds of all PPP projects have been in the UK, followed by Spain (9%) and France, Germany, Italy and Portugal (2.5% each).

The European Commission published a Communication in November 2009 setting up a framework for encouraging the use of PPPs by Member States to help invest in public services, infrastructures and research with a long-term perspective despite the financial crisis, thus boosting innovation and creating jobs. PPP has been used in the space sector, including for satellite telecommunications, to support the development of large and long-term projects and invest in R&D beyond the means of public authorities alone in the current financial situation. PPP is now at

[41] See http://www.eib.org/epec/g2g/intro2-ppp.htm and more generally: the EIB European PPP Expertise Centre at http://www.eib.org/epec/index.htm

the heart of new funding mechanisms for European space policy (see e.g. Galileo), particularly for satellite telecommunications, with the result that such PPPs have proliferated at all institutional levels (Member States, EU, and European Space Agency (ESA). These projects have been developed by ESA (ARTES), both to improve the competitiveness of the European space industry and contribute to European public policies.

European financing through European Structural Funds, the European Investment Bank (EIB) or TEN-T instruments can help to mobilise PPPs. European Structural Funds for the period 2007–13 offered important opportunities to Member States to implement operational programmes through PPPs organised with the EIB (which is Europe's leading funder of PPP with a Europe-wide portfolio of €25 bn. across 120 projects), banks, investment funds and the private sector in general. This approach will be continued with the new 2014–20 programme.

PPPs in broadband

The PPP4Broadband project financed by South-East Europe Transnational cooperation programme (http://www.ppp4broadband.eu/) has identified five broad types of PPP models for broadband:

1. The **joint venture PPP model** is one of the most common PPP models and is an agreement where ownership of the network is split between the public and private sector. Under a JV PPP model in broadband, the government acts as the regulator and active shareholder in the project (and may share the profits). The private partner undertakes the construction, operational functions, and daily management of the operations.
2. The **private design, build and operate (DBO) PPP model** involves a private sector organisation receiving some level of public funding (often a grant) to assist in its deployment of a new wholesale network. The public sector has no specific role in the ownership or running of the network, but it may impose obligations in return for the funding.
3. The **public DBO PPP model** involves the PA operating without any private sector intervention except at a service provider (either wholesale and/or retail) level. All aspects of network deployment and operation are managed by the public sector. A network company is formed by the PA and typically offers wholesale services (though some also offer retail

services).

4. The **bottom-up (or local community) PPP model** involves a group of end users (residents and/or businesses) organising themselves into a jointly owned organisational group (such as a cooperative) to oversee the contract to build their own local network. The public sector may provide funding (usually at a smaller scale than other PPPs) but typically has no role in owning or running the project. The day-to-day running of the network is usually outsourced to a telecoms operator.
5. The **government-owned-contractor-operated (GOCO or public outsourcing) PPP model** involves a single contract being awarded to a private sector organisation covering all aspects of the design or construction of the network. The network is built and operated by the private sector, but the public sector retains ownership and some control of the network.

Given the importance of PPPs to the UK, it is unsurprising that they have been extensively used in the rollout of broadband, primarily through the private DBO approach, with the public sector providing gap funding to a private sector provider. This has been the approach taken for the overarching Rural Broadband Programme, which aims to provide superfast broadband to at least 90% of premises in the UK and universal access to standard (2 Mbps+) broadband. The UK Government has allocated £530 M (c.€635M) across the UK between 2011/12 and 2014/15 to stimulate commercial investment in rollout, with individual projects remaining the responsibility of PAs (both local authorities and the UK's devolved regions), as expressed in their Local Broadband Plans.

The private partners were selected by BDUK (the Broadband Delivery UK scheme) through a framework agreement (which was advertised in the Official Journal of the European Union (OJEU), since it exceeded EU procurement thresholds. Initially two private partners were selected within the framework, Fujitsu and the incumbent operator BT, however Fujitsu eventually withdrew from the framework and all contracts to date have gone to BT. PAs are not obliged to use the framework contract, though because of the additional time, cost and risk of procuring independently most do so.

However, satellite broadband has not been widely adopted within Local Broadband Plans to date, and BDUK are only now looking at an Extension Programme for areas of the UK that will not

receive superfast broadband through the current Rural Broadband Programme, and the role of satellite in this is yet to be determined. Where PAs have included satellite in their plans (e.g. Devon & Somerset, Wales, and Hampshire) this has typically been in the form of grants to users to subsidise the installation of satellite broadband from existing providers, and therefore is not a formal PPP element of the programme. The exception to this is **Northumberland** County Council's £1.3 M iNorthumberland loan scheme for Avonline, Briskona, and QSat to develop their businesses over the next 3 years to cover the 9% of the county not covered by BT rollout. The loans are typically paid to the companies once a property has been connected, and be collected back from customers as part of the monthly rental (at around £5/month) – it is hoped that this will develop consumer confidence in the approach and be able to be rolled out in other areas.

Outside the UK, a similar gap-funded PPP approach has been adopted by the National Broadband Scheme in Ireland. The project was run by the Irish Department of Communications, Energy & Natural Resources (DCENR) with the support of regulator ComReg to address the 10%–15% of the Irish population that would not get access to basic broadband connectivity without public intervention. The €223 M investment came from a combination of Irish Government funds, EU co-financing and the selected private sector operator. The mobile operator 3 was selected through the Competitive Dialogue process to maximise the leverage of private sector funding, with a contractual obligation to upgrade services during the contract term to help future-proof the network and support its commercial sustainability. The scheme delivered broadband to over 99% of the population, including some of the most remote and sparsely populated areas of Ireland. The required outcome was specified in terms of minimum peak speeds, maximum contention ratios, and latency, in a technology-neutral way. A small fraction of sites are served using satellite with different target speeds, contention ratios, and latency. The network made available to service providers on an open access wholesale basis and end-user pricing through the scheme is the same regardless of the technology.

PPPs in the satellite telecommunications sector

At the same time that the European Union is planning to use satellite to support the Europe 2020 Strategy and the Digital Agenda for Europe to provide all European citizens, even in remote areas with affordable and high-speed broadband internet, the same European Industrial Policy for Space

also suggests the possibility of starting ambitious new PPPs. These two objectives could be combined, for example by the launch of enhanced satellite capacity to deliver faster broadband speeds – specifically 30Mbps and above in line with DAE targets – especially for those areas where other technologies are not feasible. Given that further R&D is required to develop this next-generation of satellites, plus investment in new satellite capacity, PPP maybe well suited to this longer-term strategic need. In particular:

- Financing: the private sector can raise adequate financing for the project and propose a sustainable model
- Flexibility: the PPP model allows flexible response to changes in the market and competitive situations
- Efficiency: PPP can be used to allocate and manage risk between the public and private sectors, offering potential cost savings and better control of projects assets by PAs

Europe has set up Joint Technology Initiatives (JTIs) as a new way of realising PPPs focused on research at European level that maybe relevant to the longer-term development of new enhanced satellite capacity. JTIs bring together European, national and private resources, including knowhow and research capabilities from large companies and SMEs across Europe for a period of several years to achieve critical mass and ensure that Europe can develop world-leading technologies.

PPP Conclusion

The role of PPP in supporting 100% access to broadband in line with the Europe 2020 targets is not clear. Whilst PPP models have been used in the international case studies to deliver satellite broadband, there are no current examples of PPP being used to rollout satellite broadband in Europe in this way (though it has been used for satellites themselves). The international case studies show that successful use of PPPs has been part of national-level broadband plans covering large geographic areas to reach large numbers of users, with strategic investments in satellite broadband technologies to bring connectivity to areas not reached by terrestrial infrastructures.

To make the type of integrated, strategic PPP approach taken internationally work would require intervention at the European or at least supranational level to ensure a large enough potential user

base. DG REGIO has been charged with looking into innovative PPPs to support the regions, and therefore this could incorporate satellite broadband, for example by aggregating demand across regions and/or launching PPP projects to deliver connectivity to particular communities of citizens using existing satellite capacity.

A more appropriate role for PPP in Europe is as a model for the delivery of next-generation satellite broadband capacity and services offering faster (50-100 Mbit/s) speeds to areas beyond the economic reach of terrestrial infrastructures even over the medium to long term. This latter route is potentially of long-term strategic importance to Europe and its satellite industry. This could be incorporated into a structured EU policy framework for the use of PPP in satellite telecommunication projects at European level (to be explored further during the next phase of SABER (WP4).).

4.6 Demand aggregation, demand harmonisation and demand stimulation

Demand aggregation refers to mechanisms aimed at pooling the demand for a given service over a specific region, country, and continent or even across continents.

"Demand aggregation refers to the process in which consumers pool demand for broadband telecommunications services, across a sector or within a region, as a means of achieving greater purchasing power, reduced investment outlays and improved access to broadband infrastructure." [42]

More specifically, demand aggregation includes a number of key elements, such as:

1. Coordinating and consolidating requirements.
2. Automated workflow and flexible Request For Quote (RFQ) management.
3. Single purchasing request and ordered from limited set of suppliers following standardised purchasing procedures.

The areas where demand aggregation is most appropriate are shown in figure 23.

[42]Demand Aggregation Manual, Australian Department of Communications, Information Technology and the Arts (DCITA), http://www.archive.dcita.gov.au/__data/assets/pdf_file/0017/23462/DAM.pdf

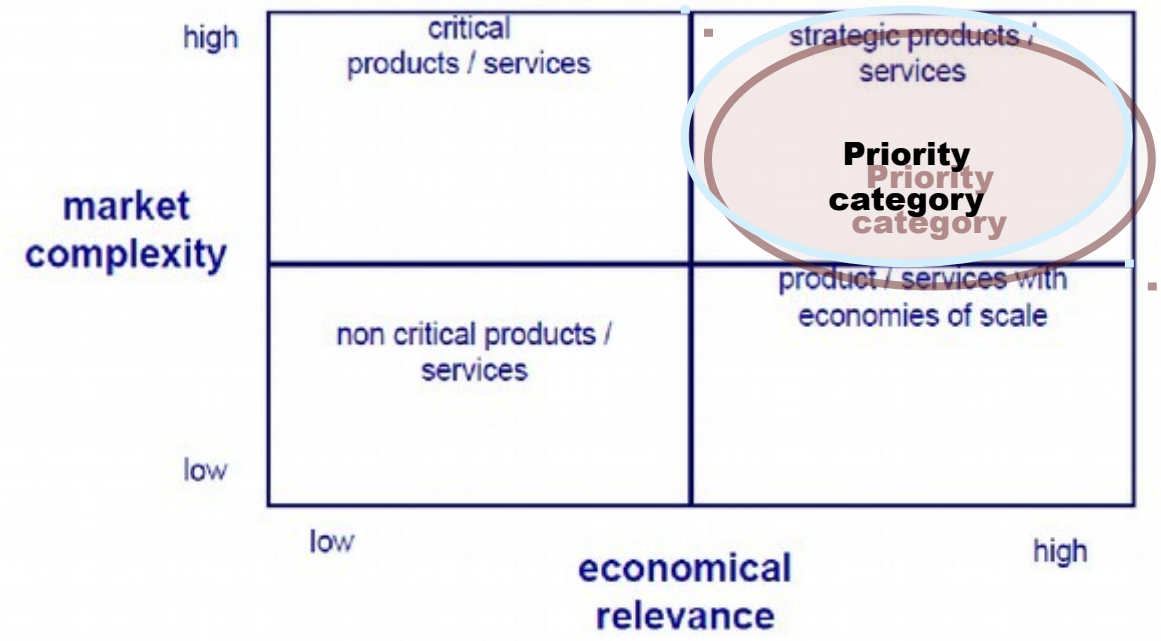


Figure 23: Demand Aggregation

Source: Workshop on good practices in modernising public procurement – Kuwait Mau 13-15 2013 (Mena-OECD workshop on modernising public procurement. Demand Aggregation, Market research, feasibility studies: options, actions and risks Consip SpA

In spite of a large literature on the subject, not many examples of implementation can be found in the different commercial sectors, and obviously only in big-scale markets. The typical example is that of a central purchasing system for very large companies and for PAs. Demand aggregation is also applied to telecommunications services and infrastructures.

The implementation of demand aggregation schemes for satellite broadband public procurement would generally present the following advantages:

1. Creating a consistent single market from a sparse demand thus making the public broadband market more attractive for operators and ISPs.
2. Realising savings of public money.
3. Favouring the emergence of a more convenient and competitive offer for the final users.

In order to be fully applicable and valid in an institutional context, demand aggregation requires:

- a central level to purchase;
- a centralised public fund;
- a central authority managing the funds.

Successful examples of demand aggregation for satellite broadband can be found outside Europe, typically in large and rural countries such as Australia, U.S.A. and Canada[43], where policymakers have centrally defined a dedicated budget and have driven the measures to provide broadband for all.

Demand aggregation was successful in these countries as a result of undertaking a mapping of the territory and a cost-benefit analysis of the available technologies, which led to pre-identifying the aggregate of rural areas where satellite broadband was found to be the most cost-effective solution.

A pragmatic approach was taken to developing the strategies recognising the complementarity of terrestrial and satellite solutions.

4.6.1. Applicability Of Satellite Demand Aggregation Scheme In the EU

The satellite broadband market in Europe is characterised by low-density areas, disparate geography and consequently sparse demand.

In order to be successful, a pan-European satellite broadband provision needs to:

- Be available in all EU countries, thus encompassing a very large network of committed ISPs (see chapter 3.6.3).
- Be compliant with the laws and regulations of each country.
- Ensure rapid availability of the hardware, thus requiring advanced procurement of thousands of Customer Premises Equipment (CPEs).
- Ensure that a certain level of centralised activities is available including; training, management, billing systems, hot line (in many different languages), and local communication/marketing campaigns throughout the entire EU (again, in many different languages), to accelerate market take-up etc.

These activities require a high level of marketing and commercial overheads that are generally not required for terrestrial operators which are focused on addressing each national or regional market individually.

[43] SABER Deliverable 3.2 – Chapter 5

Satellite broadband has already achieved the basic broadband for all (2013 Digital Agenda for Europe target), but for this to have real impact through actual broadband take-up it needs to be facilitated and accelerated through demand aggregation on a Pan-European basis.

However the EU, unlike the international case studies[44] has so far neither centralised funds for broadband nor a central authority managing the implementation of measures to close the digital divide.

The absence of a centralised public fund at EU level and managed by the EC has made so far demand aggregation hardly achievable on a Pan-European scale. In this respect, it is to be noted that the CEF (Connecting Europe Facility) 2014-2020 centralised budget devoted to ICT, which could be in line with the requirement for developing a Pan-European demand-aggregation scheme, underwent a dramatic cut thus have its impact reduced (still, about 15% of the total telecommunications component of the CEF will be dedicated to broadband networks through financial instruments such as loans) [45]. A preliminary analysis of the CEF is found in section 4.6.6.

At EU Member States level, the responsibility for broadband implementation strategies is often shared between the central government (which typically organise the National broadband deployment plans) and regional or local authorities (which implement procurement and deployment schemes at local level). The absence of common methodologies, rules, and tools further increase the diversity of the approaches.

Demand aggregation at a national level is difficult also because the implementation of the broadband strategy uses, in the majority of cases, EU funds (ERDF and EAFRD) that are usually managed by regions. Even when a dedicated national budget exists, national aggregation scheme can hardly be found: in general local authorities have a large freedom in implementing deployment policies.

Therefore, in the current EU context, the regional level, whilst representing a small market for satellite broadband, appears to be the highest possible level for a genuine and practical consideration of demand aggregation.

Today, many regions have implemented a specific procurement process for satellite broadband,

[44] SABER Deliverable 3.2 – Chapter 5

[45] Amended proposal for a regulation of the EP and the C on guidelines for trans-European telecommunications networks – ref 16681/13 – Nov28th 2013 (http://register.consilium.europa.eu/doc/srv?l=EN&t=PDF&gc=true&sc=false&f=ST%2016681%202013%20INIT&r=http%3A%2F%2Fregister.consilium.europa.eu%2Fpd%2Fen%2F13%2Fst16%2Fst16681.en13.pdf)

each defining a specific quality of service, very often because of a lack of awareness and understanding of the most recent satellite technologies. This multiplicity of different requests for what is in reality the same quality of service generates extra costs for the satellite operators and the satellite ISPs, which is reflected in the subscription prices.

Consequently, in the absence of a genuine pan-European demand aggregation, a way to nonetheless benefit from the advantages of a larger-scale demand-aggregation scheme would be to achieve a harmonisation of the demand at EU level.

4.6.2. Demand aggregation case for satellite broadband in the BB-MED report

Demand aggregation for satellite broadband is one of the major subjects dealt within the BB-MED report, which provides an analysis of the potential market size in the countries across the Union for the Mediterranean (UfM)[46], and highlights the tools susceptible to generate a wide demand. The acronym BB-MED refers to a study on the "*Evaluation of the satellite solution for the development of a BroadBand service for the Union for the MEDiterranean*" developed by a consortium led by Avanti Communications and supported by Point Topic and HellasSat on behalf of the European Space Agency (ESA)[47].

The full BB-MED report was made available to the SABER partners in the second quarter of 2013. Since then, SABER made a thorough review to analyse proposed demand aggregation methodologies and measures and verify the possibility to adopt them in Europe.

BB-MED assesses the possibility for satellite broadband internet services that could be deployed across the UfM countries in order to reduce the digital divide. A set of specific demand aggregation cases were studied within BB-MED through models of cooperation, related to geographic, socio-economic and sectorial criteria, organised around five scenarios:

- Providing satellite broadband to all schools in Facility for Euro-Mediterranean Investment and Partnership (FEMIP) countries[48] in 2013)

[46]The Union for the Mediterranean, created in July 2008, is a multilateral partnership of 43 countries from Europe and the Mediterranean Basin: the 28 member states of the EU and 15 Mediterranean partner countries 15 member states: Albania, Algeria, Bosnia-Herzegovina, Egypt, Israel, Jordan, Lebanon, Mauritania, Monaco, Montenegro, Morocco, Palestinian Authority, Syria (self-suspended on 22 June 2011), Tunisia and Turkey. Libya as an observer state.
[47]ESA – Reference AVA.BBM.REP.017
[48]Algeria, Egypt, Gaza/West Bank, Israel, Jordan, Lebanon, Libya, Morocco, Syria, and Tunisia.

- Providing satellite broadband to all farms, SMEs and consumers in Eastern Europe in 2013
- Providing satellite broadband to all identified categories in all countries in 2015 (European + FEMIP take-up across all sectors i.e. consumers, schools, hospitals, SMEs, and farms)
- Providing satellite broadband to all identified categories in all countries in 2020 (European + FEMIP take-up across all sectors i.e. consumers, schools, hospitals, SMEs, and farms able to get broadband)
- Providing satellite broadband to all SMEs and/or schools and hospitals in Libya.

Cases 1 and 5 are not relevant in an EU context.

To enable a wider broadband deployment, the report proposes that: "*Governments adopt policies and strategies that encourage an increase in demand. Typical policy areas that can encourage demand growth […] are:*

- *Demand aggregation – governments can become anchor users to guarantee revenues at the ramp-up phase of broadband deployment […-.*
- *The provision of subsidies to subscribers to encourage demand uptake*
- *Introducing fiscal incentives such as a reduction in local taxes to small and medium enterprises linked to their ICT adoption to stimulate adoption in areas that can have an impact on the national economic output."*

BB-MED also suggests that demand aggregation is triggered by the coordination of public demand, typically through core user groups (government administrations, public services, local schools, healthcare facilities, etc.), the negotiation of wholesale rate and long-term service level agreements, and the adoption of initiatives that enhance awareness and ICT skills.

As to the subsidies for customer premises equipment (CPE), BB-MED briefly describes three subsidy mechanisms: the *direct-to-consumer* subsidy model, the direct-to-operator (i.e. ISP) subsidy model (these mechanisms corresponds to that which has already been worked out in detail in the SABER deliverable 2.2[49], and the framework agreement model: *"a national framework agreement with one or more selected companies to provide broadband services to citizens in a regional environment."*, which has some commonality with the "BDUK Connection Voucher scheme" currently being developed in the UK and analysed in 4.6.4.

[49] SABER Deliverable 2.2 – Early guidelines on satellite service procurement

Lastly, the BB-MED report concludes with a recommended Action Plan to enhance demand aggregation for satellite broadband. The SABER consortium looked at BB-MED findings in order to assess:

- Their applicability in the EU context
- The barriers and enablers associated with the above subsidy schemes that are not detailed further in the BBMED report.

The table below summarises BB-MED recommendations, assessing their suitability in the EU context, and SABER analysis and critical review:

BB-MED recommendations	Relevance & adaptation to EU DAE context (according to SABER consortium)
1. Identify tactical opportunities to promote satellite broadband along the lines of scenario 5 in Libya	Not relevant in an EU context
2. Lobby the stakeholders (EC, UfM and in-country) to secure support for aggregation schemes similar to those considered in scenarios 2 and 3 *(SABER note:* 1. *aggregation for consumers and by sector by 2013–15* 2. *BBMED suggested public support: participation to capital investment e.g. gateways, subsidy per user who connects; one time support of a few hundreds € for the first set of deployment sites (up to 150000); R&D for the Very*	Large scale aggregation scenarios necessitate a significant CAPEX investment upfront which cannot be covered by private operators alone (see 4.5.1). The need for a central public fund able to cover upfront expenses is confirmed in BBMED. The possibility to use the CEF Broadband Networks funds in the next 2014–20 period for achieving some level of demand aggregation will be investigated in the next phase of the SABER project (WP4).

High Speed broadband satellites)	
3. Seek endorsement from EC and UfM for aggregating demand to drive satellite broadband to help close the digital divide *(SABER note: same suggested public support as above)*	
4. Develop a representative pilot aggregation project through the EC Competiveness Innovation Programme (CIP) or similar in support of schemes similar to those considered in scenario 3 *(SABER note: scenario 3 addresses aggregation for consumers and by sector by 2015)*	The CIP instrument is not considered a tool adapted to close-to-market broadband deployment pilot projects (see 4.6.5). No other instrument than the CIP could be found in the 2007–13 period. Possibilities offered by the 2014–20 instruments, such as the territorial cooperation objective 2014 2020, could be more suitable, and will be analysed during the next phase of SABER (Work Package 4).
5. Develop appropriate detailed representative framework and operator support procurement models for the scenarios	Rather than true demand aggregation scenarios, SABER recommend accepting the reality of scattered demand but to look for tools enabling a certain level of centralisation at budget and legislation level, while maintaining local implementation (the BDUK Connection Voucher scheme in the UK, explored further in 4.6.4). SABER aims to develop detailed guidelines (including procurement models) for the most efficient and realistic broadband deployment scenarios.
6. Agree and promote a PPP scheme with EIB and their "European PPP Expertise Centre" *(SABER note: the BBMED report identifies PFI as a likely option when significant investments needed in satellites and their gateways).*	PPP is not expected to be a significant tool to address the short-term DAE objectives, as described in detail (see 4.5.2). However PPP might be of potential relevance to the DAE 2020 objectives, particularly the development of next-generation satellite capacity.
7. Support the development of the next-generation of Terasat class satellite technologies so these can be launched in time for service in 2020 as discussed in scenario 4 *(SABER note: scenario 4 addresses aggregation by sector by 2020).*	The EC currently supports the FP7 project BATS (*www.**batsproject**.eu/)* which addresses the integration of Terabit class satellite with the terrestrial network. ESA also run system studies addressing very high-speed satellites, together with a large range of accompanying R&D activities. Next-generation satellites and associated services will be addressed further during the next phase of SABER (WP4).

In summary:

- **Most BB-MED recommendations propose demand aggregation through voluntary agreements amongst PAs. Such scenarios are not considered realistically feasible by SABER in the current EU context (based on field experience).**
  Rather than true demand aggregation, SABER recommends accepting the current reality of scattered demand but instead to take central actions to enable a certain degree of harmonisation and stimulation of the demand and of the procedures, whilst maintaining local implementation. SABER will look at the possibilities offered by future public funds to implement schemes based on centrally managed budgets (e.g. the CEF) during the next phase of the project (WP4).

- BB-MED also recommends deploying a large-scale pilot project: this opportunity was tried out in 2013 by a consortium made, among others, of a few SABER partners (see 4.6.5) which concluded that there was a lack of adequate EU instruments within the 2007–13 portfolio. The possibilities offered by the 2014–20 instruments will be assessed during the next phase of the SABER project (WP4).

- Lastly, BB-MED recommends agreeing a PPP scheme with the EIB. PPP is not expected to be a significant tool to address the short-term DAE objectives (deliverable xx § xx). However PPP is potentially of relevance to the DAE 2020 objectives, particularly the development of next-generation satellite capacity, which will also be explored further during the next phase of the SABER project (WP4).

4.6.3. From demand aggregation to demand harmonisation and demand stimulation

The analysis developed in the chapters 3.4, 3.5, 3.6 tends to show that the European satellite broadband market has some specific features which make difficult the implementation of genuine demand aggregation within the current EU context.

A way to benefit from some of the typical advantages of large-scale demand-aggregation schemes in the framework of the current public procurements, in which funds are managed at a regional (or

sometimes even more local) level, is to achieve a harmonisation of the demand throughout Europe, which will in turn favour the emergence of a more convenient and competitive offer for the final users. A widely shared understanding of the technical and commercial features of satellite technologies, and the environment (e.g. geography, timely deployment, etc.) in which satellite solutions are cost effective and particularly suited to reducing the digital divide, should lead to a more homogeneous demand from regions.

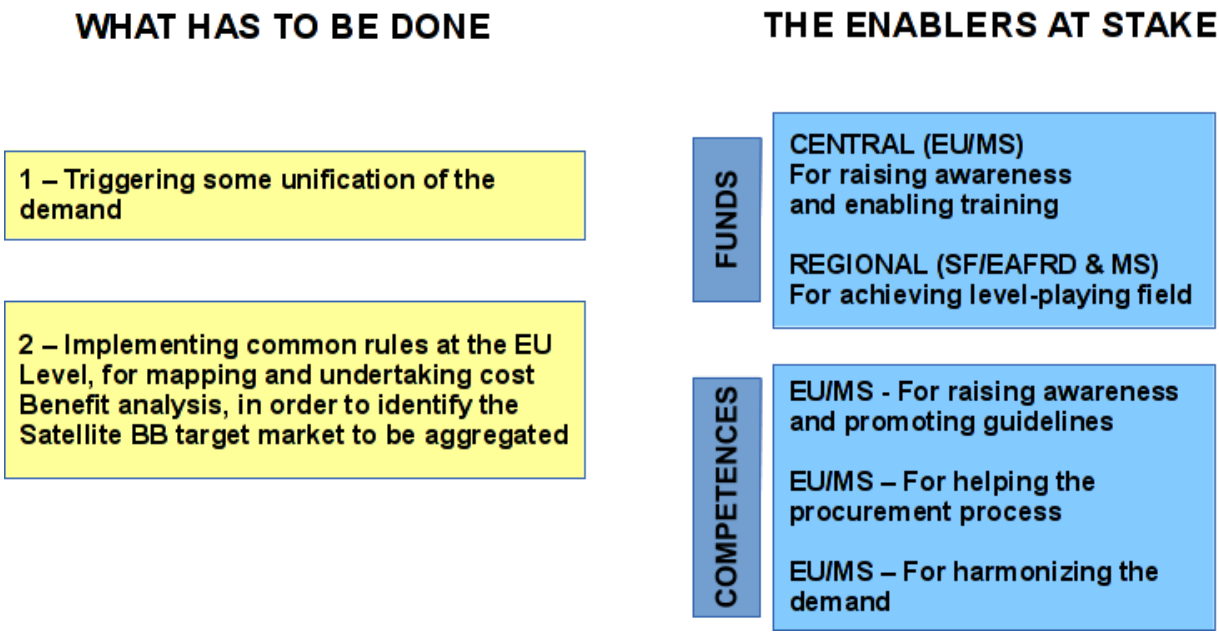


Figure 24: How to obtain some demand-aggregation benefits in the present European institutional context

Therefore, as shown in figure 24 the EU institutions should concretely support the awareness raising of satellite broadband – among others, by endorsing and disseminating the information provided by the SABER project.

In addition, common methodologies, rules and tools that are developed by SABER can equally support the objective of a harmonised approach to the procurement of satellite solutions in the various European regions in need.

In summary, SABER recommends central guidelines (managed at EU level) intended to harmonise the demand when deploying local procurement, and notes that accompanying actions such as awareness raising and demand stimulation actions are key success factors for this

initiative

4.6.4. Demand harmonisation and demand stimulation in the BDUK Voucher Scheme

Among the examples of best practises enabling a certain level of centralisation at budget and legislation levels whilst maintaining local implementation, an interesting one is the BDUK Connection Voucher scheme[50].. This refers to a centrally-managed broadband procurement and demand aggregation scheme in cities in the UK and includes demand stimulation measures.

Although the primary focus of the BDUK Connection Vouchers scheme is on SMEs in urban areas seeking very high-speed terrestrial connections (typically fibre), the share of responsibilities and actions between national and local stakeholders is relevant to SABER's analysis.

The UK Department for Culture, Media and Sport (DCMS – of which BDUK is a delivery arm) issued a consultation in summer 2013 on connection vouchers, and ran a pilot during August and September 2013 in a selected number of UK cities that were awarded funding under its Super-Connected Cities Programme, including Belfast, Cardiff, Edinburgh, Manchester and Salford. The Connection Vouchers scheme is intended to stimulate the market (thereby driving economic growth) and improve digital connectivity in participating cities, in particular for the benefit of SMEs (the definition includes third sector organisations, and small office/home office workers).

The scheme will ultimately address SMEs in 22 participating cities and it is compliant with State aid rules and *de minimis* rules.

The vouchers will pay for their one-off broadband connection costs up to £3,000 (c.€3,600) where there is evidence that demand exists and that enhanced connection charges are a genuine barrier to take-up. The voucher is a grant not intended to fund any recurring charge or subscription, which will remain the sole responsibility of the voucher recipient – in other words, the scheme is for capital expenditure only and not operating expenditure. The scheme is a technology-neutral intervention as to the medium over which the service is delivered, whether this is fibre, wireless or any other technology. However, given the urban nature of the programme and the emphasis upon very high-speed connectivity, in most (if not all) cases it is expected that this will be a 'step change' improvement in speed and to over 30 Mbps. Suppliers are pre-qualified locally in each

[50]See http://www.connectionvouchers.co.uk

city for the voucher scheme according to a set of criteria[51]. The SMEs (or their agents) must obtain two quotes from different suppliers (though are not obliged to take the cheapest quote, and can select the quote that best meets business needs), and once approved by the scheme, the SMEs are free to spend their vouchers with any of the registered suppliers, and assume the contractual relationship with that supplier. Suppliers are paid directly by the voucher rather than the SME.

There is a recognition by BDUK that the scheme relies upon demand stimulation in order not only to encourage SMEs to sign-up to the vouchers, but also to make best use of the connection.

The features of this scheme which are relevant for SABER are:

- The scheme is demand-driven – i.e. adoption is determined by users selecting from services available from market – this makes the scheme well suited to satellite where a market offer already exists but take-up remains low (though any truly demand-driven scheme must remain technology neutral and therefore could not be for satellite connections only).
- The scheme provides overarching direction yet permitting some degree of local customisation.
- The scheme provides promotion and guidance (documentation and portal) at central level.
- The scheme clearly expects local cities to implement demand stimulation for voucher take-up.

The table below taken from the BDUK consultation document illustrates the split between central and local responsibilities and can be easily extended to other voucher-based scheme:

Activity	Central Government	Local City
Core scheme design	√	
Specification of local parameters		√
Provision of guidance documentation	√	
Provision of central "Information Portal"	√	
Provision of funding to cities	√	
Scheme administration		√
Delivery of anti-fraud checks		√
Local demand stimulation (for the take-up of vouchers)		√
Payments to suppliers		√
Scheme reporting (local level)		√
Scheme reporting (programme level)	√	

Whilst the pilot has now concluded, its full assessment has not yet been released, and therefore

[51]See https://www.connectionvouchers.co.uk/category/registered-suppliers/

there remains some learning needed to be able to properly inform the development of new models based upon this approach. For example, some issues regarding the pilot remain in question:

- Which suppliers should be eligible for the scheme – which could range from any supplier in the market place, through any supplier expressing an interest in participating (the current approach of the BDUK scheme), to prequalified suppliers only?
- What is the true value-for-money of the scheme, since despite the relative openness of the BDUK scheme, one observes a tendency for quotes to be for the maximum voucher value when costs should be variable depending upon construction and installation costs needed to provide a connection? By contrast, satellite broadband pricing tends to be more fixed and transparent and therefore is well suitable to a voucher-type scheme. Ultimately, the BDUK scheme remains an upfront CAPEX subsidy (though it could theoretically be extended to OPEX if funding allowed).
- What is the risk that the BDUK scheme merely provides subsidies to SMEs that would have adopted the technology anyway and therefore offers little net additional benefits? The key additional – albeit indirect – benefit of the scheme therefore is that it acts to catalyse demand and requires at least some demand stimulation/marketing to encourage take-up.

4.6.5. Large-scale pilot projects as a measure for demand stimulation

Close-to-market, large-scale pilot projects in the field of satellite broadband deployment could have a positive impact, as also suggested by BB-MED (see 4.6.2). Provided they deploy mature e-services in a realistic environment, large scale pilots would:

- Test demand aggregation mechanisms from economic and governance perspectives.
- Contribute to awareness raising.
- Provide an ideal environment for stimulating demand.

Looking at the 2007-2013 framework, these pilots were too close to market to be implemented through a pure R&D environment such as FP7.

On the other side, projects related to broadband investments were not eligible within the European Territorial Co-operation objective 2007-2013 (financed by ERDF) that supports cross-border,

transnational and interregional cooperation programmes at EU levels.

Eventually, the CIP ICT PSP, and in particular Pilot B-type projects, could have provided the right environment.

A proposal to address the deployment of public e-services in broadband white areas of Europe was submitted by a consortium made (among others) of a few SABER partners to the CIP ICT PSP 2013 call, namely to the only relevant line (Open Objective for Innovation).

In the end this proposal was not selected (even if evaluated as relevant and eligible for selection).

Without going into any detail on the perceived quality of the proposal - yet noting that the specificities of satellite broadband apparently suffered from some lack of awareness during the evaluation process, some general conclusions can be drawn from this experience:

- ICT PSP Pilot B, calls for project delivering trans-European e-services. In practice, the availability of a common trans-European connectivity infrastructure among different regions or areas is a pre-condition for the creation of trans-European public e-services, which today do not exist and/or are neither accepted not put forward for various reasons, including for instance language barriers and governance issues, etc.

- Some of the ICT PSP, Pilot B, financial rules (namely on sub-contracting) could prevent projects from being aligned with the standard value chain for the supply of satellite broadband in Europe (see 3.2) and the standard public procurement. In other words, to be representative of the way of working with the market.

- Nonetheless, the public partners involved in the unsuccessful proposal confirmed that a large-scale awareness raising, promotion, and demand stimulation effort, based on concrete offers and labelled by European and/or national public authorities, is an essential condition to trigger end-user motivation in rural and isolated areas for adopting e-services of local or general interest. And that demand for connectivity, namely satellite connectivity in rural and isolated areas, is stronger when associated with a demand for e-services, especially for public services.

4.6.6. Potentially relevant tools within the 2014–20 programmes

The peculiarity of the Multi-annual Financial Framework 2014 2020 is the simplification of funding procedures and the consolidation of the Programmes. Even though the in depth analysis of the relevant tools will be done within the SABER WP4 Deliverables, once the 2014–20 multi-annual financial framework and its associated instruments are finalised, it is worth providing an early analysis of 2014-2020 Programmes related to Demand Aggregation/Stimulation projects. In particular:

CEF for telecommunications networks:

It appears to be a tool with good potential, when bringing this approach up to European level and focusing on closing the remaining digital divide in Europe, to support:

- The design of a core European scheme to tackle the digital divide, e.g. development and implementation of tools and mechanisms aiming to favour the absorption of European funds for regional development , especially those relevant for broadband infrastructure (e.g. EU-labelled guidelines detailed which funds can be used for broadband infrastructure procurement –including those relating to satellite solutions- and how)
- The development of guidance documentation, such as those developed by SABER, but preliminary assessment of EU 2014–20 relevant tools also beyond this, e.g. the provision of central technical assistance to PAs or other groups (e.g. SMEs, schools, hospitals, etc.)
- The provision of a central information portal, specifically the revival of the EU Broadband portal
- The provision of funding to local bodies, e.g. for local demand stimulation actions in critical regions, or to provide a technical assistance framework.

A preliminary analysis of CEF for telecommunication networks found that although the actual budget is much lower than was initially requested (€1 bn. instead of €9.2 bn.), CEF still incorporates activities highly relevant to supporting the deployment of satellite broadband. The current draft version of the CEF regulation (COM(2013)329, May 19th, 2013) indicates:

"Horizontal actions: The deployment of trans-European telecommunications networks that will

help to remove the bottlenecks existing in the digital single market shall be accompanied by studies and programme support actions:

- Technical assistance to prepare or support implementation actions in their deployment, governance and addressing existing or emerging implementation problems.
- Actions to stimulate existing demand or create new demand for digital service infrastructures."

These CEF actions are expected to be studies or to support actions selected through competitive calls for projects. It is important to note that, although the CEF is a central budget, it should fund actions proposed by the Member States, be it in the field of broadband network deployment, digital service infrastructure, or technical assistance.

Based on the early elements available on the CEF and on the assessment in this chapter, SABER's preliminary recommendations for the CEF for Telecommunications Networks is for Horizontal Action projects in the following areas:

- The development and implementation of tools and mechanisms aiming to favour the absorption of European funds for regional development, especially those relevant for broadband infrastructure (e.g. EU-labelled guidelines detailed which funds can be used for broadband infrastructure procurement and how, including those relating to satellite solutions).
- **A centrally-managed (EU level) technical assistance framework for local PAs or sectoral groups** (e.g. the establishment, at EU level, of technical best practice for operators/owners of e-services willing to deploy in broadband white areas through satellite connectivity).
- A large-scale and organised **dissemination of proven demand stimulation techniques for connectivity or ICT in general,** adapted to the targeted communities.
- The implementation of **local demand stimulation actions**.

- **The mapping of existing e-services** addressing EU priorities (typically societal challenges) seeking deployment of broadband in white or grey areas.
- In order to ensure the efficiency of the above, the establishment **of a tool ensuring the local dissemination of the initiatives and best practices centrally elaborated at EU level.** This could be realised through a specific EU body, such as a DAE Council funded through the CEF, with offices and expertise in critical regions.

The EC has an obvious added value for the actions listed above, namely its capability to:

- Organise calls for interest that can widely reach e-services owners and/or operators willing to deploy outside their national boundaries.
- Advertise EU-wide the possibility to use the framework of such CEF-funded support action.

Horizon 2020:

It is not yet clear whether the programme, with a specific emphasis upon innovation, will allow deploying large-scale close-to-market pilot projects. In addition, the evolution of the previous CIP programme is not yet known by the SABER partners.

ESI funds 2014 2020

Even though this subject will be deeply analysed in SABER WP4, it is worth to mention the importance of ERDF and EAFRD to finance Demand aggregation projects at national / regional level. Moreover, in consideration of the fact that ICT sector is the fourth Concentration thematic objective for ERDF in 2014-2020, fast and easy to implement solutions as the demand aggregation model could play an important role in the commitment of the UE funds for broadband access especially in un-served remote areas to improve grow and jobs.

Moreover, it is important to mention that in the Territorial Cooperation Objective 2014-2020 large-scale broadband infrastructure project are eligible. This means that, within this Objective, Broadband Projects will have Cross Border, transnational and interregional characteristics. It is worth to mention that these Territorial Cooperation Operational programmes, for their multi-Member State participation characteristics, are the best soil to develop and implement projects on

demand aggregation at all European levels. In this context, satellite broadband, for its pan-European characteristic and being an in place infrastructure, is the easier and faster way to implement cross border, transnational and interregional broadband demand aggregation projects.

4.6.7. Conclusions and recommendations

The analysis of demand aggregation as a method to quickly close the digital divide for satellite broadband in Europe does not highlight easy or universally applicable mechanisms. However, it does provide an understanding of what needs to be done to facilitate the take-up of satellite broadband in unserved and under-served areas, how this can be done and by whom. In the current context, SABER concludes that actions for truly closing the Digital Divide should rely on formalised and balanced task sharing between a central body, the EC, and the local implementing public authorities (Member States, regions, etc.). The tools at our disposal to achieve those goals include:

- The SABER thematic network (guidelines, dissemination)
- The EC action capacity (communication, promotion, labelling, etc.)
- The central European budget and mechanisms available through the CEF for telecommunication networks (especially the horizontal actions addressing technical assistance and demand stimulation)
- The EU programmes able to support large-scale close-to-market pilot projects (such as the follow-on of CIP in the 2014–20 programme)

In summary, the demand aggregation, harmonisation and stimulation support actions recommended by SABER encompass:

- The development and implementation of tools and mechanisms aiming to favour the cost-effective absorption of European funds for regional development for broadband infrastructure (e.g. EU-labelled guidelines detailed which funds can be used for broadband infrastructure procurement and how, including those relating to satellite solutions)
- A centrally-managed (EU-level) technical assistance framework for local PAs or sectoral groups (e.g. the establishment, at EU level, of a repository of technical/administrative best

practice for operators/owners of e-services willing to deploy in broadband white areas through satellite connectivity)

- The implementation of local demand stimulation actions through an EU-managed mechanism such as the CEF
- In order to ensure the efficiency of the above, providing recommendations to ensure the local dissemination of the initiatives and best practices centrally elaborated at EU level. This could be realised through a specific EU body, such as a DAE Council, with offices and expertise in critical regions.

The following analysis confirmed that closing the digital divide not only requires the availability of broadband connectivity, but also strong demand stimulation efforts adapted to local target communities, combined with public mechanisms harmonising demand. Also, the initiation of formalised task sharing between Europe and the local level (i.e. Member States, regions, sub-regions, etc.) is highly recommended, to ensure both awareness and implementation of potential solutions at local level.

5. Final conclusions and recommendations

It is normally claimed that the DAE target of providing 100% of Europeans with basic broadband by 2013 has been officially reached because satellite signals are present anywhere, and so in principle all EU citizens have the possibility to get on line. In practice, however, the cost of purchasing end-user equipment – a few hundred Euros per household – represents (alongside with the low awareness of the quality of new satellite systems) a real hurdle that keeps take-up in the most rural areas particularly low. In fact, it could be argued that until that cost is substantially higher than in more densely populated areas, full coverage of basic broadband cannot really be claimed and the digital divide will persist. Currently, initiatives from public authorities are focused on terrestrial solutions, and investment and business models are tailored around such solutions. Consequently, little support is provided to remove the cost hurdle for satellite broadband adoption, and hence to provide true 100% basic broadband coverage.

In order to take advantage of the availability of satellite-based broadband infrastructure, SABER has identified voucher schemes as the simplest, quickest and most effective solution to subsidise the purchase and installation of the end-user equipment. This recommendation stems from the fact that, unlike for terrestrial broadband, for satellite broadband the backbone infrastructure already exists in the form of satellites and teleports (notwithstanding the ongoing need to increase and improve this capacity), while investment is needed at the level of the end user, in order to enable the take-up, as argued above.

Two considerations can be made around this solution. Firstly, voucher schemes need to be designed in such a way that they are not considered as subsidies to the end user. If installation of a end-user equipment is viewed as necessary infrastructure in order to provide broadband, in a similar way to a fibre deployment or DSLAM upgrade, then funding can be channelled to service providers to contribute to part of that "infrastructure deployment cost". If needed, the clear eligibility of the satellite equipment to public funding should be re-stated by the European Commission.

Secondly, although several voucher schemes have been successfully used in key regional-level publicly-supported satellite deployment, such schemes are most likely best run at national or European level. Indeed, while regions and municipalities are the best vehicles to drive investment

for terrestrial solutions (which need local networks on the ground, with consequent right-of-way and digging permits, construction or lease of antenna and local node sites, compliance with local town planning, coordination with other utilities, local geographical and socio-demographic knowledge, etc.), national or European investment bodies are better positioned to aggregate large numbers of end-users (scattered over large areas, often across different regions), hence achieving a certain critical mass to ensure the necessary economies of scale for network deployment, management and operation. This also leverages the better technical know-how and market knowledge available at higher government levels.

Nonetheless, we are aware that the current set-up of European fund distribution is often structured at regional level, and we recognise that regional and local public authorities can leverage local awareness and more successfully take the role of identifying the end users that are best suited for satellite coverage. A possible solution could then be implementation at regional level of centrally-designed voucher schemes. Such schemes could reuse procurement schemes from best practices across the Continent (e.g. in the UK, France and Spain).

A further issue – that was introduced in this deliverable, but will be dealt with during the remainder of the project – is that the target of 100% coverage of 30 Mb/s broadband access by 2020 looks increasingly difficult to achieve. This is especially true for the most remote areas, for which terrestrial solutions are either ineffective, due to the long distances (e.g. for DSL and radio) or too expensive (for fibre). Unlike for the 2013 target mentioned above, help from satellite broadband is formally not be available, since the commercial residential systems currently only deliver speeds up to 20 Mb/s (download). A possible solution could be to allow for the DAE target of 30 Mb/s coverage by 2020 to be interpreted flexibly in those areas in which the cost of fibre-based solutions (be it FTTP/FTTH, or FTTCab+VDSL, or 4G with fibre backhauling) are deemed prohibitively expensive; satellite broadband may then provide an attractive option to no-broadband, or to low quality basic broadband. The coming deliverables will present this and other possible approaches in more detail.

6. Acronyms

4G - 4th Generation (mobile)
ACM - Adaptive Coding and Modulation
ADSL – Asynchronous Digital subscriber line
ARPU - Average Return Per User
BB-Med - Broadband Mediterranean Development
CAPEX - Capital Expenditure
CEF – Connecting Europe Facility
CIP – Competitiveness Innovation Programme
CMTS - Cable Modem Termination System
CPE - Customer Premises Equipment
DAE – Digital Agenda Europe
DCENR - Department of Communications, Energy & Natural Resources
DOCSIS - Data Over Cable Service Interface Specification
DSL – Digital Subscriber Line
DSLAM - Digital Subscriber Line Access Multiplexer
EBM – European Broadband Map
EIB – European Investment Bank
EIRP - Effective Isotropic Radiated Power
ERDF – European Regional Development Fund
ESI - European Structural and Investment funds
EAFRD – European Agricultural Fund For Regional Development
FAP - Fair Access Policy
FEMIP - Facility for Euro-Mediterranean Investment and Partnership
FP7 – Seventh Framework Programme
GDP – Gross Domestic Product
IRU - Indefeasible Rights of Use
FTTP – Fiber to the Premises
FUP - Fair Usage Policy

Gbps – Gigabit per second

GEO - Geosynchronous

HTS - high-throughput satellites

ICT – Information and Communications Technologies

iLNB – interactive Low-Noise Block (down converter)

IP – Internet Protocol

JTI - Joint Technology Initiatives

ISP – Internet Service Provider

LNB – Low-Noise Block (down converter)

LTE – Long Term Evolution

Mbps – Mega bits per second

NGA – Next Generation Access

NOC - Network Operations Centre

OJEU - Official Journal of the European Union

OPEX – Operating Expenditure

OPIE - Operational Programme Innovative Economy

PA - Public Authorities

POP – Point Of Presence

PPP – Public Private Partnership

PSP – PolicySupport Programme

QoS – Quality of Service

R&D – Research and Development

ROI – Return On Investments

SLA – Service Level Agreement

SME – Small and Medium Enterprises

TCP – Transmission Control Protocol

UfM - Union for the Mediterranean

VAT – Value Added Tax

VDSL - Very High-speed Digital Subscriber Line

VoIP – Voice over IP

Wi-Fi – Wireless Fidelity

WiMAX - Worldwide Interoperability for Microwave Access

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A Annex I: Frequently Asked Questions

A.1 FAQs for Public Authorities

1. What is internet- by- satellite and why should a Public Authority consider it?

2. Are internet- by- satellite solutions too complex? What kind of support material is needed?

3. Is satellite broadband any good? Which applications does it allow?

4. What are satellite broadband limitations?

5. What are the quality and performance criteria to decide among the various broadband technologies?

6. Is satellite broadband affordable?

7. How does a Public Authority efficiently procure satellite broadband?

8. Who has contractual relations with the Public Authority?

9. Is satellite broadband eligible for local subsidies?

10. How can an administration ensure that its subsidy has been properly spent?

11. How does satellite broadband compare with other solutions in term of cost-benefit analysis?

12. Is satellite broadband eligible for state aid? Can it be considered as infrastructure?

13. Does financing a satellite solution mean financing an "Open Architecture" solution? Does it allow competition?

14. Can a public administration own the satellite infrastructure it is financing?

15. Can satellites achieve very high speed (100 Mbps and beyond)?

16. Will satellite broadband still exist in 10 years or 20 years? Will it be performing better?

1. What is internet- by- satellite and why should a Public Authority consider it?

- Internet- by- satellite, also referred to as satellite broadband, is a high speed internet connection made via communications satellites instead of a telephone landline or other terrestrials means. It provides a bi-directional connection, meaning the possibility to download and upload data between the internet and your computer.
- It is available everywhere and immediately across Europe unlike other broadband solutions (no need for the local authority to deploy a terrestrial support network).
- It is the only broadband solution for those who live in areas without or with slow terrestrial or wireless/mobile broadband access. It can complement terrestrial and wireless networks to ensure 100% broadband coverage across Europe.
- It is recognised by the EU as the immediate gap filler while waiting for ADSL or fibre – if planned and technically feasible. European Commissioner Nelly Kroes, in charge of the Digital Agenda for Europe (DAE), stated in June 2013: “Basic Broadband is now virtually everywhere in Europe – satellite performance has improved, helping to cover the 4.5% of population not covered by fixed basic broadband. The Commission is now focused on getting better take-up of satellite where this can bridge remaining gaps.”
- Choosing satellite broadband services generate local jobs: qualified Internet Service Providers (ISP, also referred to as Distributors) and antennas installers. Across Europe, SES, Eutelsat and their distributors have already trained several thousands of local antennas installers.
- Choosing satellite broadband services enables Public Authorities to ensure the continuity of their public services, typically in the field of e-health and e-administration. Satellite broadband services can support large scale WiMax and Wi-Fi solutions.

2. Are internet by satellite solutions too complex? What kind of support material is needed?

- Internet- by- satellite solutions are not complex. They require an antenna (a white satellite TV-like dish, though slightly bigger at 70 cm diameter) connected to a modem inside the house (as for traditional solutions): this replaces the connection to the copper network through the phone line or to fibre. There is no need for any specific software application on the Personal Computer.
- The positioning of the antenna is a bit more accurate than for a TV-antenna, so a guidance system (generally sound-based) is incorporated. The antenna can be installed by an average user.
- Legal authorisation is not normally required for installing a satellite dish but it is recommended to check local legislation for possible similar restrictions in historic areas or areas of natural beauty. No specific procedure towards the Telecommunication administration is required to install the satellite dish (in other terms, no specific radio-equipment licence or fee is needed).

3. Is satellite broadband any good? Which applications does it allow?

- Downloading and uploading files is as fast and reliable with satellite broadband as with ADSL. Web surfing is the same as other terrestrial and wireless solutions.
- Triple play packages (Voice Over Internet Protocol - VoIP) based on satellite solutions are now available: internet, TV and voice with the same internet dish (reversely, TV-only dish cannot be used for internet services). Satellite broadband also allows supporting video-conferencing. The latency impact (0.5 second delay) is not considered as annoying by the users for the voice applications.
- Offers range in terms of speed and monthly data allowance is typically equivalent or sometimes better than traditional ADSL:
- a. Up to 20 Mbps download and 6 Mbps upload
- b. As with wireless technologies, most subscriptions are capped in term of monthly data use. A 10 GB monthly volume is often associated to a 20 Mbps download subscription (down to 2 GB for 2 Mbps), which allows frequent internet usage, including downloading music and movies and downloading/posting videos.
- Services (internet connection) are guaranteed at least at 99.5% for the contractual period set by

your local Service Internet Provider.

4. What are satellite broadband limitations?

- Satellite broadband does not allow massive downloading and video streaming because of the limitation on the monthly volume allowance (typically 10 GB per month, i.e a few movies).
- Satellite broadband is not well suited to online “fast twitch” or “first person shooter” interactive gaming because of longer delay (0.5s latency) than that of fixed broadband. It will work too slowly with buffered periods. Satellite broadband will work fine for “turn-based” games (e.g. chess).

5. What are the quality and performance criteria to decide among the various broadband technologies?

- The European Thematic Network SABER issued in 2013 guidelines for satellite services procurement aiming to fulfil the DAE 2013 target and available upon request at www.project-saber.eu. Those guidelines propose a list of technical criteria to be set by the implementing Public Authority in order to ensure high-quality broadband interventions that are technology neutral. Those criteria encompass:
    - a comprehensive cost/benefit analysis in order to determine the most economically advantageous solution in term of total cost per connected user.
    - the level of use of infrastructures already in place, in order to limit the need of public investment and potential competition distortion
    - the timeliness of the broadband services deployment
    - thresholds for download and upload speeds: 6Mbps/2Mbps
    - a minimum global traffic allowance: 3 GB/month.

6. Is satellite broadband affordable?

- Monthly subscriptions compare with equivalent performance ADSL offers. On the European market, subscription starts from 18 €/month for a download speed up to 2 Mbps and 2 GB of monthly volume. Offers allowing 20 Mbps download start from 30 €/month.
- Satellite broadband subscription prices increase with the data allowance. Bill-shocks (unexpected charges, e.g when going beyond the data allowance) cannot happen with Satellite broadband contracts.
- As for terrestrial offers, prices vary a lot across Europe: for satellite broadband, these variations are due to specific marketing approach taken by each Internet Service Providers and the existence –or not – of local government support for satellite broadband.

7. How does a public Authority efficiently procure satellite broadband?

- The European Thematic Network SABER issued in 2013 guidelines for satellite services procurement aiming to fulfil the DAE 2013 target and available upon request at www.project-saber.eu. Those guidelines describe two approaches for procuring satellite broadband:
    - A call-off procedure leading to the selection of a pool of internet service providers. This solution provides financial aid in the form of a voucher payable to the service provider to procure and put into service an antenna and modem for satellite internet access for residents in areas where the scheme is implemented.
    - A tender leading to the selection of a unique provider for an area.
    - The list of service providers available across Europe can be found at www.broadbandforall.eu (click-on-your-country approach which embeds SABER input).

8. Who has contractual relations with the Public Authority?

- In most cases, Public Authorities have a contractual relation directly with the local Internet Service Provider(s).

- Satellite operators manage the central communication hub and network, and thus guarantee service continuity to the Internet Service Providers.
- Would a local Internet Service Provider fail to deliver the service contracted with a Public Authority, the satellite operators would propose another local distributor to the Public Authority.

9. Is satellite broadband eligible to local subsidies?

- Yes local subsidies are possible. Customer Premises Equipment (antenna and modem and their installation) can be subsidised by the municipality or the region (European Regional Development Fund - ERDF- and European Agriculture Fund for Rural Development- EAFRD- have already been used for such purpose):
    - Many municipalities/regions have deployed a Broadband Deployment plan: they reimburse the expenses or provide a voucher to get the equipment installed for free.
    - The average value of a grant covering Customer Premises Equipment purchase and installation is around 500 €.
- The option of monthly leasing also exists with most Internet Service Providers (typically an additional 5 to 8 €/month).

10. How can an administration ensure that its subsidy has been properly spent?

- The European Thematic Network SABER issued in 2013 early guidelines for satellite services procurement aiming to fulfil the DAE 2013 target and available upon request at www.project-saber.eu. Those guidelines include recommendations to efficiently address the audit system to ensure compliance with EAFRD and ERDF regulations (on-the-spot check procedures).
- The guidelines recommend in particular pragmatic means to verify the proper spending of public funds, such as:
    - Photos tagged with GPS coordinates and date can be taken by the installer and sent to the Administration that manages the Audit.
    - Satellites operators can be asked to inform the Administration about the status of the antenna (ON or OFF; approximate localisation).

11. How does satellite broadband compare with other solutions in term of cost-benefit analysis?

Satellite broadband compares very well with other solutions from a cost-benefit point of view. Indeed:

- The satellite space and ground infrastructures are fully financed by the satellite operators.
- The only infrastructure cost left is that for Customer Premises Equipment (the antenna and its installation plus modem). Public Authorities are allowed to subsidise these equipment costs.

12. Is satellite broadband eligible for a state aid? Can it be considered as an infrastructure?

- Satellite Customer Premises Equipment (antennas and modems) is recognised as infrastructure eligible for public funding, provided the EU Guidelines for the application of state aid rules in relation to the rapid deployment of broadband networks are respected (see Legislation 2013/C 25/01).
- Beside national, regional or local funds, the main EU funds available for satellite broadband financing, managed at national/ regional level, are:
    - The European Agriculture Fund for Rural Development (EAFRD). See Art 52-b-i and Art 56 from the EAFRD Regulation 1698/2005. To check the availability of subsidies, you need to check the Rural Development Plan of your region or State.
    - The European Regional Development Fund Structural Fund (ERDF). To check the availability of subsidies please check the Regional Operational Programme of your region or the specific National Operational Programme.

- Subscription fees are not eligible at present (in 2013) to public funds aiming to support broadband deployment actions.

13. Does financing a satellite solution mean financing an "Open Access" solution? Does it allow competition?

- Satellite broadband provides an Open Access. In fact, satellite operators are wholesale operators and lease satellite capacity and connection services to resale service providers, which in turn offer services to consumers even if they do not operate the local loop.
- The Open Access is guaranteed in satellite broadband via the "bitstream"; the "bitstream" is the sole Open Access solution complying with the architecture of satellite broadband network (satellite network is an active infrastructure).
- The bit-stream is a wholesale product consisting of the access and the backhaul services. The traffic is transparently carried between the Customer Premise Equipment and the satellite teleport. In more precise technical jargon, the traffic of the resale operators is transparently carried by the wholesale operator between the termination point of the satellite CPE and a point of presence on the backbone connected with the satellite teleport (handover point).

- Satellite broadband deployment allows competition at several levels:
- Satellite operators only provide the infrastructure, the Internet Service Providers dealing with the provision of services. Satellite operators do not give nor request any exclusive rights to one ISP. There is no competition restriction on the ISPs market: the consumer and the Public Authorities can freely choose.
- Moreover, competition exists also among operators to sell their available in-orbit capacity to the pool of local Internet Service Providers.

14. Can a public administration own the satellite infrastructure it is financing?

- Generally, public grants in satellite broadband deployment schemes provide an individual satellite antenna and modem for users' premises, typically worth a few hundred euros. Maintaining the ownership of this Customer Premises Equipment at Public Authority level (in terms of accounting, liability, etc.) is often more expensive than the value of the grant itself, and as such whilst feasible is not recommended.
    - Obviously, the above does not apply where the beneficiaries of the grant are Public Authorities themselves.
    - This ownership model better fits a demand-stimulation action (unrecoverable funds) than a supply-support one.
- In Europe, the satellite itself belongs to the operator and its capacity is sold. The ownership of a tangible element of the satellite, such as a transponder (i.e. a situation in which the capacity of this element belongs to the contractor throughout the lifetime of the satellite in orbit, and therefore corresponds to CAPEX – CAPital EXpenditure) is very unusual even if it might be considered in very specific cases. Examples exist in the US and could be envisaged by over-sea regions of Europe.

15. Can Satellites achieve very high speed (100 Mbps and beyond)?

- High-Throughput Satellites (HTS) based on presently available technologies already deliver up to 20 Mbps internet access to any consumer. Customised offers for Professional users are available, with internet access speeds up to 50 Mbps.
- Within five years, newly-developed technologies will allow higher performance while maintaining a viable economic model. The technology developments which will allow this performance improvement are ongoing. Services proposing 50 Mbps for the consumer should be feasible by 2017 and 100 Mbps by 2020.

16. Will satellite broadband still exist in 10 or 20 years? Will it be performing better?

- The lifetime of the satellites in orbit today is about 15 years. Satellites are replaced over time by the satellite operators.
- In parallel, technology is evolving and should allow by 2020 offering consumers speeds of around 100 Mbps.

A.2 FAQs for Final Users

1. What is internet- by- satellite? Why should I adopt it? Who is it for?

2. Are internet- by- satellite solutions too complex? What kind of support material is needed?

3. What are the quality and performance criteria for choosing a satellite broadband offer?

4. Is satellite broadband any good? Which applications does it allow?

5. What are satellite broadband limitations?

6. How is data confidentiality ensured with a satellite broadband service?

7. Can I get broadband over a wireless (Wi-Fi) network in my home if I have satellite broadband subscription?

8. Can I share one antenna with my neighbour?

9. Are satellite broadband installations potentially dangerous for health?

10. Is satellite broadband cheap?

11. How do I subscribe to internet- by- satellite?

12. Is satellite broadband eligible for support by local government?

13. Have the satellite broadband services commercial offers stabilised? Can I upgrade to a higher speed package at a later date?

14. Is there a 24/7 Customer Service for satellite broadband?

15. Will satellite broadband still exist in 10 or 20 years? Will it be performing better?

1. What is internet- by- satellite? Why should I adopt it? Who is it for?

- Internet- by- satellite, also referred to as satellite broadband, is a high speed internet connection made via communications satellites instead of a telephone landline or other terrestrials means. It provides a bi-directional connection, meaning the possibility to download and upload data between the internet and your computer.
- Internet- by- satellite is available now and everywhere in Europe: it is the only broadband solution for those who live in areas without or with slow terrestrial or wireless/mobile broadband access.
- It is an immediate gap filler, possibly whilst waiting for another solution (such as ADSL or fibre etc.).

2. Are internet- by- satellite solutions too complex? What kind of support material is needed?

- Internet- by- satellite solutions are not complex. They require an antenna (a white satellite TV-like dish, though slightly bigger at 70 cm diameter) connected to a modem inside the house (as for traditional solutions): this replaces the connection to the copper network through the phone line or to the fibre. There is no need for any specific software application on the Personal Computer.
- The positioning of the antenna is a bit more accurate than for a TV-antenna, so a guidance system (generally sound-based) is incorporated. The antenna can be installed by an average user.
- Legal authorisation is not normally required for installing a satellite dish but it is recommended to check local legislation for possible similar restrictions in historic areas or areas of natural beauty. No specific procedure towards the Telecommunication administration is required to install the satellite dish (in other terms, no specific radio-equipment licence or fee is needed).

3. What are the quality and performance criteria for choosing a satellite broadband offer?

- Maximum monthly data allowance is in practice more important than speed. For example, a monthly allowance of around 10 GB allows frequent internet usage, including downloading music, video clips and movies such as:
    - exchanging 5000 mails of 1 MB each
    - and downloading 500 documents of 1 MB each
    - and posting/downloading 150 photos of 1 MB each
    - and browsing the web 10 hours per day
    - and downloading 100 music pieces of 3 MB each
    - and streaming 20 video clips of 60 MB each
    - and posting about 1 hour of iPad videos
    - and downloading 4 Standard Definition movies (typically 700 MB each) or 2 High Definition movies.
- Offers vary in terms of speed and data allowance, but are typically equivalent or even better than traditional ADSL broadband:
    - Up to 20 Mbps download and 6 Mbps upload
    - As with wireless technologies, most subscriptions are capped in term of monthly data use. A 10 GB monthly volume is often associated to a 20 Mbps download subscription (down to around 2 GB with speeds of 2 Mbps).

4. Is satellite broadband any good? Which applications does it allow?

- Downloading and uploading files is as fast and reliable with satellite broadband as with ADSL. Web surfing is the same as other solutions.
- Internet Service Providers (ISP, also referred to as “Distributors”) offer 99.5% guarantee for the service (i.e internet connection). Some ISPs propose a minimum speed guarantee, providing the maximum data allowance is not exceeded.
- Triple play packages (Voice Over IP, VoIP) based on satellite solutions are now available: internet, TV and voice with the same internet dish (reversely, TV-only dish cannot be used for internet services). Satellite broadband also allows supporting video-conferencing. The latency impact (0.5 second delay) is not considered as annoying by the users for the voice applications.

5. What are satellite broadband limitations?

- Satellite broadband does not allow massive downloading and video streaming because of the limitation on the monthly volume allowance (typically 10 GB per month, allowing downloading several standard definition movies). Video streaming quality is not affected by the volume limitation.
- Satellite broadband is not well suited to online “fast twitch” or “first person shooter” interactive gaming because of longer delay (0.5s latency) than that of fixed broadband. It will work too slowly with buffered periods. Satellite broadband will work fine for “turn-based” games (e.g. chess).
- Internet- by- satellite works when it rains, even in heavy rains. New technologies are much less sensitive to rain than a few years ago because they allow maintaining the link while adapting the data rate to rain conditions. The performances are in line with availability specifications (better than 99,5%). In very high rainfall areas, the sizing of the dish is adapted to secure the link. Only heavy hail can generate short outages.
- Due to the shortage of IP addresses in some countries and to the Europe-wide coverage of satellites, IP addresses provided for internet- by- satellite services might not always have the same nationality than the customer. In case of specific need for a national address, it is recommended to check in advance the availability with the Internet Service Provider.

6. How is data confidentiality ensured with a satellite broadband service?

- Several sophisticated mechanisms and encryption algorithms ensure a high security level during the “on-air” data transmission between the user premises and the satellite, and between the satellite and the internet backbone.
- Concretely, every modem connected to the satellite is protected thanks to a unique MAC (Media Access Control) address, i.e a unique identifier assigned for communications on networks. Beside, all data transmissions are fully encrypted in order to ensure confidentiality of the transmissions, as well as of the transmitted information.

7. Can I get broadband over a wireless (Wi-Fi) network in my home if I have satellite broadband subscription?

- Personal Wi-Fi networks can be supported by satellite-broadband solutions. Satellite broadband does not generate any interference with your wireless network.
- Anyone can set up a wireless network in their home so that they can go online from more than one PC or use their broadband in different rooms. Unless included in your Internet Service Provider package, you will need to purchase your own wireless router; these devices are available from

most computer retailers.

- Also, several satellite-broadband systems can be installed close to each other.

8. Can I share one antenna with my neighbour?

- In the standard consumer offers, each dish can only be connected to one single modem. Specific architectures serving multiple users can be implemented on request but do not come at standard prices.

9. Are satellite broadband installations potentially dangerous for health?

- Satellite broadband presents absolutely no danger for health (neither dangerous radiations nor electro-magnetic pollution).
- The personal dish emits the signal to the satellite, i.e. up into space, with a power equivalent to that of a mobile phone. The signal received from the satellite is attenuated through the atmosphere and is thus one million times weaker than signals received by mobile phones.

10. Is satellite broadband cheap?

- Monthly subscriptions compare with equivalent performance ADSL offers. On the European market, subscription starts from 18 €/month for a download speed up to 2 Mbps and 2 GB of monthly volume. Offers allowing 20 Mbps download start from 30 €/month.
- Satellite broadband subscription prices increase with the data allowance. Bill-shocks (unexpected charges, e.g when going beyond the data allowance) cannot happen with Satellite broadband contracts.
- As for terrestrial offers, prices vary a lot across Europe: for satellite broadband, these variations are due to an uneven density of Internet Service Providers across Europe and the existence –or not – of local government support for satellite broadband.

11. How do I subscribe to internet-by-satellite?

- Subscriptions can be obtained through local satellite Internet Service Providers. They operate independently from the satellite operators and offer their own commercial policies and subscription models.
- The European Thematic Network SABER issued in 2013 a review of the retail offers by 250 providers across 24 European countries. The list of service providers available across Europe can be found at www.broadbandforall.eu (click-on-your-country approach which embeds SABER input). All SABER outcomes can be obtained upon request at www.project-saber.eu.

12. Is satellite broadband eligible for local government support?

- Many municipalities/regions run a Broadband Deployment plan: they reimburse the expenses or provide a voucher to get the Customer Premises Equipment (antenna and modem and its installation) for free.
- The average purchase price for a satellite dish is 350 €.
- The option of monthly leasing also exists with most Internet Service Providers (typically an additional 5 to 8€/month).

13. Have the satellite broadband services commercial offers stabilised? Can I upgrade to a higher speed package at a later date?

- Upgrade of the subscription to another service level is possible at any time during the contract period with most Internet Service Providers without any additional equipment change or charge or on site intervention.
- Downgrades are also available, usually after completion of a minimum contract period.

14. Is there a 24/7 customer service for satellite broadband?

- Satellite operators are available 24/7 for local Internet Service Providers.
- Local Internet Service Providers independently decide the customer support they provide, such as helplines or online support. Their choice is not limited by the satellite technology.

15. Will satellite broadband still exist in 10 or 20 years? Will it be performing better?

- The lifetime of the satellites in orbit today is about 15 years. Satellites are replaced over time by the satellite operators.
- Satellite technology continues to evolve and should allow speeds around 100 Mbps by 2020.

B Annex II: Validation

B.1 Introduction

In addition to relying on input from its 24 partner organisations, SABER has built into its methodology a validation process whereby the project seeks input from external sources to validate the findings of SABER's research and the usefulness of the deliverables created for their target audience. European Commission services were widely engaged; representatives from DG CNECT, DG AGRI and DG REGIO provided feedback on SABER deliverables through bilateral meetings, in writing and through participation on panels in SABER workshops.

Other network organisations such as NEREUS and Eurisy, the European Space Agency and the European Investment Bank have also been engaged through workshops and bilateral meetings.

Additionally a validation panel was created drawing from key contacts of the consortium partners who were well placed to offer a perspective on the deliverables and organisations that expressed an interest in SABER's activities were engaged. The following sections outline the validation methodology, a summary of the validation findings and how SABER has responded or will respond to the validation findings.

B.2 Validation Methodology

A wide range of representatives from the European Commission were engaged in the validation process; feedback on deliverables was provided by individuals from DG CNECT, DG AGRI and DG REGIO which served to ensure that the deliverable content and guidance provided was aligned with European policies and regulations. Feedback from the various DG's was provided through bilateral meetings and discussions, through written submissions and through participation in the four SABER workshops held to date.

Representatives from NEREUS, Eurisy and the European Investment Bank were invited to participate on panel discussions throughout the four SABER workshops held to date to provide input and various perspectives to the debates and discussions which have helped to form the content of SABER's deliverables.

A validation panel was created by issuing an invitation to key individuals identified by the

partners who have an interest in exploring satellite as an option for broadband. Individuals who had requested copies of the first SABER deliverables were also invited to participate on the validation panel. Efforts were made to ensure the panel was representative of both public authorities and industry players.

The following table provides details of the members of the validation panel:

Validation Panel		
Name	**Role**	**Organisation**
1. Christian Alfred	Managing Director	Satellite & Digital Services Ltd
2. Jon Wakeling	Head of Alternative Technologies, Group Strategy	BT
3. Ken Stockil	Director (formerly a member of the Ireland National Broadband Advisory Group and Manager of Shannon Broadband)	Central Solutions
4. Colin McKenna	Development Manager	Irish Central and Borders Area Network (ICBAN)
5. Frank Zeppen-feldt	Future Programmes	European Space Agency

Once the validation panel members were confirmed each member was forwarded a copy of the deliverables for validation along with a review template for each deliverable. The review template requested feedback on the following four aspects:

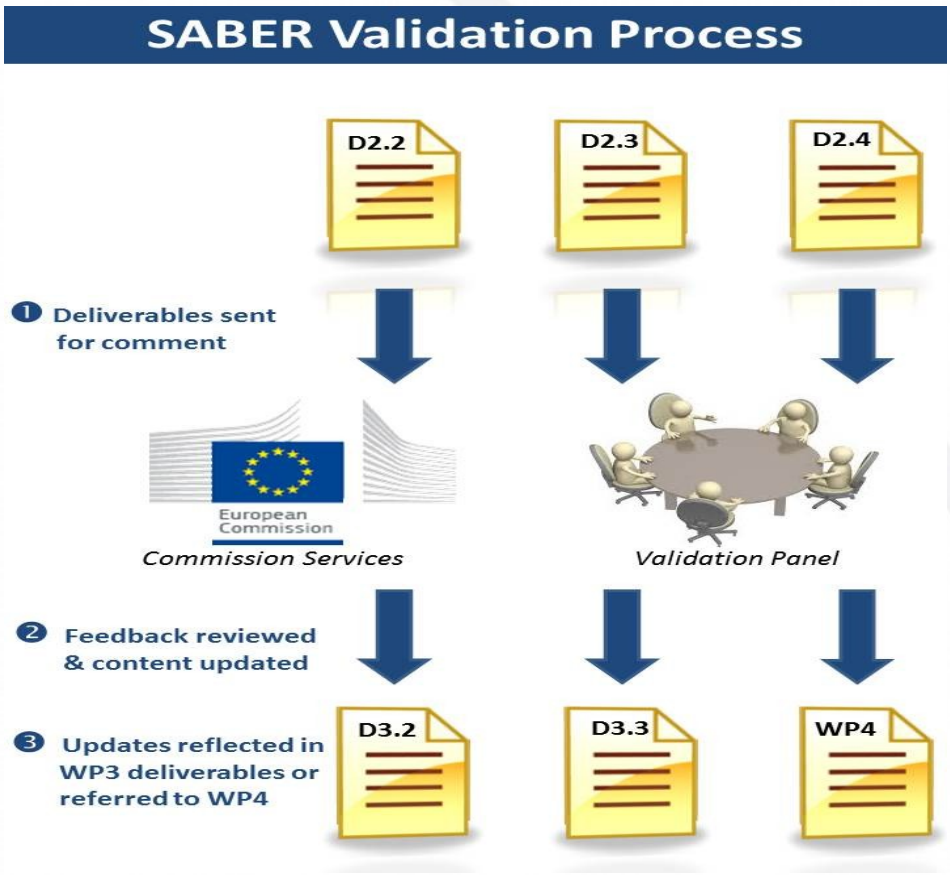
- General comments or observations on the deliverable(s).
- Omissions that need to be addressed.
- Areas that require more clarification or information.
- Additional aspects that could add value to the deliverable(s).

The review of deliverables was undertaken remotely and the review templates were returned by email by the requested due date. The panel members were invited to attend the 4th SABER workshop held in Brussels on the 11th of October to participate in the validation panel discussion. Each panel member was given the opportunity to summarise their feedback which was followed

by a questions and answers session that facilitated seeking clarification or elaboration on their feedback. DG CNECT was also represented on the workshop panel.

The validation feedback received was reviewed by the SABER partners; where appropriate updates to content were reflected in D3.2 and D3.3 of WP3 which will supersede the WP2 deliverables. Where feedback provided related to future activities it was referred to WP4.

The following figure summarises the validation process:



B.3 Validation Findings

The feedback received on D2.4 Early Report on Satellite Broadband as an Option for Regions can be classified under the following headings:

- General Comments
- Language & Style
- Additional Information Required

The following feedback was received from the Validation Panel:

General Comments

- The document was considered very useful overall.
- Some concerns that offerings from current satellite broadband providers would be diluted by aggregating demand were expressed; this appears to be a local supplier concern.
- More widespread awareness raising of the benefits of satellite broadband is needed; the deliverable might benefit from additional higher, non-technical level descriptions of satellite broadband more suitable for the intended audience of Public Administrations; e.g. "one satellite can serve a million users".
- The non-technological roadblocks section was well received; this could be worthy of a stand-alone document.
- The analysis of the Satellite ISP offer might be better presented in a separate document or database; concern over maintaining the currency of this information was expressed.
- Some of the tools mentioned in section 4.2 could be transferred to D2.2 Early Guidelines on Satellite Services Procurement to provide guidance to Public Administrations.
- The 'green' nature of satellite installations could be highlighted.

Language/Style

- Care needs to be taken in the use of language throughout the deliverable; one reviewer felt that the document read like a sales brochure for satellite broadband services; highlighting the perceived unfair treatment of satellite by Public Administrations could be perceived negatively; particularly for the target audience.

Additional Information Required

- A suggestion for providing more rules of thumb for the non-satellite aware Public

Authority was proposed; e.g. “one installer can install 2 terminals per day”.

- Public Administrations generally define their requirements on the basis of the required end user service; this will form the basis of any procurement; a perceived overselling satellite could be counter-productive for satellite providers.
- Equally, making broad claims about where terrestrial broadband can or cannot deliver can have a negative effect on how satellite providers are perceived.
- The quality of experience for end users should be the main focus for presenting the benefits of satellite broadband.
- An analysis of satellite broadband compared to other broadband offers could be useful.
- More in-depth treatment of topics such as demand aggregation would be useful; a step by step guideline would be useful for Public Administrations that could highlight the practical actions and issues that need to be addressed in a demand aggregation initiative.

Copies of the completed validation templates are included in next chapter.

Responding to Feedback on D2.4 Early Report on Satellite Broadband as an Option for Regions

General Comments

The benefits of satellite broadband are presented from the user perspective in chapter 4 of this deliverable following a study of 15 end user scenarios.

The non-technological roadblocks section is further developed in chapter 5 of this deliverable. Demand aggregation is further addressed in chapter 6 of this deliverable.

A drive towards greater awareness raising of satellite broadband and the use of clear, user-friendly language and terminology is being considered very seriously by the SABER partners; in the next phase of the project the focus shifts to providing very practical toolkits and guidance for regional organisations. The presentation of information will be framed to suit the context and needs of policy makers and investment decision makers at the regional level.

Language / Style

Concern over the use of overly commercial or non-biased language has been expressed. This is taken very seriously by the SABER consortium. Every effort is being made to present useful information and guidance to regions that can be used to inform and expand their knowledge and understanding of satellite broadband and its capabilities. As part of this effort dispelling some of the myths that surrounds some regions existing knowledge and understanding of satellite broadband is also a focus.

Additional Information Required

As indicated under 'General Comments' above D3.3 presents an analysis of end users experience of satellite broadband.

The requests made for more information and guidance on topics such as demand aggregation are addressed in section 6.2 of this deliverable (D3.3). Further guidance on engaging in a demand aggregation exercise will be provided in the regional guidelines to be developed in WP4.

The positioning of satellite broadband alongside other broadband offers will be explored in more detail in the preparation of regional guidance in WP4 along with some 'rules of thumb' guidance to assist regions in assessing the scope of satellite broadband in specifying services levels required in their territories.

B.4 Validation Templates

VALIDATION TEMPLATE

Deliverable:	**D2.4 Early report on Satellite Broadband as an option for Regions**		
Validation Panel Member Name:	Jon Wakeling		
Organisation:	BT		
Category:	**Regional Organisation**	**Broadband Advisor**	**Broadband Provider**
Please tick relevant category:			☐

General comments

This document reads like a sales brochure for satellite broadband services. While it is not unreasonable for the document to advocate the benefits of satellite, it is something else to try to position satellite as a victim of biased Public Administration policies. The simple fact of the matter is that the current generation of satellite broadband services suffer from high deployment costs. This will result in satellite capacity being highly contended across the user base when systems achieve the take-up required to deliver the business case. This in turn will result in individual users receiving relatively low throughput during the busy period. Fixed line technologies deliver dedicated capacity to the end user, so it is quite likely that a lower rate assured fixed line service will deliver a better quality user experience than a highly contended 20Mbit/s satellite (or terrestrial wireless) service. Governments understand this and define their requirements on the basis of the end user service they want to have provided. Talking-up satellite in the way that it is done in this document is inappropriate and could backfire if the reader thinks that the satellite offering is being over sold.

The document is littered with comments that suggest governments are ignoring satellite in their broadband deployments 'even when it is the best option'. Such comments require substantiation otherwise they read as throw away lines intended to make satellite look as if it is being disadvantaged in some way while glossing over the underlying issues, e.g. Page 6. "So far, most European

governments have been extensively investing in fibre optic broadband, even where in some cases satellite broadband might better serve broadband not-spots" and "Current State aid guidelines tend to favour wired solutions, which partly explains why governments have focused on fibre, even though this is sometimes a more expensive or less effective option." State Aid rules are technology neutral for delivery of the same service definition. Where differentiation is made it is typically because some technologies cannot deliver the same level of service. The comments about the "effectiveness" of satellite need to put into some context to explain what point is being made.

Section 3.1 makes broad claims about areas where terrestrial technology will "never" be able to deliver broadband – this comments needs careful thought: on-going developments in copper technology mean that the proportion of lines that will remain un-addressable by fixed lines is falling and it is a brave assertion that a solution will "never" be found for the remainder.

The recommendations are actually reasonable, as far as they go. However, the worst thing about this document is that it avoids the most important questions for Public Authorities when procuring / facilitating broadband deployment: what quality of experience will the user get? I note that there is no recommendation about standardising a common basic broadband definition in terms of technical parameters, application consumption performance or quality of experience. Why is this?

Omission

Clarification or elaboration

Added value

VALIDATION TEMPLATE

Deliverable:	**D2.4 Early report on Satellite Broadband as an option for Regions**		
Validation Panel Member Name:	Frank Zeppenfeldt		
Organisation:	ESA		
Category:	**Regional Organisation**	**Broadband Advisor**	**Broadband Provider**
Please tick relevant category:			

General comments

The first part of this document is rather general explanation of DAE and satellite broadband: no comments but perhaps ill-placed in this deliverable. For the intended audience this might be better rephrased at even higher non-technical level. It should contain then more statements alike "one satellite can do a million users", etc.

The non-technological roadblocks are well described and would be worth a self-standing document

Omission

Good analysis of the demand aggregation – but no link to the public entity that is struggling to have his BB demand fulfilled.

More rules of thumb for the non-satellite aware public entity to be listed: e.g. one installer will be able to install 2 terminals per day, or similar statements.

4.3 here some tools are mentioned that would help for the public entity move to D2.2

3.4.4

This section could possibly add also:

- that satellite installations are very "green
- nowadays very aesthetically and non-obtrusive satellite antenna are available
- related to the TCP issues:
  - future transport protocols (e.g. SPDY as active in Google) are mitigating such effects

- it is in general rather negative – why not indicate that this is mitigated for 90% by certain measures?

- Can well guarantee a high degree of net-neutrality, as passing only through limited number of ISP autonomous systems

p.26 For certain rural areas the need for connectivity seems to be driven to agricultural applications – it needs to be checked at high level whether satellite can serve such applications. (I.e. can a milk-machine be remotely maintained over satellite, etc.)?

Clarification or elaboration

Added value

VALIDATION TEMPLATE

Deliverable:	**D2.4 Early report on Satellite Broadband as an option for Regions**		
Validation Panel Member Name:	Colin Mc Kenna		
Organisation:	Irish Central Border Area Network (ICBAN)		
Category:	**Regional Organisation**	**Broadband Advisor**	**Broadband Provider**
Please tick relevant category:	√		

General comments

There still remains in my opinion a general lack of awareness amongst the public sector regarding satellite broadband. This has a negative economic impact. I agree that authorities need to find how to deploy satellite broadband in the most efficient and effective way possible.

Omission

There wasn't anything that I didn't agree with but we need to get the message to key stakeholders in the region that Satellite is a viable option.

Clarification or elaboration

none

Added value

I think that a stronger way of getting the message about Satellite needs to found. I have friends in Uganda who work in education and the Satellite broadband is their only choice and which they are quite happy with.

VALIDATION TEMPLATE

Deliverable:	**D2.4 Early report on Satellite Broadband as an option for Regions**		
Validation Panel Member Name:	Ken Stockil		
Organisation:	CSL		
Category:	**Regional Organisation**	**Broadband Advisor**	**Broadband Provider**
Please tick relevant category:		x	

General comments

Overall this is an excellent document, written from a more objective perspective than the other two and a useful resource in this discussion.

Omission

In places the document is too general. For example it deals with the concept of demand aggregation at quite a high level whereas a step by step guideline would be useful, or at a minimum a list of practical actions and issues that need to be addressed in any demand aggregation initiative.

Clarification or elaboration

Added value

VALIDATION TEMPLATE

Deliverable:	**D2.4 Early report on Satellite Broadband as an option for Regions**		
Validation Panel Member Name:	Christian Aldred		
Organisation:	Satellite & Digital Services Ltd – West Country Broadband Ltd		
Category:	**Regional Organisation**	**Broadband Advisor**	**Broadband Provider**
Please tick relevant category:		Y	Y

General comments

Demand Aggregation. Is there really a need to dilute down the offering from the current satellite broadband providers, and more importantly their wholesalers by setting up yet another channel? Currently in Devon, the chosen SPA is the most expensive of the three Tooway providers in the UK, by a mile with equipment costs of £349 compared to as little as £50 from another provider, and the same SPA is £5 per month more expensive than the same alternative. Who is the Demand Aggregation going to help, certainly neither of the two current providers, one too expensive, the other too cheap. Our website www.westcountrybroadband.com sells on behalf of the cheaper provider, Bentley Walker, yet we don't get a look in when it comes to being promoted by our Local Authorities, so this is not money best spent. Will Demand Aggregation work? It may actually stop us and Bentley Walker from subsidising a product to promote its appeal when our local authority chooses to promote others. Demand Aggregation, will this serve the local ISP / Provider of satellite broadband services or further alienate them? Without subsidy, and through Bentley Walker and SES – BeyondSL, we have installed over a thousand terminals in the South & Southwest UK and South Wales. With subsidies, we could have managed 10 times that amount, and best of all we are based in this area with our own employed workforce.

Omission

Can I add that satellite broadband is always viewed as the last resort or final solution. This is not

always the case. Quite often Clients of ours require line security and guaranteed uptime without a reliance on a cabled solution to the premises especially in remoter locations, even though their ADSL broadband speeds were actually not too bad on a good day. Satellite broadband is fairly consistent, especially the SES offering.

Clarification or elaboration

Added value

The real value has to be the "Seeing is believing" attitude we are adopting at SDS by setting up a showroom dedicated to SES and Tooway, alongside a Wireless Service and also Mobile 3G all under one roof. The plan is to invite Local Authorities from across the region, and further afield if demand dictates, and to ask them to bring their iPads, Laptops and Mobile devices to try the available services and have a demonstration on how these are delivered. Until satellite broadband has been tried, it is hard to appreciate how it differs from lower latency options, but still has a very enjoyable user experience so long as Customer Expectations have been understood before delivery of product to home or business. We also have VoIP running on SES Broadband, with a UK local number of 01271 828773, try it, experience VoIP over satellite broadband. The added value of this as a service is in the cost comparable to a terrestrial telco with fixed telephone line rental in addition to other charges. Compare this to an SES basic satellite broadband package of £15.95 per month plus £7 VoIP bolt-on, and this is then cheaper than the terrestrial telcoofferings as no telephone line rental is required with satellite, and yet you can still get a local regional number from a VoIP provider like ours above. The latency incidentally of VoIP over satellite broadband we have roughly measured as 750ms full round trip, which takes a little getting used to but nevertheless compared to a latency of 400ms on many mobile operator platforms anyway isn't so bad.

C Annex III: Satellites Interviews

C.1 France

Refuge de Bésines

User

Mr. Jean-Claude Perry

Phone: +33 9 88 77 35 28

Website: www.refugedesbesines.ffcam.fr

Location

Eastern Pyrénées, Ariège, France. Altitude: 2104m. 3 hours walking from the closest town (l'Hospitalet). The refuge was created18 years ago.

Type of use

The refuge is equipped with both internet and phone through satellite communication but uses mostly the phone. There used to be mobile phone coverage through an Andorran network but it disappeared 4 years ago so now there is none. Prior to satcom, other solutions were implemented but they were either not satisfying and/or too expensive, with France Télécom for example.

Opinion on satellite communication

Access to the phone is vital for the refuge; it is absolutely not doable without it, both in terms of booking and of discussing with suppliers. It also improves the safety of the hiker, thanks to a better communication system.

Funding

The Fédération Française des Clubs Alpins et de Montagne paid for the installation of the satcom system, and the refuge pays for the subscription to the NORNET service.

Refuge du Goûter

User

Mr. Thomas Duconseille and Mrs. Amélie Faure

Phone : +33 4 50 54 40 93

Website : **www.**nouveaurefugedugouter.ffcam.fr

Location

French Alps (Mont Blanc), Haute-Savoie, France. Altitude: 3835m. It is the highest refuge in France. The refuge is only open during summer.

Type of use

The refuge is equipped with both internet and phone through satellite communication. Prior to this installation, which was done in July 2013, they were using radio-phones. There is very weak mobile phone coverage.

Opinion on satellite communication

The refuge du Goûter is the most frequented in France. Hence there hasn't been much difference in terms of booking since the implementation of satcom, since there is no need for extra communication or visibility. It is more the "convenient" side of the new and better working system that has been underlined.

Funding

The Fédération Française des Clubs Alpins et de Montagne paid for the installation of the satcom system, and the refuge pays for the subscription to the NORNET service.

Refuge de Temple Ecrins

User

Mr. Guillaume Bailly

Phone: +33 4 76 79 08 28

Website: www.refugetemplecrins.ffcam.fr

Location

Ecrins National Park, Isère, France. Altitude: 2400m. The refuge is close to the highest tops of the massif. This location made it very difficult to implement satcom, the area refuge being almost non-eligible.

Type of use

The refuge is only equipped with internet through satcom since this summer. The phone is still a radio-based one which was implemented in the 1980's. There is no mobile phone coverage and there was no internet before. So far, they are using internet for e-mails and a billing software but no yet for bookings. They are not sure it would increase the number of bookings a lot, but it makes it easier for foreigners to communicate via e-mails. The user also plans to improve the communication and visibility of the refuge since he is now able to update the webpage more often.

Opinion on satellite communication

The main issue is the amount of energy consumed by the satcom system. Indeed, the refuge is quite remote in terms on energy supplies. There are solar panels that are enough for daily electricity but not for internet; they often need to use an extra generator. **The user insisted a lot on this point**. Moreover, the internet connection is not always working; the speed quality varies a lot, and it is not possible to open big attachments in e-mails. They are not planning on getting the phone by satellite because they really appreciate their current assistance program via France Télécom.

Funding

The Fédération Française des Clubs Alpins et de Montagne paid for the installation of the satcom system, and the refuge pays for the subscription to the NORNET service.

Refuge des Ecrins

User

Mrs. Jocelyne and Mr. Jef Fouchard

Phone: +33 4 92 23 46 66

Website: www.refugedesecrins.ffcam.fr

Location

Ecrins National Park, Isère, France. Altitude: 3200m. It is a very famous refuge in the area because it is one of the few giving access to the 4000m tops in South-Alps.

Type of use

The refuge has been equipped with Internet through satcom for 5 years. The phone is a radio-based one with a relay station in the valley. There is no mobile phone coverage. They mainly use internet for booking via e-mails. So far it is still mostly done by phone, but there is a growing demand. They also have multilingual e-mail templates for a simpler and better communication with foreign guests. An online booking system will be implemented next year. One of the main assets is the reception of daily weather forecast by e-mail, which is then displayed in the refuge for hikers, thus improving the global safety.

Opinion on satellite communication

Though the speed is not very fast, the system works well, in spite of bad weather conditions from time to time. This summer, lightning hit the satellite dish and burnt it, so the refuge went out of connection for a few days. Internet is mostly seen as a time-saving tool.

Funding

The Fédération Française des Clubs Alpins et de Montagne paid for the installation of the satcom system, and the refuge pays for the subscription to the NORNET service.

Refuge d'en Beys

User

Mr. Julien Militon and Mr. Sylvain Freche

Phone: +33 61.64.24.24

Website: http://www.refuge-enbeys.com/

Location

Pyrénées, Ariège, France. Altitude : 1970m. The refuge is 3 hours walk from the road.

Type of use

The refuge has been equipped with internet through satcom for 2 years. They don't have an online booking system yet since guests need extra information such as weather forecast before booking. They use it mostly for booking with tour-operators (they host a lot of school groups) and for pay-pal payments for foreigners; they also use it for ordering to their providers. They also have a website, a Facebook page and send a newsletter by e-mail. Along with other refuges, they plan on making an online booking service for hiking trails, so that guests can book all the nights in different sites at the same time.

Opinion on satellite communication

The connectivity is a bit limited because of the location of the refuge. The weather (snow, wind…) also has an important impact on the internet access. The user has a good opinion of the system, as satcom is a real tool to save time.

Funding

The refuges in Ariège are gathered in the "Association des gardiens de refuge des Pyrénées" (Association of Pyrénées huts keepers) which applied for a grant to the Conseil Général of Ariège, which is the county local authority. The Conseil Général financed all the satellite communication installations for refuges in Ariège.

Refuge des Cortalets

User

Mr. Thomas Dulac

Phone: +33 4 68 96 36 19

Website: http://cortalets.com/

Location

Pyrénées, Hautes-Pyréenées, France. Altitude: 2200m. The refuge is located10km from the first city (where the cable for internet is installed)

Type of use

A few years ago, a first satcom system for internet was implemented (Wimax). However the connectivity was not really good and it suffered disconnections and cuts. In 2012, the Eutelsat-Tooway system was installed, both for internet and the phone this time, and it has been working well so far. The refuge has a website, as well a Facebook page and an online booking and payment system. The keeper also orders to his providers via internet. Moreover, it enables his employees and himself to maintain a social connection with relatives and friends in the valley. They foresee to implement a joint booking system with other refuges around for hiking trails.

Opinion on satellite communication

Satcom is useful because there is a real need for stable connection. However the satellite dish is very unaesthetic in the landscape which is a problem since nature is the main attraction and "product" for the refuge.

Funding

The user received public funding for the installation.

Refuge d'Avérole

User

Mr. Sébastien Notter & Mrs. Alexandra Buisson

Phone: +33 4 79 05 96 70

Website: http:// refugeaverole.ffcam.fr

Location

Alps, Savoie, France. Altitude: 2200m. The refuge is located at the boarder with Italy. It is 1h45 walking from the closest road.

Type of use

The refuge has been equipped with satcom for 3 years, only for internet. There is no mobile coverage. Avérole was the first test refuge for satcom implementation. They have a website as well as an online booking and payment system. The internet connection is good, with almost no weather impact, except the wind sometimes.

Opinion on satellite communication

It is very useful for foreign clients, because it makes it much easier for them to book. The satcom installation needs a lot of energy to work so the keeper asked the Fédération Française des Clubs Alpins et de Montagne to install an extra solar panel just for the satcom device. There is a real need for a secure energy supply.

Funding

The Fédération Française des Clubs Alpins et de Montagne paid for the installation of the satcom system, and the refuge pays for the subscription to the NORNET service.

Refuge de Wallon-Marcadau

User

Mr. Yannick Le Lay & Mr. Yannick Furlan

Phone: + 33 5 62 92 64 28

Website: http://www.refuge-wallon.net/

Location

Pyrénées, Haute-Pyrénées, France. Altitude : 1865m. The refuge is located 2h30 walk from the first road.

Type of use

The refuge is equipped with satcom for internet. There is no mobile coverage. They have a website, as well as an online billing system but no online booking is available except for Spanish clients on the website of the Aragon Mountain Federation.

Opinion on satellite communication

Internet is seen as a tool which makes things easier, as well as enables to have a diverse clientele.

Funding

They paid for the installation themselves.

Refuge de la Dent Parrachée

User

Mr. Franck Buisson

Phone: +33 4 79 20 32 87

Website: http://www.dentparrachee.refuges-vanoise.com/

Location

Vanoise National Park, Alps, Savoie, France. Altitude: 2500m.

Type of use:

The refuge is equipped with internet through satcom. There is no mobile coverage. The refuge has a website, as well as an online booking system that can be extended to other refuges in the Park for a full journey. There is also a Facebook page. The refuge receives daily weather forecast. All the refuges in the Park communicate with one another via Skype for a better coordination.

Opinion on satellite communication

Satcom is very reliable for a low price. The refuge's turnover has doubled since the implantation of internet (and it seems to be the same for other refuges in the Park). Satcom is also a really asset in terms of safety and security improvement (better communication, better information on weather forecast…).

Funding:

The Fédération Française des Clubs Alpins et de Montagne along with the Vanoise National Park paid for the installation for all of the nine refuges of the domain thanks to European grants.

C.2 Ireland

Ai Bridges

User

Mr. Kevin Hayes, Managing Director

E-mail: khayes@aibridges.ie

Website: http://www.aibridges.ie

The company

Ai Bridges is a leading supplier of innovative broadband & telecommunication solutions and services for the telecom's industry. The company is based in Ennis, Clare County, in Ireland.

Uses of satellite internet

Since 2002, Ai Bridges has been providing satellite internet access to corporate customers located in remote rural areas, mostly in Ireland and in the UK. The first implementation of satellite internet was for a Red-Cross emergency project overseas.

Satellite internet is mostly used as a "backup connection". Indeed, it represents an automatic resilience when radio broadband internet, commonly used by the customers, fails.

However, the original satellite connection available and the sharing capacity (provided via Tooway) were too slow. Therefore, Ai Bridges purchased its own satellite bandwidth in order to improve the capacity offered to its customers. Ai Bridges financed this purchase on its own, without any public grant or else. Moreover, Ai Bridges itself uses satellite internet for remote control of its service centres in the UK.

Opinion on satellite internet access

Satellite internet is a very expensive technology; Ai Bridges corporate customers pay around 300€/month. Private users could not afford to pay the necessary installation and subscription fees for having a satellite connection at home. Furthermore, the speed is not fast enough for more than minimum services (e-mails, surfing the web…), even with Ai Bridges' own bandwidth. For instance, customers complain about not being able to use Voice over IP. Radio broadband internet is still much faster.

Global Irish Sports

User

Mr. Alan Foudy

E-mail: globalirishsports@gmail.com

Website: https://www.facebook.com/GlobalIrishSports

The company

Global Irish Sports is a sports internet website launched in April 2013. Global Irish Sports streams sport events to customers to their laptop, smartphone and television, anywhere in the world and live. It is located in County Clare, Ireland.

Uses of satellite internet

Mr. Foudy is no longer using satellite internet connection. He used it at the creation of the website, for almost three months, but resigned his subscription because of speed and quality issues.

Opinion on satellite internet access

Internet is at the core of Mr. Foudy's activities. Indeed, to successfully run his business, Mr. Foudy needs a fast connection and a good streaming quality. A satellite internet connection was implemented at first because there is no land broadband where Mr. Foudy lives and satellite internet was the best broadband connection available at the time. However, the connection proved to be too slow, with an insufficient download capacity (between two and four mega), so Mr. Foudy was not able to offer a good service to his customer. Moreover the streaming quality was fluctuant, and mostly not good enough.

The development of 4G broadband networks in Mr. Foudy's County might offer an interesting alternative for him.

Funding

Mr. Foudy funded his installation on his own, without any grant. The subscription was not too expensive, around 60€ per month.

C.3 Norway

User Case 1

User

Mr. Svein Skagen
E-mail: Svein.Skagen@kristiansand.kommune.no

Location

Kristiansand, Norway

Type of use

Mr. Skagen has a private access to internet through satellite communication at home, since there is no other infrastructure connecting the area. They are using the Tooway satellite service.

Opinion on satellite communication

The installation is working very well. However, the main problem is that the server is located in Italy which raises issues for accessing TV channels or music, as well as any other elements under copyright or only distributed in Norway.

Funding

Private

Enhancing business thanks to satellite communication

Satellite communication enables employees living in remote areas to home-work and develop business activities

User Case 2

User

Mr. Eivind Buckner

E-mail: eb@jbu.no

Eivind Buckner is the Head of Property Development at J.B. Ugland Eiendom AS in Grimstad, Norway. Previous to his current position, he used to manage his own property development company. He lives in a farm in a remote forest area, and works from home almost half of the week.

The challenge

A few years back, when Mr. Buckner decided to create his own business, home-based, he was confronted to major communication issues. Indeed, his residence area is not covered by high-speed internet, and the closest phone center is too far to connect to. There is only an old telephone line reaching his home, but the connection is way too slow to be able to send or download heavy documents, such as maps and reports, which are essential components of Mr. Buckner's property development activities.

The solution

Satellite broadband internet quickly appeared to be the only solution possible, as well as the most efficient one, to bring quality service where needed the most. Mr. Buckner thus installed a satellite dish linked to a modem and wireless router. The result is a 18 MB download speed internet connection.

The result

Thanks to satellite communication, Mr. Buckner was able to successfully launch his first company and is now sharing his working time between his current office in Grimstad and his home without any difficulties. Satellite broadband internet is an essential component of Mr. Buckner's activity, which is extremely dependant of the service. Mr. Buckner would quickly run out of business if the satellite connection was damaged or no longer available.

Quote : "*Satellite communication is the only practical and technical tool that gives the possibility to live a modern life in rural areas – both when it comes to running a business and to giving the children modern ways of learning and communicating!*" Eivind Buckner

C.4 United Kingdom

Affordable satellite broadband in rural areas

The Rural Connection programme enables to equip inhabitants in rural areas with satellite broadband via a grant scheme.

User

Mr. Howard Reeves

Howard Reeves runs Beaples Barton Sporting Holidays, a specialised holiday letting business for those interested in shooting sports. He lives and works near Knowstone, South Molton in the United Kingdom.

The challenge

Once the company website **www.beaplesbarton.co.uk** was established twenty years ago, Mr. Reeves needed an effective broadband service to ensure he could communicate online. Living 12 kilometres from the nearest telephone exchange, many creative solutions were used to try to connect to broadband. Using the existing telephone lines was beset with problems: travelling through wooded country and in and out of valleys, the connection was constantly interrupted by a whole host of problems, from damage because of windblown trees, impact from stormy weather, or disruption to low hanging wires - even animals chewing cables.

Over the years, Mr. Reeves has tried various different services, combining different computer technologies with a variety of equipment or modems. He even juggled multiple broadband services so that one could back up the other when a connection went down. But, with top speeds of just 115Kbps, Mr. Reeves had to rely on friends to help with his online business activities, particularly as customers relied more and more on the website and emails to request information or make bookings.

The satellite solution

Early 2012, Mr. Reeves heard that a nearby neighbour had satellite broadband. Anticipating this to be an expensive option, Mr. Reeves investigated further and found out that the Rural Connection initiative offered subsidised connections to properties and businesses within his area.

Rural Connection is a project run by The Rural Development Programme for England (RDPE), Devon and Somerset County Councils. This programme has European funding and is providing selected rural areas with free installation of satellite broadband. Grants are available for the installation of equipment and set up costs in these areas, and the customer just pays a monthly fee to stay connected. Free training and support are also available, to help those subscribing to this service to get the best of the greater connectivity this faster broadband brings.

The result

The flexibility of the service means that Mr. Reeves can increase his broadband capacity in the future if he needs to, for example if he wants to provide wi-fi for guests. He is also now recommending satellite broadband to friends and

neighbours.

Quote: "*I no longer worry about missed emails for business because it now only takes a few seconds to access my inbox. The connection is reliable and doesn't cut out or stall. Whereas before I did not look forward to checking mails in the morning, it has now become a pleasure. I no longer worry about people sending long and complicated emails and attachments as my broadband can cope: it's like lightening!*"

C.5 Spain

Refugio de Pineta

User

Mr. Jaime Arbex

Phone: +34. 9 74 50 12 03

Website: **http://www.refugiopineta.com**

Location

Ordesa and Monte Perdido National Park, Pyrénées, Aragon, Spain. Altitude: 1240m. The refuge is located 2km from the closest road.

Type of use

The refuge is only equipped with internet through satcom, for around 10 years. They have a website for online booking as well as a Facebook page. Since the implementation of internet, there have been many evolutions in the type of clients as well as in the number of bookings.

Opinion on satellite communication

There are sometimes cuts depending on weather conditions. They have changed the satellite dish so now the connection is faster.

Funding

The Climbing Federation of Aragon (Federacion aragonesa de montañismo) paid for the installation and the refuge only pays for the subscription.

D Annex IV - Satellite Internet Access: Retail Offer Database

The present Annex[52] collects an extensive database of retail offers of satellite-based consumer broadband Internet in the countries represented in the SABER project (UK, Ireland, Germany, Austria, Switzerland, France, Italy, Poland, Romania, Slovenia, Hungary, Greece, Sweden, Norway and Spain), provided both as general reference and as a potential input of the preliminary market analysis for Public Authorities aiming to address broadband gaps in their territory.

The document includes the offers currently available to consumers through different ISPs, that were identified or validated by the two satellite operators members of the SABER project (Eutelsat and SES), and by Hellas Sat. Therefore, the ISPs list was built with a neutral and comprehensive approach. Regarding the retail offers, the main source of information has been the websites of the satellite ISP mentioned above; each record shows the ISP website link where the offer is published and can be independently checked at any time. This factual methodology is also aimed to provide a tool to enable periodical maintenance of the database itself.

The database is organized by country, and includes approximately 250 broadband retail offers (rows) organized around the main parameters (columns) essential to understand the quality of service (QoS) and the value for money - download speed, upload speed, monthly data volume where applicable, monthly subscription fees including local VAT, and price of CPE. For each retail offer the offering ISP, the satellite operator and the link to web offer are also provided.

The database shows a wide range of performances and of commercial conditions; this patterns confirms that this niche market, addressed in Europe only since 2007, is still evolving and competition is taking place at all levels of the value chain – among satellite operators on the technical ground, and among all actors (satellite operators, local ISPs and installers networks) on the commercial ground. As an evidence, the most dynamic markets (e.g. France, Germany, UK, Spain, Italy) already show the most attractive and affordable offerings; a desirable target for all involved stakeholders would be to encourage a similar development in the other countries of the EU.

[52] Disclaimer: "The present data have been validated by Eutelsat, Hellas Sat and SES on a voluntary basis. Avanti and Hispasat validation are still pending. The data have been extracted from publicly available sources and are subject to modification upon operators request"

D.1 UK and Ireland

Speed		Volume	CPE purchase	End User pricing (incl. VAT)	Satellite operator	Local service provider (ISP)	Website	Update
Download (kbit/s)	Upload (kbit/s)	(GB/month incl.)	EUR	(EUR/month)				
2048	1024	2	180	20,4	SES Broadband	Beyondsl	http://www.satelliteinternet.co.uk/packages?pkg=2	
8192	1024	8	156	36,0	SES Broadband	Beyondsl	http://www.satelliteinternet.co.uk/packages?pkg=3	
10240	1024	10	120	48,0	SES Broadband	Beyondsl	http://www.satelliteinternet.co.uk/packages?pkg=4	
20480	1024	20	0	60,0	SES Broadband	Beyondsl		29/05/2013
16384	1024	32	0	120,0	SES Broadband	Beyondsl	http://www.satelliteinternet.co.uk/packages?pkg=5	
20480	1024	50	0	168,0	SES Broadband	Beyondsl	http://www.satelliteinternet.co.uk/packages?pkg=6	
2048	256	2	348	15,6	SES Broadband	Apogee	http://www.apogeeinternet.co.uk/	
6144	256	2	348	19,8	SES Broadband	Apogee	http://www.apogeeinternet.co.uk/	
6144	256	4	348	27,6	SES Broadband	Apogee	http://www.apogeeinternet.co.uk/	
6144	256	6	348	33,6	SES Broadband	Apogee	http://www.apogeeinternet.co.uk/	
6144	256	8	348	39,6	SES Broadband	Apogee	http://www.apogeeinternet.co.uk/	
10240	256	10	348	57,6	SES Broadband	Apogee	http://www.apogeeinternet.co.uk/	29/05/2013
2048	256	2	348	21,6	SES Broadband	Apogee	http://www.apogeeinternet.co.uk/	
6144	256	4	348	38,4	SES Broadband	Apogee	http://www.apogeeinternet.co.uk/	
6144	256	6	348	45,6	SES Broadband	Apogee	http://www.apogeeinternet.co.uk/	
6144	256	8	348	54,0	SES Broadband	Apogee	http://www.apogeeinternet.co.uk/	
10240	256	10	348	79,2	SES Broadband	Apogee	http://www.apogeeinternet.co.uk/	
20480	6144	10	TBC	28,7	Eutelsat Broadband	Bentley-Walker	www.bentley-walker.com/tooway/	
20480	6144	20/UNL	TBC	40,4	Eutelsat Broadband	Bentley-Walker	www.bentley-walker.com/tooway/	
20480	6144	30/UNL	TBC	52,1	Eutelsat Broadband	Bentley-Walker	www.bentley-walker.com/tooway/	29/05/2013
20480	6144	UNL	TBC	75,5	Eutelsat Broadband	Bentley-Walker	www.bentley-walker.com/tooway/	
2048	1024	2	TBC	27,9	Eutelsat Broadband	TowayDirect	http://www.toowaydirect.com/purchase/	
20480	6144	10	TBC	37,9	Eutelsat Broadband	TowayDirect	http://www.toowaydirect.com/purchase/	
20480	6144	20/UNL	TBC	47,9	Eutelsat Broadband	TowayDirect	http://www.toowaydirect.com/purchase/	
20480	6144	30/UNL	TBC	57,9	Eutelsat Broadband	TowayDirect	http://www.toowaydirect.com/purchase/	29/05/2013
20480	6144	UNL	TBC	79,9	Eutelsat Broadband	TowayDirect	http://www.toowaydirect.com/purchase/	
20480	6144	10	350	35,1	Eutelsat Broadband	BB Whereve	http://www.broadbandwherever.net/products/tooway.aspx	
20480	6144	20/UNL	350	46,8	Eutelsat Broadband	BB Whereve	http://www.broadbandwherever.net/products/tooway.aspx	
20480	6144	30/UNL	350	64,4	Eutelsat Broadband	BB Whereve	http://www.broadbandwherever.net/products/tooway.aspx	29/05/2013
20480	6144	UNL	350	87,8	Eutelsat Broadband	BB Whereve	http://www.broadbandwherever.net/products/tooway.aspx	
20480	6144	10/UNL	TBC	40,0	Eutelsat Broadband	DigiWeb	http://www.digiweb.ie/home/broadband/satellite	
20480	6144	20/UNL	TBC	59,0	Eutelsat Broadband	DigiWeb	http://www.digiweb.ie/home/broadband/satellite	
20480	6144	30/UNL	TBC	77,0	Eutelsat Broadband	DigiWeb	http://www.digiweb.ie/home/broadband/satellite	29/05/2013
20480	6144	UNL	TBC	112,0	Eutelsat Broadband	DigiWeb	http://www.digiweb.ie/home/broadband/satellite	
2048	1024	2	TBC	19,8	Eutelsat Broadband	Avonline	http://www.avonlinebroadband.co.uk/packages/	
20480	6144	10	TBC	30,0	Eutelsat Broadband	Avonline	http://www.avonlinebroadband.co.uk/packages/	
20480	6144	20/UNL	TBC	40,0	Eutelsat Broadband	Avonline	http://www.avonlinebroadband.co.uk/packages/	
20480	6144	30/UNL	TBC	50,0	Eutelsat Broadband	Avonline	http://www.avonlinebroadband.co.uk/packages/	29/05/2013
20480	6144	UNL	TBC	80,0	Eutelsat Broadband	Avonline	http://www.avonlinebroadband.co.uk/packages/	
20480	6144	10	TBC	40,0	Eutelsat Broadband	Onwave	http://www.onwave.ie/packages/broadband	
20480	6144	20/UNL	TBC	55,0	Eutelsat Broadband	Onwave	http://www.onwave.ie/packages/broadband	
20480	6144	30/UNL	TBC	70,0	Eutelsat Broadband	Onwave	http://www.onwave.ie/packages/broadband	29/05/2013
20480	6144	UNL	TBC	95,0	Eutelsat Broadband	Onwave	http://www.onwave.ie/packages/broadband	
512	128	3	599	15,6	Avanti	KryptonTV	http://www.kryptontv.co.uk/packages.php	
1024	256	5	599	24,0	Avanti	KryptonTV	http://www.kryptontv.co.uk/packages.php	
2048	516	6	599	32,4	Avanti	KryptonTV	http://www.kryptontv.co.uk/packages.php	
4096	1024	8	599	42,0	Avanti	KryptonTV	http://www.kryptontv.co.uk/packages.php	
8192	2048	10	599	51,6	Avanti	KryptonTV	http://www.kryptontv.co.uk/packages.php	
10240	2048	16	599	60,0	Avanti	KryptonTV	http://www.kryptontv.co.uk/packages.php	
1024	516	1	689	24,5	Avanti	Ethnetuk	http://ethnetuk.com/index.php?pageid=153	
2048	1024	2	689	27,4	Avanti	Ethnetuk	http://ethnetuk.com/index.php?pageid=154	
4096	1024	3	689	36,0	Avanti	Ethnetuk	http://ethnetuk.com/index.php?pageid=155	
6144	1536	4	689	41,8	Avanti	Ethnetuk	http://ethnetuk.com/index.php?pageid=156	
8192	1536	6	689	50,4	Avanti	Ethnetuk	http://ethnetuk.com/index.php?pageid=157	
10240	2048	8	689	85,0	Avanti	Ethnetuk	http://ethnetuk.com/index.php?pageid=158	
8192	2048	3	534	23,0	Avanti	Prime Sat	http://www.primesatellitebroadband.com/satellitebroadband.htm	
8192	2048	6	534	30,0	Avanti	Prime Sat	http://www.primesatellitebroadband.com/satellitebroadband.htm	
8192	2048	12	479	60,0	Avanti	Prime Sat	http://www.primesatellitebroadband.com/satellitebroadband.htm	
8192	2048	8	479	64,8	Avanti	Prime Sat	http://www.primesatellitebroadband.com/satellitebroadband.htm	

Note: activation and/or logistics fees and minimum contract commitment not included in this analysis and to be checked with the local ISP.

D.2 France

Speed		Volume	CPE purchase	End User pricing (incl. VAT)	Satellite operator	Local service provider (ISP)	Website	Update
Download (kbit/s)	Upload (kbit/s)	(GByte/month incl.)	EUR	(EUR/month)				
20480	2048	5	249	29.9	SES Broadband	Auvea	http://www.vivsole.fr	
20480	2048	15	249	39.9	SES Broadband	Auvea	http://www.vivsole.fr	29/05/2013
20480	2048	UNL	249	49.9	SES Broadband	Auvea	http://www.vivsole.fr	
TBC	TBC	TBC	TBC	TBC	SES Broadband	Wibox	http://www.wibox.fr/contact/	29/05/2013
20480	2048	10	399	29.9	SES Broadband	Nordnet	http://www.nordnet.com/offres/internet-satellite/tarifs.php	29/05/2013
20480	6144	10	349	29.9	Eutelsat Broadband	Ozone	http://www.ozone.net	
20480	6144	20/UNL	349	39.9	Eutelsat Broadband	Ozone	http://www.ozone.net	29/05/2013
20480	6144	30/UNL	349	49.9	Eutelsat Broadband	Ozone	http://www.ozone.net	
20480	6144	UNL	349	71.9	Eutelsat Broadband	Ozone	http://www.ozone.net	
20480	6144	20/UNL	399	44.9	Eutelsat Broadband	Nordnet	http://www.nordnet.com/offres/internet-satellite-pro/notre-offre.php	
20480	6144	30/UNL	399	64.9	Eutelsat Broadband	Nordnet	http://www.nordnet.com/offres/internet-satellite-pro/notre-offre.php	29/05/2013
20480	6144	UNL	399	79.9	Eutelsat Broadband	Nordnet	http://www.nordnet.com/offres/internet-satellite-pro/notre-offre.php	
2048	1024	2	399	19.9	Eutelsat Broadband	Sat2Way	http://www.sat2way.fr	
20480	6144	10	399	29.9	Eutelsat Broadband	Sat2Way	http://www.sat2way.fr	
20480	6144	20/UNL	399	39.9	Eutelsat Broadband	Sat2Way	http://www.sat2way.fr	29/05/2013
20480	6144	30/UNL	399	49.9	Eutelsat Broadband	Sat2Way	http://www.sat2way.fr	
20480	6144	UNL	399	74.9	Eutelsat Broadband	Sat2Way	http://www.sat2way.fr	
2048	1024	2	Only for rental	19.9	Eutelsat Broadband	Connexion Verte	http://www.connexion-verte.fr	
20480	6144	10	Only for rental	29.9	Eutelsat Broadband	Connexion Verte	http://www.connexion-verte.fr	
20480	6144	20/UNL	Only for rental	39.9	Eutelsat Broadband	Connexion Verte	http://www.connexion-verte.fr	29/05/2013
20480	6144	30/UNL	Only for rental	49.9	Eutelsat Broadband	Connexion Verte	http://www.connexion-verte.fr	
20480	6144	UNL	Only for rental	74.9	Eutelsat Broadband	Connexion Verte	http://www.connexion-verte.fr	
20480	6144	10	350	29.9	Eutelsat Broadband	Alsatis	http://www.alsatis.com	
20480	6144	20/UNL	350	39.9	Eutelsat Broadband	Alsatis	http://www.alsatis.com	29/05/2013
20480	6144	30/UNL	350	49.9	Eutelsat Broadband	Alsatis	http://www.alsatis.com	
20480	6144	UNL	350	74.9	Eutelsat Broadband	Alsatis	http://www.alsatis.com	
20480	6144	10	TBC	29.9	Eutelsat Broadband	IDHD Net/ Universat	http://www.universat.fr/internet-par-satellite.php	
20480	6144	20/UNL	TBC	39.9	Eutelsat Broadband	IDHD Net/ Universat	http://www.universat.fr/internet-par-satellite.php	29/05/2013
20480	6144	30/UNL	TBC	49.9	Eutelsat Broadband	IDHD Net/ Universat	http://www.universat.fr/internet-par-satellite.php	
20480	6144	UNL	TBC	74.9	Eutelsat Broadband	IDHD Net/ Universat	http://www.universat.fr/internet-par-satellite.php	

Note: activation and/or logistics fees and minimum contract commitment not included in this analysis and to be checked with the local ISP.

D.3 Germany

Speed		Volume	CPE purchase	End User pricing (incl. VAT)	Satellite operator	Local service provider (ISP)	Website	Update
Download (kbit/s)	Upload (kbit/s)	(GBytelmonth incl.)	EUR	(EURImonth)				
10240	256	UNL	TBC	30,0	SES Broadband	Filiago	https://www.filiago.org/produkte/bestellen/006/index.aspx	29/05/2013
2048	256	UNL	TBC	TBC	SES Broadband	Deutsche Telekom	http://www.telekom.de/is-bin/INTERSHOP.enfinity/WFS/EK1-GK-Site/de_DE/-/EUR/ViewError-NotFound	29/05/2013
20480	6144	10	399	29,95	Eutelsat Broadband	Toowaysat	http://en.toowaysat.com/	
20480	6144	20/UNL	399	45,95	Eutelsat Broadband	Toowaysat	http://en.toowaysat.com/	29/05/2013
20480	6144	30/UNL	399	49,95	Eutelsat Broadband	Toowaysat	http://en.toowaysat.com/	
20480	6144	UNL	399	79,95	Eutelsat Broadband	Toowaysat	http://en.toowaysat.com/	
6144	1024	UNL	399	19,9	Eutelsat Broadband	SkyDSL	https://de.skydsl.eu/index.php?c=tariff&s=skydsl2p&cs=sky2pt9#	
12288	4096	UNL	399	29,9	Eutelsat Broadband	SkyDSL	https://de.skydsl.eu/index.php?c=tariff&s=skydsl2p&cs=sky2pt6	29/05/2013
20480	6144	UNL	399	49,9	Eutelsat Broadband	SkyDSL	https://de.skydsl.eu/index.php?c=tariff&s=skydsl2p&cs=sky2pt8	
2048	1024	2	TBC	19,9	Eutelsat Broadband	StarDSL	http://www.stardsl.de	
20480	6144	10	TBC	39,9	Eutelsat Broadband	StarDSL	http://www.stardsl.de	
20480	6144	20/UNL	TBC	49,9	Eutelsat Broadband	StarDSL	http://www.stardsl.de	29/05/2013
20480	6144	30/UNL	TBC	59,9	Eutelsat Broadband	StarDSL	http://www.stardsl.de	
20480	6144	UNL	TBC	99,9	Eutelsat Broadband	StarDSL	http://www.stardsl.de	
2048	1024	2	TBC	19,9	Eutelsat Broadband	GetInternet	http://www.getinternet.de/tarife-satelliten-dsl/	
20480	6144	10	TBC	29,9	Eutelsat Broadband	GetInternet	http://www.getinternet.de/tarife-satelliten-dsl/	
20480	6144	20/UNL	TBC	49,9	Eutelsat Broadband	GetInternet	http://www.getinternet.de/tarife-satelliten-dsl/	29/05/2013
20480	6144	30/UNL	TBC	59,9	Eutelsat Broadband	GetInternet	http://www.getinternet.de/tarife-satelliten-dsl/	
20480	6144	UNL	TBC	79,9	Eutelsat Broadband	GetInternet	http://www.getinternet.de/tarife-satelliten-dsl/	
6144	1024	UNL	500	30,0	Avanti	Filiago	https://www.filiago.org/produkte/bestellen/089/index.aspx	
10240	1024	UNL	500	40,0	Avanti	Filiago	https://www.filiago.org/produkte/bestellen/015/index.aspx	

Note: activation and/or logistics fees and minimum contract commitment not included in this analysis and to be checked with the local ISP.

D.4 Italy

Speed		Volume	CPE purchase	End User pricing (incl. VAT)	Satellite operator	Local service provider (ISP)	Website	Update
Download (kbit/s)	Upload (kbit/s)	(GByte/month incl.)	EUR	(EUR/month)				
10240	1024	10	0	74,7	SES Broadband	Digitaria	http://store.digitaria.it/it/prodotti/websat	
16384	2048	16	0	98,3	SES Broadband	Digitaria	http://store.digitaria.it/it/prodotti/websat	29/05/2013
20480	2048	20	0	122,9	SES Broadband	Digitaria	http://store.digitaria.it/it/prodotti/websat	
20480	6144	10	349	24.90 then 31.90	Eutelsat Broadband	OpenSky	http://www.open-sky.it	
20480	6144	20/UNL	349	41,9	Eutelsat Broadband	OpenSky	http://www.open-sky.it	29/05/2013
20480	6144	30/UNL	349	51,9	Eutelsat Broadband	OpenSky	http://www.open-sky.it	
20480	6144	UNL	349	74,9	Eutelsat Broadband	Opensky	http://www.open-sky.it	
8192	2024	8	TBC	19.90 then 24	Eutelsat Broadband	Sitmar	http://www.sitmar.it	
12288	4096	16	TBC	30 then 35	Eutelsat Broadband	Sitmar	http://www.sitmar.it	
18432	6144	26	TBC	42 then 49	Eutelsat Broadband	Sitmar	http://www.sitmar.it	29/05/2013
18432	6144	50	TBC	80 then 89	Eutelsat Broadband	Sitmar	http://www.sitmar.it	
18432	6144	75	TBC	145 then 159	Eutelsat Broadband	Sitmar	http://www.sitmar.it	
8192	2024	8	TBC	19.90 then 24	Eutelsat Broadband	Magellano	http://www.magellanosat.it/tooway/	
12288	4096	16	TBC	34,9	Eutelsat Broadband	Magellano	http://www.magellanosat.it/tooway/	29/05/2013
18432	6144	26	TBC	53,9	Eutelsat Broadband	Magellano	http://www.magellanosat.it/tooway/	
18432	6144	50	TBC	89,9	Eutelsat Broadband	Magellano	http://www.magellanosat.it/tooway/	
8192	2024	UNL	360	29,0	Eutelsat Broadband	BroadSat	http://www.broadsat.com	
12288	4096	UNL	360	45,0	Eutelsat Broadband	BroadSat	http://www.broadsat.com	29/05/2013
18432	6144	UNL	360	59,9	Eutelsat Broadband	BroadSat	http://www.broadsat.com	
18432	6144	UNL	360	109,0	Eutelsat Broadband	BroadSat	http://www.broadsat.com	
6144	1024	UNL	399	29.90 then 19.90	Eutelsat Broadband	skyDSL	http://www.skydsl.eu	
12288	4096	UNL	399	39.90 then 29.90	Eutelsat Broadband	skyDSL	http://www.skydsl.eu	29/05/2013
20480	6144	UNL	399	69.90 then 59.90	Eutelsat Broadband	skyDSL	http://www.skydsl.eu	
20480	6144	10	323	26,9	Eutelsat Broadband	NoiSat	http://www.noisat.it/home.asp	
20480	6144	20/UNL	323	36,9	Eutelsat Broadband	NoiSat	http://www.noisat.it/home.asp	29/05/2013
20480	6144	30/UNL	323	46,9	Eutelsat Broadband	NoiSat	http://www.noisat.it/home.asp	
20480	6144	UNL	323	69,9	Eutelsat Broadband	NoiSat	http://www.noisat.it/home.asp	

Note: activation and/or logistics fees and minimum contract commitment not included in this analysis and to be checked with the local ISP.

D.5 Spain

Speed		Volume	CPE purchase	End User pricing (incl. VAT)	Satellite operator	Local service provider (ISP)	Website	Update
Download (kbit/s)	Upload (kbit/s)	(GByte/month incl.)	EUR	(EUR/month)				
2048	256	UNL	TBC	TBC	SES Broadband	Quantis	http://www.quantis.es/spa/products/ip	29/05/2013
1024	128	UNL	TBC	TBC	SES Broadband	Telecable	http://web.telecable.es/portal.do?IDM=9&NM=1	29/05/2013
20480	6144	10	299	29,9	Eutelsat Broadband	EuronaSAT	http://www.euronasat.net/particulares/internet-satelite/	
20480	6144	20/UNL	299	39,9	Eutelsat Broadband	EuronaSAT	http://www.euronasat.net/particulares/internet-satelite/	29/05/2013
20480	6144	UNL	299	69,9	Eutelsat Broadband	EuronaSAT	http://www.euronasat.net/particulares/internet-satelite/	
2048	1024	2	300	17,9	Eutelsat Broadband	Mira Novas	http://www.internetrural.eu/intranet/Formulario	
20480	6144	10	300	25,9	Eutelsat Broadband	Mira Novas	http://www.internetrural.eu/intranet/Formulario	
20480	6144	20/UNL	300	33,9	Eutelsat Broadband	Mira Novas	http://www.internetrural.eu/intranet/Formulario	29/05/2013
20480	6144	30/UNL	300	42,9	Eutelsat Broadband	Mira Novas	http://www.internetrural.eu/intranet/Formulario	
20480	6144	UNL	300	60,9	Eutelsat Broadband	Mira Novas	http://www.internetrural.eu/intranet/Formulario	
2048	1024	2	TBC	19,9	Eutelsat Broadband	StarDSL	https://ssl.stardsl.es/	
20480	6144	10	TBC	39,9	Eutelsat Broadband	StarDSL	https://ssl.stardsl.es/	
20480	6144	20/UNL	TBC	49,9	Eutelsat Broadband	StarDSL	https://ssl.stardsl.es/	29/05/2013
20480	6144	30/UNL	TBC	59,9	Eutelsat Broadband	StarDSL	https://ssl.stardsl.es/	
20480	6144	UNL	TBC	99,9	Eutelsat Broadband	StarDSL	https://ssl.stardsl.es/	
20480	6144	10	399	29,9	Eutelsat Broadband	Broadband Algarve	http://www.broadbandalgarve.co.uk/21378/broadband-algarve-products/tooway-broadband-rental-for-home/	
20480	6144	20/UNL	399	39,9	Eutelsat Broadband	Broadband Algarve	http://www.broadbandalgarve.co.uk/21378/broadband-algarve-products/tooway-broadband-rental-for-home/	29/05/2013
20480	6144	30/UNL	399	59,9	Eutelsat Broadband	Broadband Algarve	http://www.broadbandalgarve.co.uk/21378/broadband-algarve-products/tooway-broadband-rental-for-home/	
20480	6144	UNL	399	69,9	Eutelsat Broadband	Broadband Algarve	http://www.broadbandalgarve.co.uk/21378/broadband-algarve-products/tooway-broadband-rental-for-home/	
1024	256	5	360	22,1	Avanti	algarve	http://www.broadbandalgarve.co.uk/20869/broadband-algarve-products/broadband-for-home/	
2048	516	6	360	32,9	Avanti	algarve	http://www.broadbandalgarve.co.uk/20869/broadband-algarve-products/broadband-for-home/	
4096	1024	8	360	41,5	Avanti	algarve	http://www.broadbandalgarve.co.uk/20869/broadband-algarve-products/broadband-for-home/	
8192	2048	10	360	55,4	Avanti	algarve	http://www.broadbandalgarve.co.uk/20869/broadband-algarve-products/broadband-for-home/	
10240	2048	16	360	77,5	Avanti	algarve	http://www.broadbandalgarve.co.uk/20869/broadband-algarve-products/broadband-for-home/	
512	128	3	714	24,0	Avanti	GlobaTel	http://globatel.net/residential/broadband-internet-via-satellite?langre=en	
1024	256	5	714	39,6	Avanti	GlobaTel	http://globatel.net/residential/broadband-internet-via-satellite?langre=en	
2048	516	6	714	57,6	Avanti	GlobaTel	http://globatel.net/residential/broadband-internet-via-satellite?langre=en	
4096	1024	8	594	74,4	Avanti	GlobaTel	http://globatel.net/residential/broadband-internet-via-satellite?langre=en	
8192	2048	10	594	99,6	Avanti	GlobaTel	http://globatel.net/residential/broadband-internet-via-satellite?langre=en	
1024	TBC	UNL	TBC	48,3	HispaSat	Quantis	http://www.quantis.es/spa/products/quantisduo	
2048	TBC	UNL	TBC	72,5	HispaSat	Quantis	http://www.quantis.es/spa/products/quantisduo	
4096	TBC	UNL	TBC	108,8	HispaSat	Quantis	http://www.quantis.es/spa/products/quantisduo	
8192	TBC	UNL	TBC	145,1	HispaSat	Quantis	http://www.quantis.es/spa/products/quantisduo	
8192	TBC	2	TBC	36,2	HispaSat	Quantis	http://www.quantis.es/spa/products/quantismax	
8192	TBC	5	TBC	54,3	HispaSat	Quantis	http://www.quantis.es/spa/products/quantismax	
8192	TBC	11	TBC	90,6	HispaSat	Quantis	http://www.quantis.es/spa/products/quantismax	
8192	TBC	15	TBC	120,9	HispaSat	Quantis	http://www.quantis.es/spa/products/quantismax	

Note: activation and/or logistics fees and minimum contract commitment not included in this analysis and to be checked with the local ISP.

D.6 Poland

Speed		Volume	CPE purchase	End User pricing (incl. VAT)	Satellite operator	Local service provider (ISP)	Website	Update
Download (kbit/s)	Upload (kbit/s)	(GByte/month incl.)	EUR	(EUR/month)				
2048	256	UNL	TBC	TBC	SES Broadband	Orange	http://www.orange.pl/esupport_b2c_contact.phtml?footerlink=true	29/05/2013
2048	256	UNL	TBC	TBC	SES Broadband	Nask	http://www.nask.pl/run/n/kontakt	29/05/2013
2048	1024	2	TBC	21,7	Eutelsat Broadband	Avctrade	http://www.avctrade.com.pl/dladomu.htm	
10240	2048	10	TBC	28,1	Eutelsat Broadband	Avctrade	http://www.avctrade.com.pl/dladomu.htm	
10240	2048	16	TBC	39,9	Eutelsat Broadband	Avctrade	http://www.avctrade.com.pl/dladomu.htm	29/05/2013
20480	6144	20/UNL	TBC	47,0	Eutelsat Broadband	Avctrade	http://www.avctrade.com.pl/dladomu.htm	
20480	6144	30/UNL	TBC	56,5	Eutelsat Broadband	Avctrade	http://www.avctrade.com.pl/dladomu.htm	
20480	6144	UNL	TBC	80,1	Eutelsat Broadband	Avctrade	http://www.avctrade.com.pl/dladomu.htm	
8192	2048	8	362	28,1	Eutelsat Broadband	Hetan	http://www.hetan.pl/internet_satelitarny/internet_dla_domu	
12288	4096	16	362	47,0	Eutelsat Broadband	Hetan	http://www.hetan.pl/internet_satelitarny/internet_dla_domu	29/05/2013
18432	6144	26	362	66,5	Eutelsat Broadband	Hetan	http://www.hetan.pl/internet_satelitarny/internet_dla_domu	
18432	6144	50	362	94,3	Eutelsat Broadband	Hetan	http://www.hetan.pl/internet_satelitarny/internet_dla_domu	
8192	2048	8	352	23,4	Eutelsat Broadband	Infratel	http://www.infratel.pl/site,tooway,49.html	
12288	4096	16	352	42,3	Eutelsat Broadband	Infratel	http://www.infratel.pl/site,tooway,49.html	
18432	6144	26	352	61,2	Eutelsat Broadband	Infratel	http://www.infratel.pl/site,tooway,49.html	29/05/2013
18432	6144	50	352	103,8	Eutelsat Broadband	Infratel	http://www.infratel.pl/site,tooway,49.html	
2048	1024	2	354	21,0	Eutelsat Broadband	Kempa	http://www.kempa-satellite.com	
8192	2048	8	354	28,1	Eutelsat Broadband	Kempa	http://www.kempa-satellite.com	
12288	4096	16	354	42,3	Eutelsat Broadband	Kempa	http://www.kempa-satellite.com	29/05/2013
18432	6144	26	354	56,5	Eutelsat Broadband	Kempa	http://www.kempa-satellite.com	
18432	6144	50	354	94,3	Eutelsat Broadband	Kempa	http://www.kempa-satellite.com	
2048	1028	2	TBC	24,6	Eutelsat Broadband	StarDSL	https://ssl.stardsl.pl/	
10240	2048	10	TBC	29,3	Eutelsat Broadband	StarDSL	https://ssl.stardsl.pl/	
20480	6144	10	TBC	41,1	Eutelsat Broadband	StarDSL	https://ssl.stardsl.pl/	29/05/2013
20480	6144	20	TBC	50,6	Eutelsat Broadband	StarDSL	https://ssl.stardsl.pl/	
20480	6144	30	TBC	60,0	Eutelsat Broadband	StarDSL	https://ssl.stardsl.pl/	
2048	1024	2	388	21,6	Eutelsat Broadband	Wachowiak	http://www.internetsatelitarny.pl/tooway-dla-domu.html	
8192	2048	8	388	28,9	Eutelsat Broadband	Wachowiak	http://www.internetsatelitarny.pl/tooway-dla-domu.html	
12288	4096	16	388	43,5	Eutelsat Broadband	Wachowiak	http://www.internetsatelitarny.pl/tooway-dla-domu.html	30/03/2013
18432	6144	26	388	58,1	Eutelsat Broadband	Wachowiak	http://www.internetsatelitarny.pl/tooway-dla-domu.html	
18432	6144	50	388	96,9	Eutelsat Broadband	Wachowiak	http://www.internetsatelitarny.pl/tooway-dla-domu.html	

D.7 Romania

Speed		Volume	CPE purchase	End User pricing (incl. VAT)	Satellite operator	Local service provider (ISP)	Website	Update
Download (kbit/s)	Upload (kbit/s)	(GByte/month incl.)	EUR	(EUR/month)				
3072	256	3	TBC	TBC	SES Broadband	E-Sourcing	http://www.e-sourcing.ro/contact/	29/05/2013
2048	1024	2	TBC	25,0	Eutelsat Broadband	ToowaySat	http://www.tooway sat.ro/intrebari-frecvente_2-70-0	
8192	2048	8	TBC	35,0	Eutelsat Broadband	ToowaySat	http://www.tooway sat.ro/index.php?page=new_order_form	
12288	4096	16	TBC	45,0	Eutelsat Broadband	ToowaySat	http://www.tooway sat.ro/index.php?page=new_order_form	29/05/2013
18432	6144	26	TBC	60,0	Eutelsat Broadband	ToowaysSat	http://www.tooway sat.ro/index.php?page=new_order_form	
18432	6144	50	TBC	95,0	Eutelsat Broadband	ToowaySat	http://www.tooway sat.ro/index.php?page=new_order_form	
2048	1024	2	349,0	17,0	Eutelsat Broadband	Mediasat	http://www.mediasat.ro/tooway-abonamente.html	
8192	2048	8	349,0	21,0	Eutelsat Broadband	Mediasat	http://www.mediasat.ro/tooway-abonamente.html	
12288	4096	16	349,0	35,0	Eutelsat Broadband	Mediasat	http://www.mediasat.ro/tooway-abonamente.html	29/05/2013
18432	6144	26	349,0	51,0	Eutelsat Broadband	Mediasat	http://www.mediasat.ro/tooway-abonamente.html	
18432	6144	50	349,0	87,0	Eutelsat Broadband	Mediasat	http://www.mediasat.ro/tooway-abonamente.html	

Note: activation and/or logistics fees and minimum contract commitment not included in this analysis and to be checked with the local ISP.

D.8 Slovenia

Speed		Volume	CPE purchase	End User pricing (incl. VAT)	Satellite operator	Local service provider (ISP)	Website	Update
Download (kbit/s)	Upload (kbit/s)	(GByte/month incl.)	EUR	(EUR/month)				
4096	256	4	420	30,0	SES Broadband	Elsat	http://www.elsat.si	
6144	256	5	420	40,0	SES Broadband	Elsat	http://www.elsat.si	
512	96	UNL	420	20,0	SES Broadband	Elsat	http://www.elsat.si	29/05/2013
1024	128	UNL	420	30,0	SES Broadband	Elsat	http://www.elsat.si	
2048	256	UNL	420	40,0	SES Broadband	Elsat	http://www.elsat.si	
8192	2048	8	TBC	33,0	Eutelsat Broadband	satelitski-internet	http://satelitski-internet.si/	
12288	4096	16	TBC	47,0	Eutelsat Broadband	satelitski-internet	http://satelitski-internet.si/	29/05/2013
18432	6144	26	TBC	63,0	Eutelsat Broadband	satelitski-internet	http://satelitski-internet.si/	
18432	6144	50	TBC	99,0	Eutelsat Broadband	satelitski-internet	http://satelitski-internet.si/	

Note: activation and/or logistics fees and minimum contract commitment not included in this analysis and to be checked with the local ISP.

D.9 Hungary

Speed		Volume	CPE purchase	End User pricing (incl. VAT)	Satellite operator	Local service provider (ISP)	Website	Update
Download (kbit/s)	Upload (kbit/s)	(GByte/month incl.)	EUR	(EUR/month)				
3072	256	3	TBC	TBC	SES Broadband	VanNet	http://vannet.hu/contact	29/05/2013
20480	6144	10	275	40,0	Eutelsat Broadband	SatDSL	http://internet.mediaservices.hu/en/products/tooway-satdsl	
20480	6144	20	275	53,0	Eutelsat Broadband	SatDSL	http://internet.mediaservices.hu/en/products/tooway-satdsl	29/05/2013
20480	6144	30	275	66,0	Eutelsat Broadband	SatDSL	http://internet.mediaservices.hu/en/products/tooway-satdsl	
20480	6144	UNL	275	125,0	Eutelsat Broadband	SatDSL	http://internet.mediaservices.hu/en/products/tooway-satdsl	
8192	2048	8	TBC	24,4	Eutelsat Broadband	VanNet	http://www.btel.hu/lakossagi/muholdas_internet	
12288	4096	16	TBC	62,1	Eutelsat Broadband	VanNet	http://www.btel.hu/lakossagi/muholdas_internet	29/05/2013
18432	6144	25	TBC	96,8	Eutelsat Broadband	VanNet	http://www.btel.hu/lakossagi/muholdas_internet	
18432	6144	50	TBC	173,1	Eutelsat Broadband	VanNet	http://www.btel.hu/lakossagi/muholdas_internet	

Note: activation and/or logistics fees and minimum contract commitment not included in this analysis and to be checked with the local ISP.

D.10 Cyprus

Speed		Volume	CPE purchase	End User pricing (incl. VAT)	Satellite operator	Local service provider (ISP)	Website	Update
Download (kbit/s)	Upload (kbit/s)	(GByte/month incl.)	EUR	(EUR/month)				
512	96	UNL	412	41,0	HellasSat	Hellas Sat	http://www.hellas-sat.net/en/home_500.html	29/05/2013
1024	128	UNL	412	61,3	HellasSat	Hellas Sat	http://www.hellas-sat.net/en/home_1000.html	29/05/2013
512	256	UNL	1488,3	146,38	HellasSat	Hellas Sat	http://www.hellas-sat.net/gr/business_500.html	29/05/2013
1024	256	UNL	1488,3	244,78	HellasSat	Hellas Sat	http://www.hellas-sat.net/gr/business_1000.html	29/05/2013
1024	512	UNL	1488,3	367,78	HellasSat	Hellas Sat	http://www.hellas-sat.net/gr/business_1000_plus.html	29/05/2013
2048	512	UNL	1488,3	675,28	HellasSat	Hellas Sat	http://www.hellas-sat.net/gr/business_2000.html	29/05/2013

Note: activation and/or logistics fees and minimum contract commitment not included in this analysis and to be checked with the local ISP.

D.11 Greece

Speed		Volume	CPE purchase	End User pricing (incl. VAT)	Satellite operator	Local service provider (ISP)	Website	Update
Download (kbit/s)	Upload (kbit/s)	(GByte/month incl.)	EUR	(EUR/month)				
512	96	UNL	412	41,0	HellasSat	Hellas Sat	http://www.hellas-sat.net/en/home_500.html	
1024	128	UNL	412	51,3	HellasSat	Hellas Sat	http://www.hellas-sat.net/en/home_1000.html	
512	256	UNL	1488,3	146,38	HellasSat	Hellas Sat	http://www.hellas-sat.net/gr/business_500.html	29/05/2013
1024	256	UNL	1488,3	244,78	HellasSat	Hellas Sat	http://www.hellas-sat.net/gr/business_1000.html	
1024	512	UNL	1488,3	367,78	HellasSat	Hellas Sat	http://www.hellas-sat.net/gr/business_1000_plus.html	
2048	512	UNL	1488,3	675,28	HellasSat	Hellas Sat	http://www.hellas-sat.net/gr/business_2000.html	

Note: activation and/or logistics fees and minimum contract commitment not included in this analysis and to be checked with the local ISP.

D.12 Sweden

Speed		Volume	CPE purchase	End User pricing (incl. VAT)	Satellite operator	Local service provider (ISP)	Website	Update
Download (kbit/s)	Upload (kbit/s)	(GByte/month incl.)	EUR	(EUR/month)				
2048	1024	2	TBC	22,7	Eutelsat Broadband	RBcom	http://www.rbcom.se/tooway-prislista/	
20480	6144	10	TBC	34,3	Eutelsat Broadband	RBcom	http://www.rbcom.se/tooway-prislista/	
20480	6144	20/UNL	TBC	45,9	Eutelsat Broadband	RBcom	http://www.rbcom.se/tooway-prislista/	29/05/2013
20480	6144	30/UNL	TBC	57,5	Eutelsat Broadband	RBcom	http://www.rbcom.se/tooway-prislista/	
20480	6144	UNL	TBC	92,4	Eutelsat Broadband	RBcom	http://www.rbcom.se/tooway-prislista/	

Note: activation and/or logistics fees and minimum contract commitment not included in this analysis and to be checked with the local ISP.

D.13 Norway

Speed		Volume	CPE purchase	End User pricing (incl. VAT)	Satellite operator	Local service provider (ISP)	Website	Update
Download (kbit/s)	Upload (kbit/s)	(GByte/month incl.)	EUR	(EUR/month)				
8192	2048	8	631	53,12	Eutelsat Broadband	Radio Link	https://www.radio-link.no/privat.html	
12288	4096	16	631	66,44	Eutelsat Broadband	Radio Link	https://www.radio-link.no/privat.html	30/03/2013
18432	6144	26	631	79,75	Eutelsat Broadband	Radio Link	https://www.radio-link.no/privat.html	
18432	6144	50	631	119,7	Eutelsat Broadband	Radio Link	https://www.radio-link.no/privat.html	
2048	1024	2	TBC	52,51	Eutelsat Broadband	Direct Connect	http://www.directconnect.no/privat/produktoversikt/satellittbredbaand/	
20480	6144	10	TBC	65,67	Eutelsat Broadband	Direct Connect	http://www.directconnect.no/privat/produktoversikt/satellittbredbaand/	
20480	6144	20	TBC	78,83	Eutelsat Broadband	Direct Connect	http://www.directconnect.no/privat/produktoversikt/satellittbredbaand/	29/05/2013
20480	6144	30	TBC	91,99	Eutelsat Broadband	Direct Connect	http://www.directconnect.no/privat/produktoversikt/satellittbredbaand/	
20480	6144	UNL	TBC	105,14	Eutelsat Broadband	Direct Connect	http://www.directconnect.no/privat/produktoversikt/satellittbredbaand/	

Note: activation and/or logistics fees and minimum contract commitment not included in this analysis and to be checked with the local ISP.