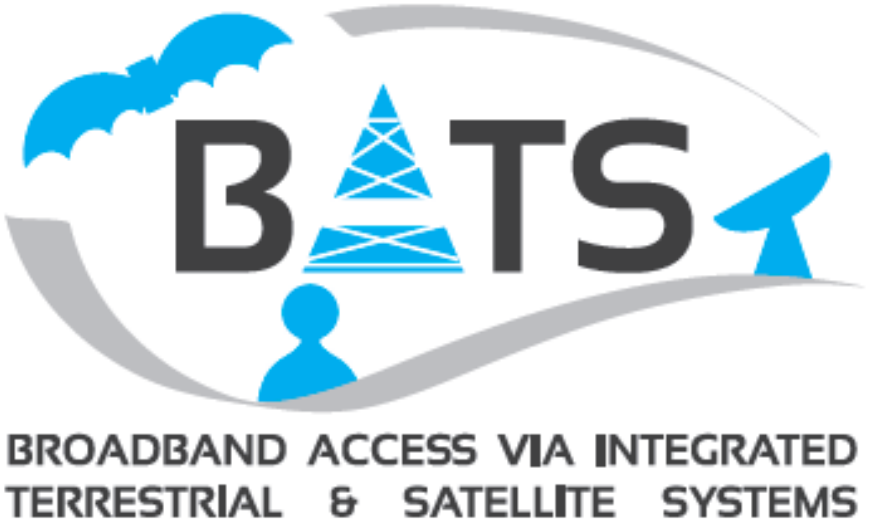

D5.4
Business Case

Instrument	Collaborative Project
Topic	ICT-2011.1.1
Project Title	Broadband Access via Integrated Terrestrial & Satellite Systems
Project Number	317533
Project Acronym	BATS
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List of Acronyms

BATS	Broadband Access via Integrated Terrestrial & Satellite Systems
AM	Analysys Mason
BDUK	Broadband Development UK
Capex	Capital (or one time) expenditure
CDN	Content Delivery Network
CPE	Customer Premise Equipment
DSL	Digital Subscriber Line
EU27+T	The member states of the European Union prior to Croatia joining plus Turkey
GEO	Geostationary Earth Orbit (satellite)
HAP	High Altitude Platform
HAPS	High Altitude Pseudo Satellite
IUG, ING, IxG	Intelligent User Gateway, Intelligent Network Gateway, both together
LEO	Low Earth Orbit (satellite)
LTE	Long Term Evolution
(M)VNO	(Mobile) Virtual Network Operator
Opex	Operational (or ongoing) expenditure
OTT	Over The Top (usually video content)
POP	Point Of Presence
TT&C	Tracking Telemetry & Control
UK	United Kingdom
VPN	Virtual Private Network
VSAT	Very Small Aperture Terminal

Executive Summary

This deliverable reports the findings of the work done in WP5.4 “BATS Business case analysis” to assess the business case for BATS and articulate the key messages for the different stakeholders in the key players of the value chain.

Inputs to this deliverable were the stakeholder and value chain analysis in D5.1, the cost benefit work in D5.2 and the energy efficiency findings of D5.3 along with the field trial work reported in D7.1. The business case was analysed in detail from the perspectives of a satellite operator and as an in country telecommunications operator (using Galicia as a good reference case of this analysis). Relevant feedback from the field trials has been evaluated. This allowed the commercial viability of the BATS concept to be assessed and the key messages articulated.

A viable plan can be foreseen by phasing service introduction to focus on the target high demand countries initially and by encouraging uptake of BATS precursor services on satellites in orbit now or planned prior to the BATS baseline satellites. This plan is dependant on working with partners in these countries and others that already have terrestrial infrastructure that falls short of the NGA targets in some of their regions. These partnerships should be developed in the high demand countries well before new satellites are launched to develop the systems, technologies and relationships. This plan requires the core BATS service be led by satellite operator. The actual service being delivered by in country partners who have the brand and the need to offer service to under-served locations.

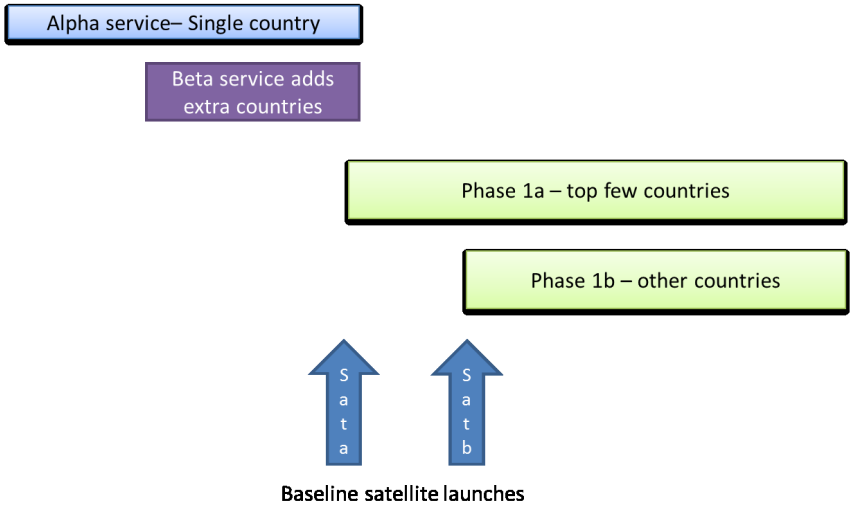


Figure E-1 : Illustrating phased service introduction.

There are good reasons for maintaining focus on the use of High Throughput Satellites (HTS) in geosynchronous orbit to deliver services to households in the unserved and underserved regions of Europe as Low Earth Orbit (LEO) based solutions can’t provide sufficient capacity and High Altitude Platforms (HAP) based solutions focus more on access to smartphones rather than households. BATS provides a good solution to use HTS capacity with a good terrestriallatency for latency critical applications.

There are a number of ways to make BATS a profitable business case for the in country partner and the satellite service provider. These include the following:

- **Acceptable satellite costs:** The analysis service can be offered at the required €20 to €25 per home per month levels;
- **Eliminate the cellular link:** These costs are not regulated. The product works well enough with a single terrestrial path;

- **Lobby for DSL regulated cost reduction in BATS areas:** As these underserved areas are those where no realistic alternatives are available this may be something the regulators would look favourably at;
- **Obtain grants to offset the capital expenditure:** Along the lines of the Voucher+ scheme providing support both for the initial one-time costs and the ongoing service.

The following diagram (Figure E-2) illustrates how the monthly payments might be distributed between the VNOs, their own service costs and the satellite service provider.

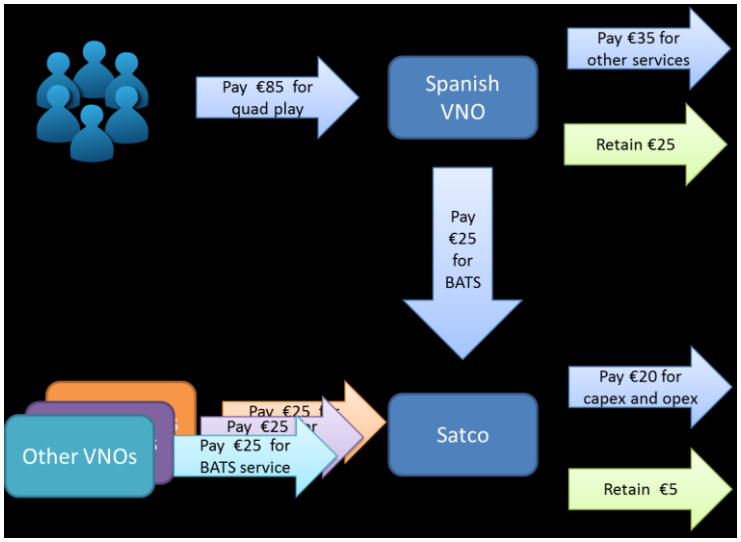


Figure E-2 : Money flow in combined VNO / satco service model.

Of course the other VNOs may use different bundles and may also reduce the charge to the home by complementing with a Voucher+ scheme. This diagram represents the investment of €959M by the satco where the investments need to be repaid over 15 years at 6.5% plus operational costs equating to a monthly cost to the satco of €20. A gross margin of 20% has been assumed €25 per HH per month. In other analyses a high volume gross margin of 10% has been used and different bandwidth/numbers of homes. The likely wholesale price for the BATS core service (satellite, backbone and INGs) in 2020 will be between €20 and €25 per home per month.

It is clear from the trials that an integrated service is of interest as long it is correctly defined, communicated, implemented and tested. A stable service is an absolute requirement. The data usage levels seen in the trials suggest that some reduction in the predicted data volumes for 2020 is likely and realistic.

To be ready for a full service in 2020 with new next generation HTS at least one in country operator in one of the key BATS demand countries and satellite operator need to work together to develop an initial service. It is likely that a simplified service will be implemented initially for the consumer along with a further developed IUG for business.

There are many different messages for the many different potential stakeholders identified. The common themes are that BATS;

- Offers a stable next generation broadband access service solution for underserved regions;
- Has a viable phased business plan;
- Is competitive financially and environmentally with identified alternatives.

1 Introduction

1.1 Purpose of deliverable

This deliverable reports the findings of the work done in WP5.4 “BATS Business case analysis” to assess the business case for BATS and articulate the key messages for the different stakeholders in the key players of the value chain.

Inputs to this deliverable were the stakeholder and value chain analysis in D5.1, the cost benefit work in D5.2 and the energy efficiency findings of D5.3 along with the field trial work reported in D7.1. This is summarised below Figure 1-1.

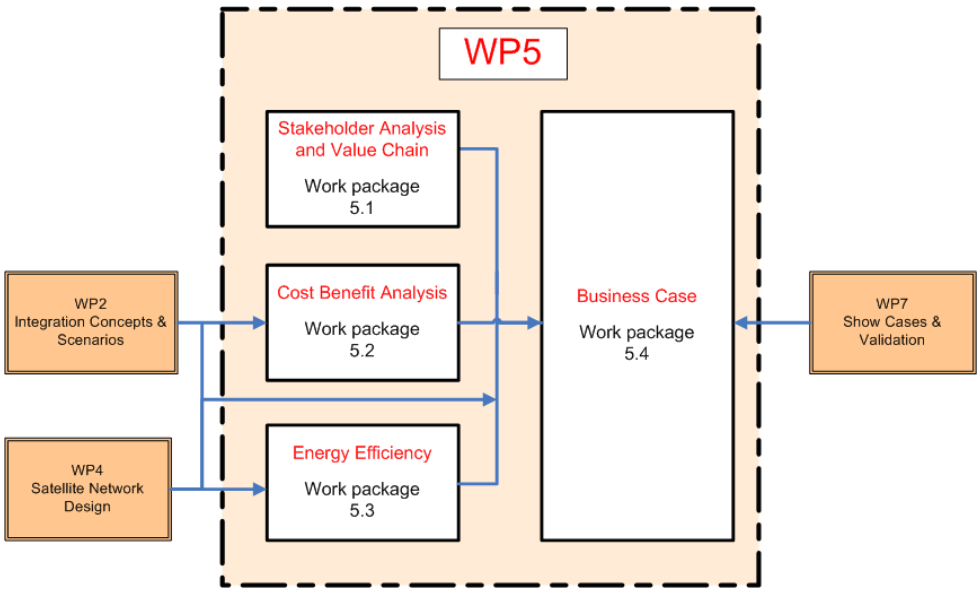


Figure 1-1: WP5.2 in overall WP5 structure.

1.2 Deliverable structure

This deliverable has a number of chapters addressing the questions asked in the BATS DoW, these chapters are:

Chapter 2: Assesses the business case for a satellite communication service company (SatCo) to take the BATS concept, implement and sell this across Eu27 + T;

Chapter 3: Assesses the business case for a regional managed or mobile virtual network operator company (MVNO) to take the BATS concept, implement and sell this in their territory (in this case R in Galicia in north west Spain;

Chapter 4: Makes an initial assessment of the business case for the incumbent telco in Turkey;

Chapter 5: Summarises the key findings of the field trials, how these would impact on the delivery of service and the resulting business case;

Chapter 6: Synthesises the findings of chapters 2 to 5 inclusive and comments on the commercial viability of each approach;

Chapter 7: Details the key arguments supporting the BATS concept for a variety of different organisations.

2 Service delivery assessment for satco lead

2.1 Scope for a satco lead scenario

The initial focus will be on analysing the core network costs and determining their sensitivity to variations in basic cost and design. This will be followed in Section 2.5 by a consideration of the business implications of the BATS service being led by a pan-European satellite service provider (satco); the implications of this on the core service design and end user pricing.

Different kinds of satellite operator exist. For example the traditional model is where they act as a wholesaler who simply provide the spacecraft and sell bandwidth. Satellite service operators then:

- Buy capacity as a proportion of the spacecraft capacity (typically sold as MHz);
- Provide and operate gateway facilities;
- Have direct or indirect relationship with end users via resellers.

The architecture of High Throughput Satellites (HTS) requires the use of satellite gateways to maximise throughput (e.g. [1]), which in turn leads to a different level of vertical integration. Here the satellite operator also manages and operates the gateways. They may then either sell direct to the end user (such as Hughes and ViaSat in North America) or through resellers (including Ka-Sat and Avanti in Europe). In the latter case the satellite service operator may sell capacity in a variety of different ways, such as [2]:

- Dedicated spacecraft capacity (typically sold as bandwidth in MHz);
- Guaranteed capacity in Mbit/s (including access to Operations Support Systems (OSS) tools to create, allocate and manage end user service plans);
- Pre-packaged service plans (access to the OSS to manage end user service plan allocation).

The BATS analysis also requires the use of gateways with one or more resellers selling service plans to end users. In addition a backbone network to POPs with INGs is required to combine the satellite and terrestrially routed data.

2.2 Review of previous analysis

2.2.1 Reviewing core network costs from D5.2

In the cost benefit analysis we calculated the both proportion of traffic carried via satellite (shown in D5.2 tables 5-14 to 5-17) and presented the predicted busy hour traffic loads for different countries (see D5.2 Figure 2-23) showing the predicted increase to 2020.

One can combine these to consider how the traffic is split between satellite and terrestrial paths. This split will vary depending on the capability of the terrestrial link. As in the earlier analysis, three different bands are used to group the terrestrial link performance; <2Mbps, 2-8Mbps and 8-15Mbps. The following graphs (Figure 2-1 to Figure 2-4) show the results of this analysis for four representative different levels of total traffic demand.

The following charts assume that all video traffic is carried via satellite.

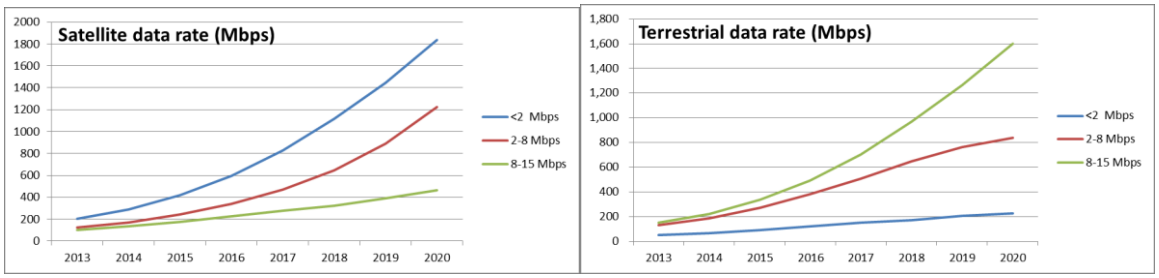


Figure 2-1 : Traffic proportions in Spain

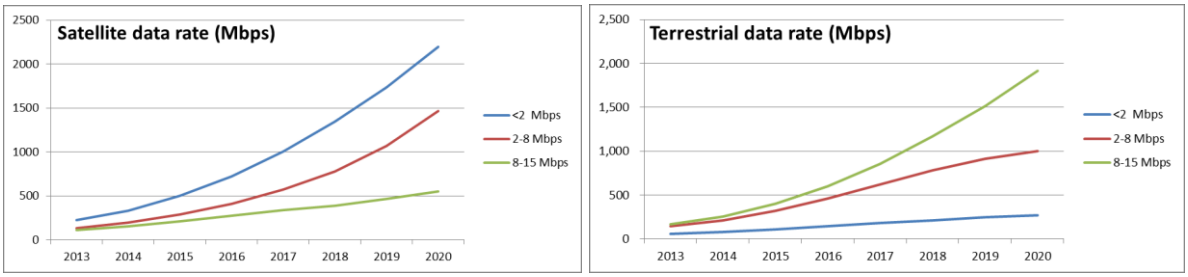


Figure 2-2 : Traffic proportions in UK

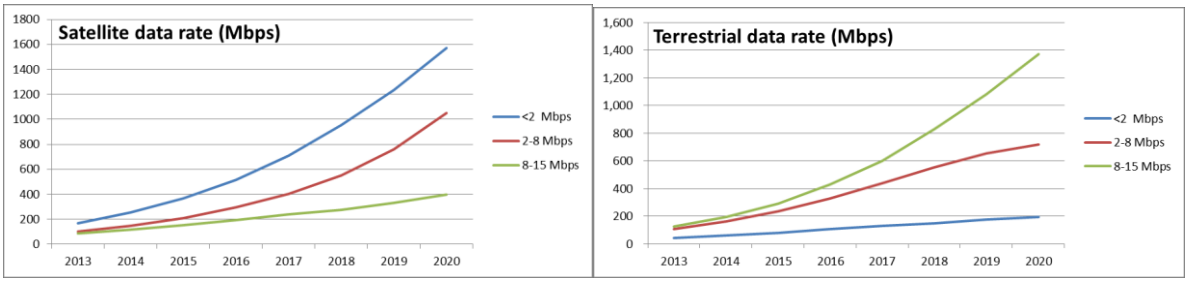


Figure 2-3 : Traffic proportions in Turkey

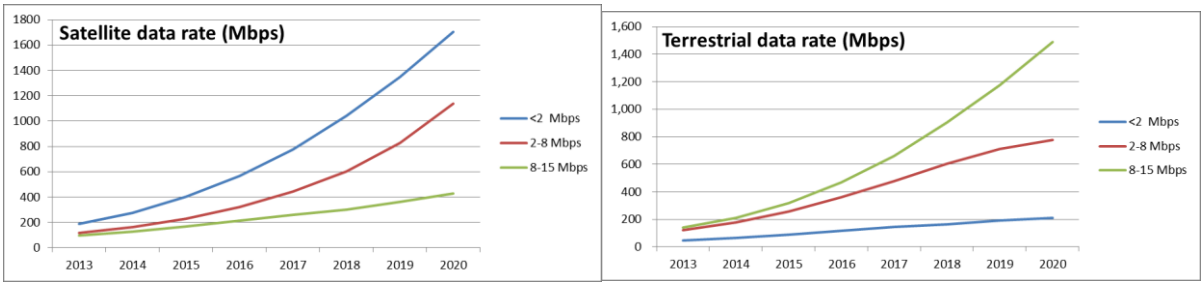


Figure 2-4 : Traffic proportions in West Europe

Whilst the general trends are the same the total traffic levels do vary by around 20%, the UK being towards the higher end.

In the detailed analysis in D5.2 this was enhanced to allow for some video to be carried terrestrially which tends to increase the terrestrial traffic and reduce the satellite traffic. This analysis was made for 2020 only as this is a complex process looking at the different data types and improvement in video codecs. This reflects the expected improvements in IxG routing processes.

In addition the core network costs were evaluated in D5.2 and mapped out as costs per household per month for different amounts of data carried over the satellite and different satellite fill factors (see D5.2 table 8-1). We also saw that there were different scenarios with different satellite fill factors (D5.2 section 6), in particular the satellite fill reduces as the average traffic reduces as less spots are full with traffic.

These data sets can be combined to calculate the cost contributions as shown below in the following table, based on predicted take up at ARPU+50% (the methodology used in D5.2, to look at the average broadband revenue and then consider the price elasticity above this for the BATS service) which gives the number of customers per terrestrial speed bracket. The average costs assume the supply is filled with the same proportion for each speed bracket, the focussed sale concept is the same as in D5.2; selling to the underserved and then topping up with as many unserved homes (<2Mbps) as possible to fill the capacity.

The total satellite throughput for unicast traffic has been set at 709Gbps for the two baseline 2020 satellites per section 2.5.3.2 of BATS deliverable D4.3.2 "Q/V Feeder Link design and BATS satellite system performance", and assumes the 22 beams with no traffic (per D5.2) are in the unfilled capacity. The term core network encompasses the satellites, their gateways and backbone network.

Table 2-1: Core network cost contributions (2020).

	Analysis Mason (AM) traffic levels		50% of AM traffic levels	
(€ per hh per month)	**Average cost**	**Cost for focussed sales**	**Average cost**	**Cost for focussed sales**
Spain	29.68	16.08	17.37	9.68
UK	38.9	19.26	22.76	11.72
Turkey	33.53		19.62	
EU27+T	28.74	14.88	16.82	8.71

The Turkey results reflect that fact that there is capacity for the vast majority of demand therefore no benefit from focussed selling.

Note that these are the direct costs and D5.2 suggests a 10% margin would be added for volume sales. For example therefore the baseline average wholesale price for Spain would be €33.04, the figure used for the baseline analysis in section 3. In the subsequent sections in section 2.2 the impact of changing different parameters will be measured against this reference.

This figure reduces to €17.87 for focussed sales; reducing to €19.30 if the traffic levels were half of the baseline and to €10.76 if this traffic level is combined with focussed sales. It should be noted that for the Satco this is a volume project with associated small margins.

The following graph (Figure 2-5) shows where the major expenditures occur and the focus will naturally be on the sensitivity to the "larger ticket items", in this case the top four.

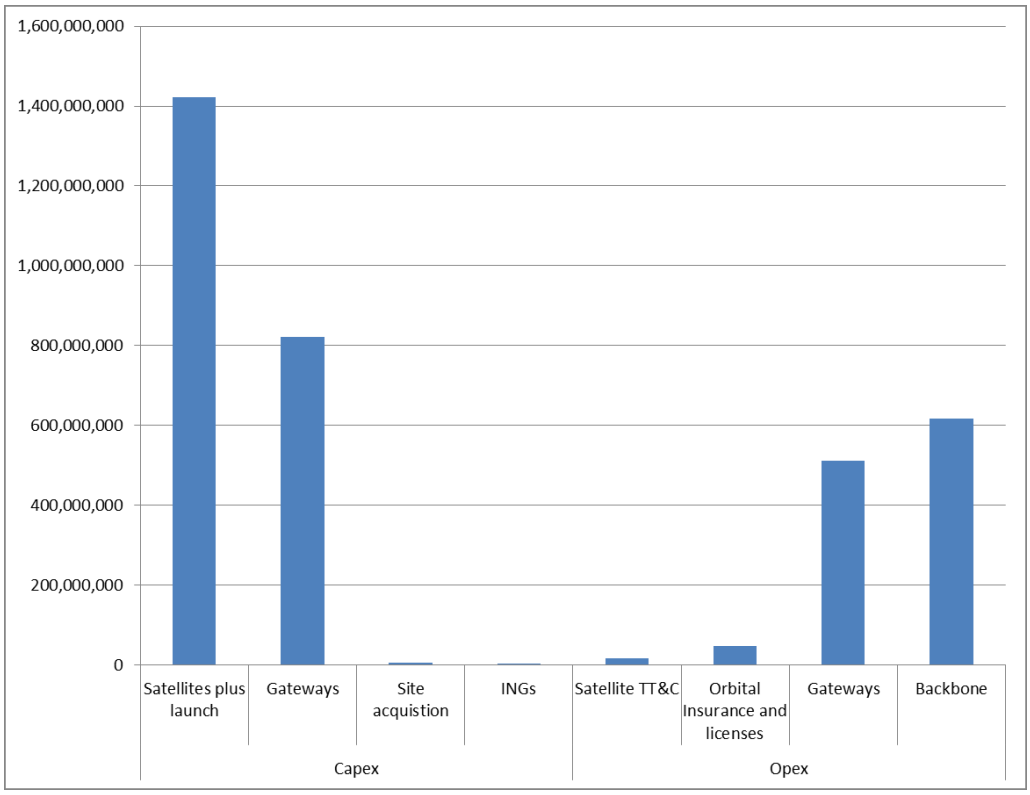


Figure 2-5 : Breakdown of core network costs (€ over 15 years)

2.2.2 Review and analysis of satellite costs

A review of the cost sensitivity of the satellite design was held. This found that:

a) The cost savings to serve a reduced number of countries with the 2020 baseline satellite design will be minor if the initial design is retained (2 satellites);

b) The link budget analysis is not conservative and the scenarios used are based on major improvements on the DVB-S2 interface and technological advancements on the feeder links. But this approach is plausible and all the related technological advancements can be provided by 2020;

c) The satellite and launch costs are best estimates from team and include predict reductions in space hardened components and in launch costs.

If a single satellite was launched the costs would nearly halve, but if the fill factor was the same then the cost per household served would not change significantly.

2.2.3 Review and analysis of backbone costs

The costs are based on the best estimates. Clearly if less user beams are required then less gateways and backbone connections are required. However as this is a relatively large number of gateways (50 at 37 locations), if one halves the number of user beams one halves the number of gateways and the cost per household served would not change significantly.

2.2.4 Impact on core network cost contributions

Core Network Costs

No significant changes from the data already provided in D5.2 have been identified.

The following table (Table 2-2) shows the impact on the EU27+T service cost contribution for a 25% increase in each of the four categories.

Table 2-2: Sensitivity impact on core network cost contribution (EU 27+T, 2020).

Change	Baseline	Focussed	Increase
Satellite in orbit +25%	€31.72	€16.42	10.4%
Gateway capex +25%	€31.56	€16.34	9.8%
Backbone opex +25%	€30.59	€15.84	6.4%
Gateway opex +25%	€29.81	€15.44	3.7%

Where “Baseline” means modifying the baseline model, and “Focussed” means modifying the Focussed sales model; capex is the capital expenditure and opex is the operational expenditure.

Core network capital investments

These consist of the satellite, launch thereof, along with the gateways and setting up the backbone network. This has been calculated as €820M in total. This would be incurred by the satellite service operator

Core network operating costs

These consist of the tracking telemetry and command (TT&C) system of the satellites, the orbital insurance and licenses required, the operational costs of the gateways (staff, maintenance, lease and services), and the backbone lease costs. This has been calculated as €76M in 2020, and would be incurred by the satellite service operator.

2.2.5 Other investments

As will be shown in section 2.3, the terrestrial costs and “service wrap” will be best done by other parties. These investments will vary from country to country and will depend significantly on the existing business. In D5.2 the investments for UK, Spain and Turkey were considered and these are considered below in Table 2-3.

Table 2-3: Analysing other investments.

Investment	Analysis
Brand	Required to sell in volume to consumers and small business. Low cost if adding BATS as a complementary service product, very high for introducing a new brand.
Other marketing	Low cost if adding BATS as a complementary service product, high for introducing a new product.
Fixed line interconnection	Different countries need different numbers of lines to make this cost effective, concerns over access to wholesale VULA costs noted in D5.2.
Customer Premise Equipment (CPE)	Sufficient inventory will need to be ordered to meet the roll-out and maintenance commitments, this can usually be ordered in tranches where the cost is negotiated against expected annual order volumes.
Installation	This requires sufficient teams with good geographical deployment to minimise costs; this requires a reasonable volume of BATS and similar work to keep these costs under control.
Service desk	First level service desk support needs to be in the correct language. For many European languages this support can be bought in if not available in-house though this may not be the case for all languages.
Other overheads	Not anticipated to be a major factor though as will all cases the economies of scale in each country will help.

2.2.6 Predicted market mix in 2020

All the above mentioned information along with the data and diagrams extracted from the spreadsheets provided by Analysys Mason have led to a series of findings and outcomes that are useful for the creation of a solid business model that minimizes the risks and attempts a market approach which can maximize the profits for the required investment.

Here is presented the percentage of the total addressable market for each country for residential users, business premises and total market share. The data used to create these charts is the Analysys Mason addressable market 2020 table for the baseline scenario. From these charts we can conclude that Germany, Spain, France, Italy, Poland, Turkey and UK are the countries with the biggest addressable markets.

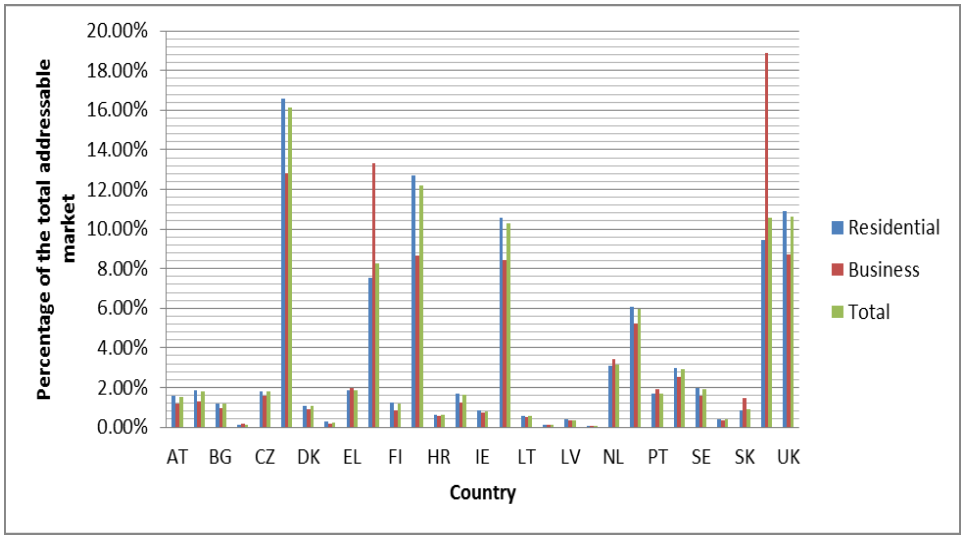


Figure 2-6: Total addressable market percentage per country for all premises

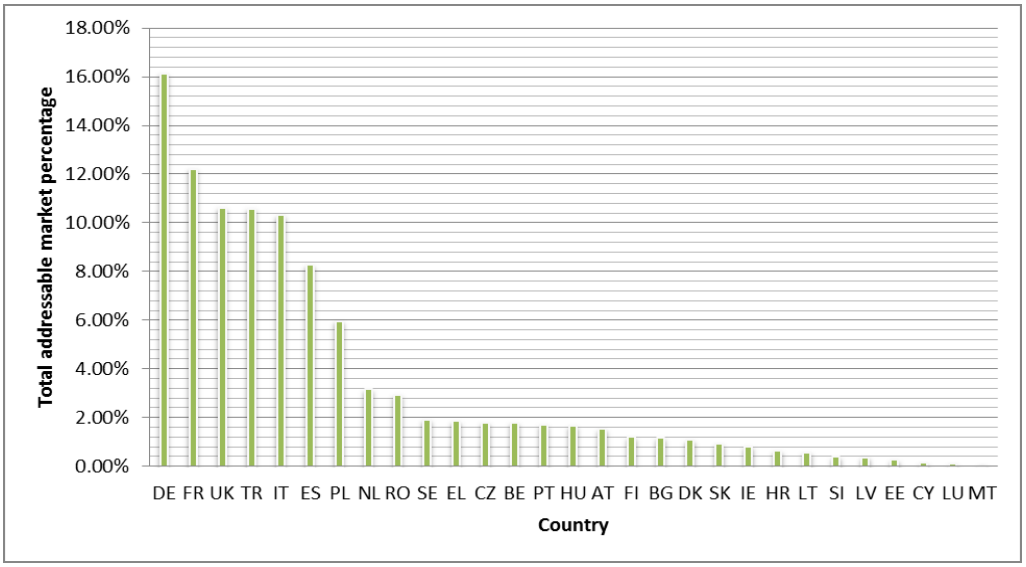


Figure 2-7: Total addressable market per country

Apart from the total number of premises it is a matter of paramount importance to recognize the nature of the premises, business or residential, as this can have an impact on the market strategy designed for each country. Below a business premises market percentage per country is presented. As shown in Figure 2-8; Turkey, Spain, Germany, UK, France, Italy and Poland are the markets with the highest percentages regarding business premises.

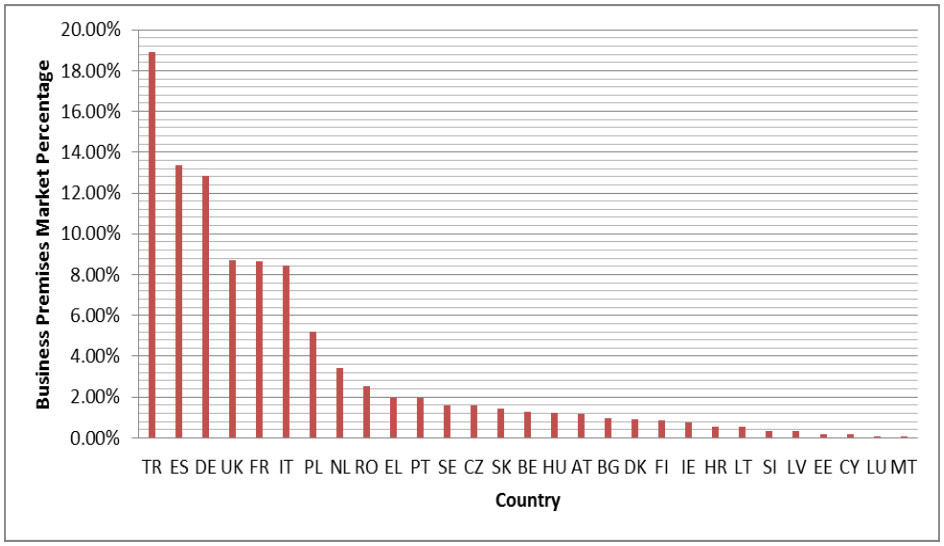


Figure 2-8: Business premises market percentage per country

The same thing applies for the residential premises market. In this part of the market Germany, France, UK, Italy, Spain and Poland are the biggest markets as shown below in Figure 2-7.

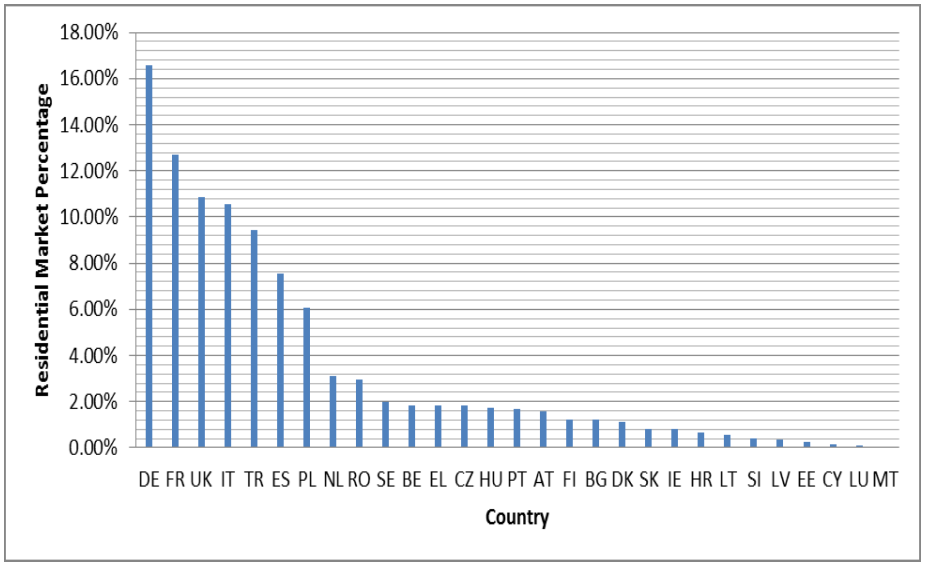


Figure 2-9: Residential market percentage per country

The segmentation into residential and business premises will have significant implications for the marketing strategy designed for each country, as local strategy should be adjusted to each countries characteristics and needs.

2.3 Commercial practicability of satco lead scenario

2.3.1 Scope

This section looks at the implications for a single satellite company to lead sales across the EU27+T and then considers similar but less audacious and more plausible solutions.

2.3.2 Challenges for a pan-European service

There are many differences across the EU27+T such as:

a) Twenty five official languages [4];

b) Multiple religions (many sources from daily news and including [5]);

c) Wide variations in gross domestic product per capita (D5.2 and e.g [6]);

d) Social needs, media consumption habits and many more.

As an illustration of the "game changing" media consumption, Netflix is available about one third of the states in the EU27+T ([8]) and once expanded video consumption will increase significantly in the newly connected states. In D5.2 we saw there is no single price that can be used across the BATS countries. Therefore a minimum of twenty-eight national marketing campaigns will be needed. In addition close to that number of relationships for good in country wholesale broadband suppliers and for fulfilment teams.

The cost of launching a new pan-European brand would therefore be astronomical and not viable. One approach would be to design an approach that addresses only the most valuable part of the market initially and then seek to expand from there.

2.3.3 Staggered service launch

Predicted national requirements for BATS

One thing is very clear from D5.2 whichever scenario one looks at – the different countries have different levels of demand.

Table 2-4 below shows how this varies in quantity, proportion of the total and where each country ranks in order for three different measures (number of homes, bandwidth demand, total revenue). This is also compared with the supply of capacity from the 2020 BATS satellite design (homes with demand that can be supplied).

Table 2-4: Baseline predicted demand per country from D5.2 (2020).

Country	No of sites	Sat demand (Mbps)	Revenue (€ pcm)	Rank by homes	Rank by bandwidth demand	Rank by revenue	Rank by supply	Average rank	Prop. Of sites	Prop. Of demand	Prop. Of Revenue	Prop. Of Supply
Austria	8,415	7,523	143,809	17	17	15	15	16.00	1.4%	1.4%	1.0%	1.5%
Belgium	1,834	1,756	59,351	22	23	22	23	22.50	0.3%	0.3%	0.4%	0.6%
Bulgaria	13,158	17,002	127,155	11	11	16	12	12.50	2.2%	3.1%	0.9%	2.4%
Cyprus	833	753	20,578	26	26	26	25	25.75	0.1%	0.1%	0.1%	0.6%
Czech Republic	8,832	7,898	182,905	16	15	13	19	15.75	1.5%	1.4%	1.3%	1.1%
Germany	51,428	31,931	1,298,118	4	8	5	6	5.75	8.7%	5.8%	9.4%	5.5%
Denmark	4,730	4,637	168,347	19	19	14	17	17.25	0.8%	0.8%	1.2%	1.2%
Estonia	1,823	1,830	46,999	23	22	23	21	22.25	0.3%	0.3%	0.3%	0.9%
Greece	45,038	36,072	987,083	7	5	7	5	6.00	7.7%	6.5%	7.2%	5.9%
Spain	73,731	62,751	2,266,776	2	3	1	2	2.00	12.5%	11.4%	16.5%	11.9%
Finland	10,241	9,044	300,886	13	13	10	11	11.75	1.7%	1.6%	2.2%	3.4%
France	63,417	69,821	1,579,377	3	2	3	3	2.75	10.8%	12.7%	11.5%	10.3%
Hungary	11,650	11,081	228,339	12	12	11	14	12.25	2.0%	2.0%	1.7%	1.7%
Ireland	9,227	8,882	98,602	15	14	19	16	16.00	1.6%	1.6%	0.7%	1.3%
Italy	48,610	62,601	1,268,933	6	4	6	4	5.00	8.3%	11.4%	9.2%	9.3%
Lithuania	1,713	1,557	42,745	25	25	24	20	23.50	0.3%	0.3%	0.3%	1.0%
Luxembourg	67	61	617	27	27	27	27	27.00	0.0%	0.0%	0.0%	0.0%
Latvia	3,066	2,927	84,323	20	20	20	18	19.50	0.5%	0.5%	0.6%	1.1%
Malta	18	21	325	28	28	28	28	28.00	0.0%	0.0%	0.0%	0.0%
Netherlands	1,727	1,702	42,662	24	24	25	24	24.25	0.3%	0.3%	0.3%	0.6%
Poland	49,034	34,884	1,686,351	5	6	2	8	5.25	8.3%	6.3%	12.3%	4.7%
Portugal	10,072	7,602	109,064	14	16	18	13	15.25	1.7%	1.4%	0.8%	2.3%
Romania	26,151	34,365	560,912	8	7	8	9	8.00	4.4%	6.2%	4.1%	4.7%
Sweden	20,650	18,279	116,335	10	10	17	10	11.75	3.5%	3.3%	0.8%	4.1%

Country	No of sites	Sat demand (Mbps)	Revenue (€ pcm)	Rank by homes	Rank by bandwidth demand	Rank by revenue	Rank by supply	Average rank	Prop. Of sites	Prop. Of demand	Prop. Of Revenue	Prop. Of Supply
Slovenia	1,854	2,114	60,483	21	21	21	26	22.25	0.3%	0.4%	0.4%	0.4%
Slovakia	7,569	6,527	218,967	18	18	12	22	17.50	1.3%	1.2%	1.6%	0.9%
Turkey	89,127	80,797	1,497,546	1	1	4	1	1.75	15.2%	14.7%	10.9%	17.5%
United Kingdom	24,090	26,769	556,080	9	9	9	7	8.50	4.1%	4.9%	4.0%	5.1%

The following three graphs (in Figure 2-10, Figure 2-11 and Figure 2-12) show the same data, this time sorting the countries to largest first for each of the same three measures (left and primary y axis) and the cumulative proportion of that measure (right and secondary y axis).

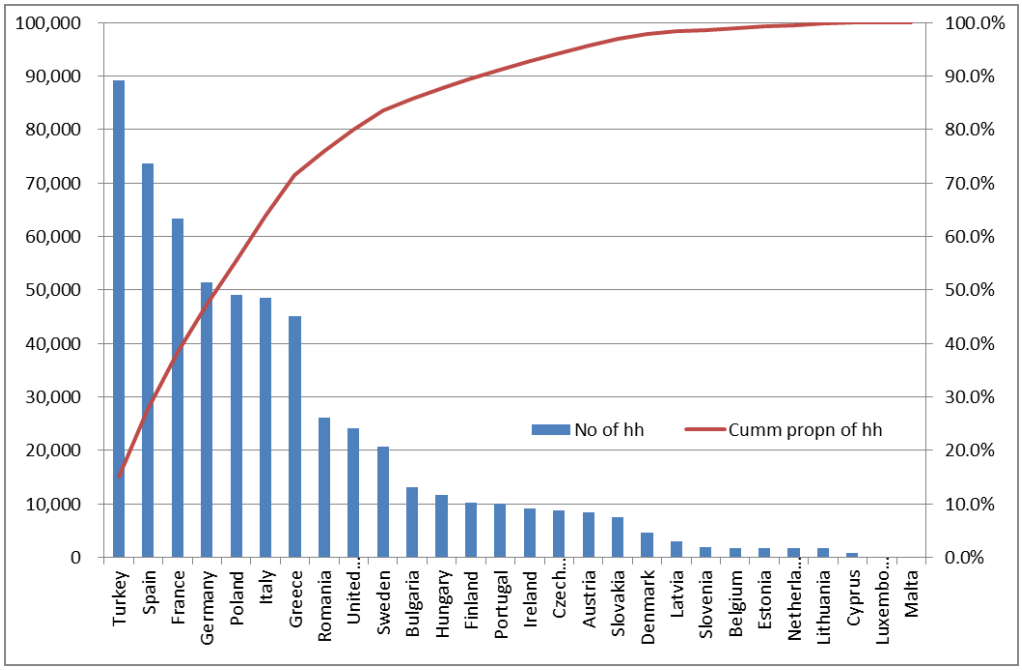


Figure 2-10 : Baseline scenario national demands by number of hh served

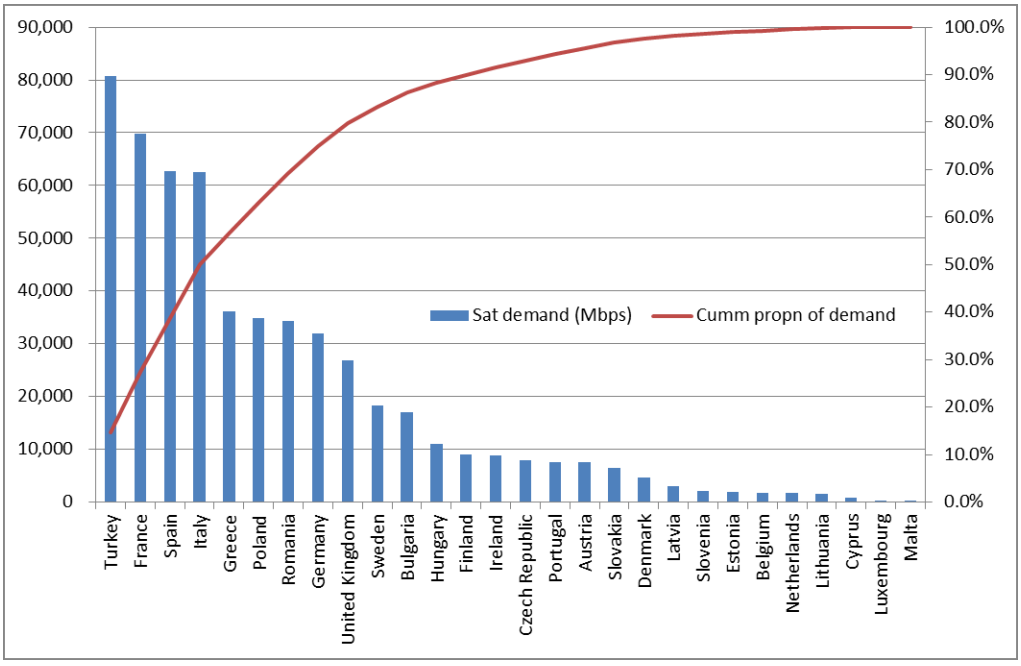


Figure 2-11 : Baseline scenario national demands by bandwidth demand

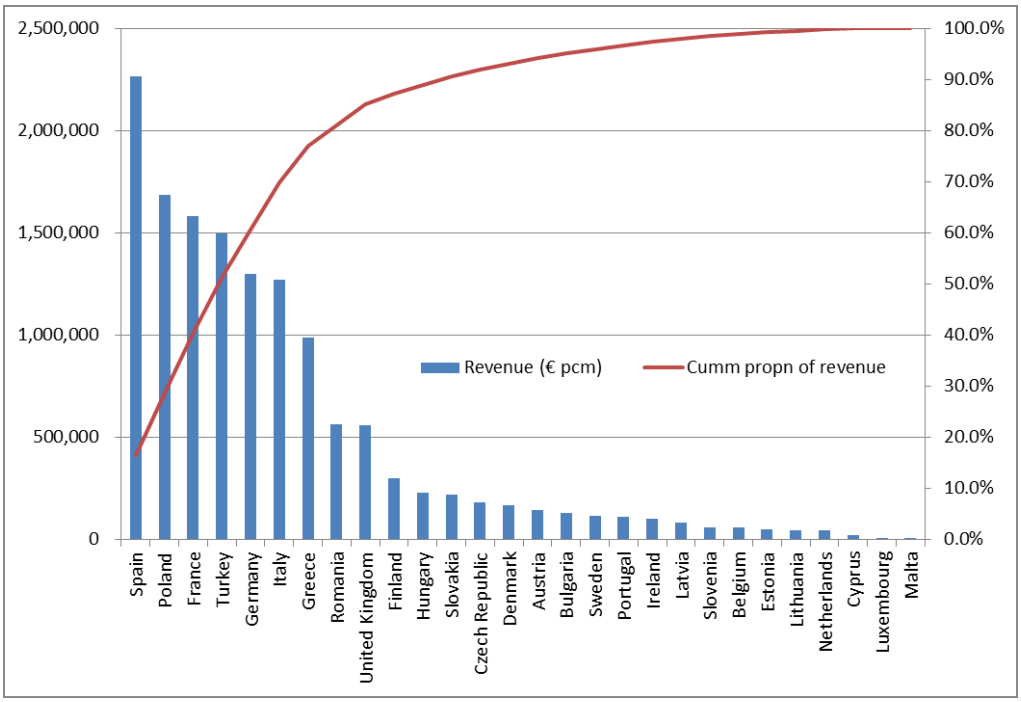


Figure 2-12 : Baseline scenario national opportunities by revenue provided

Analysis

Looking at the data a number of points become clear:

- Considering the revenue available, the top four countries account for over 60% of the predicted total and the top ten for over 97% of the total;
- Turkey tops the demand based on both households and data throughput yet drops to fourth in the calculated revenue;
- Spain tops the revenue available and is highly placed on the other two measures;
- France rates highly on all three measures.

All of this suggests that one might design the service launch to address a smaller number of countries than the full 28 perhaps along the following lines:

- Launch BATS in the top 4 or 5 countries;
- Once established, move to next 5 to 10 countries and launch there;
- Launch in remainder on an ad hoc basis based on financial and or societal demand.

This concept is illustrated on the map in Figure 2-13 below.

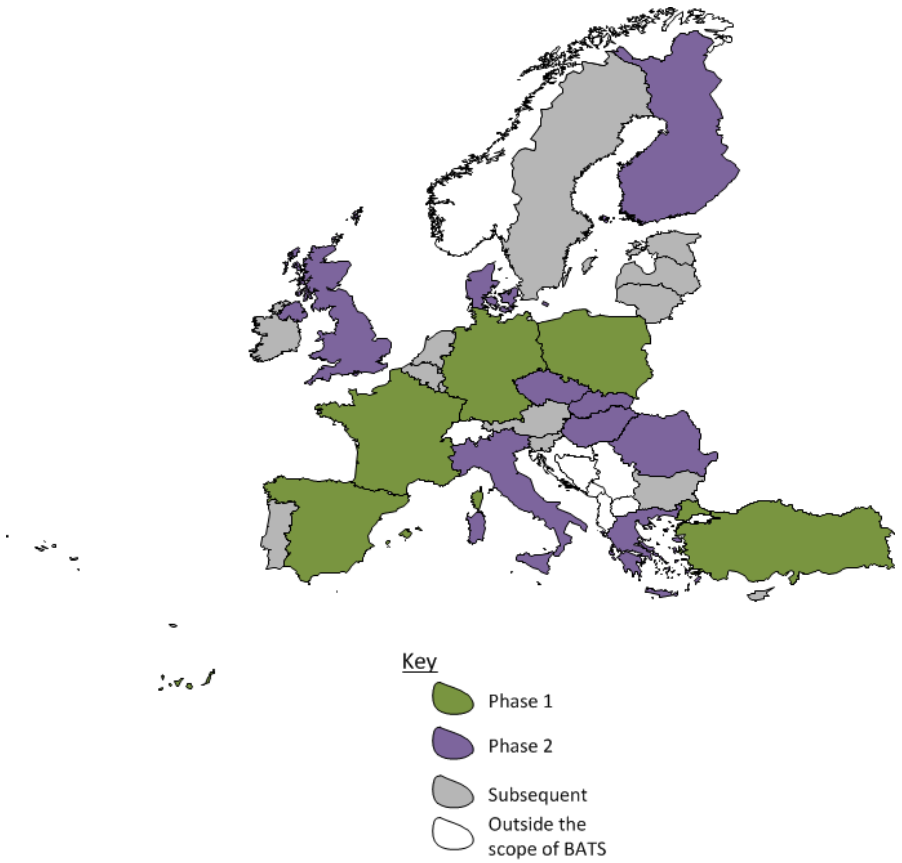


Figure 2-13 : Illustrating the phased deployment concept

The actual countries and number of countries in each phase may of course change and would need to be reviewed by the broadband satellite service operator taking the lead. The following chart shows how the revenues per country map to the phases.

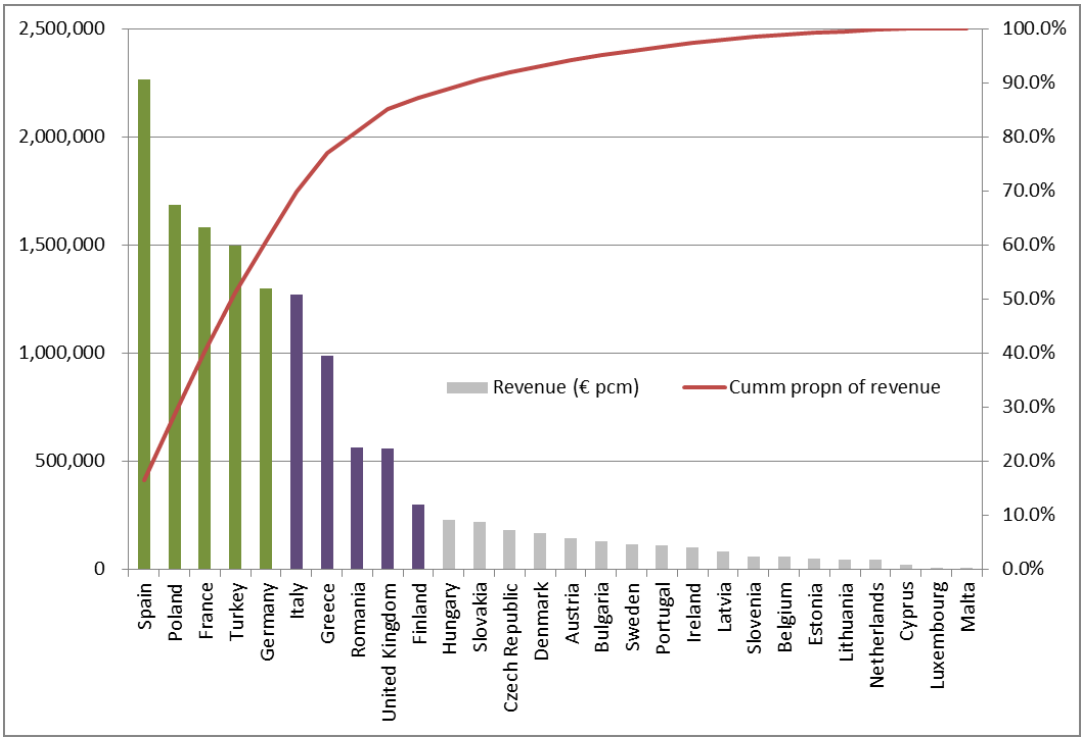


Figure 2-14 : Revenue per country (baseline satellites) showing phases

The following chart shows the bandwidth available per country with the current satellite 2020 baseline design.

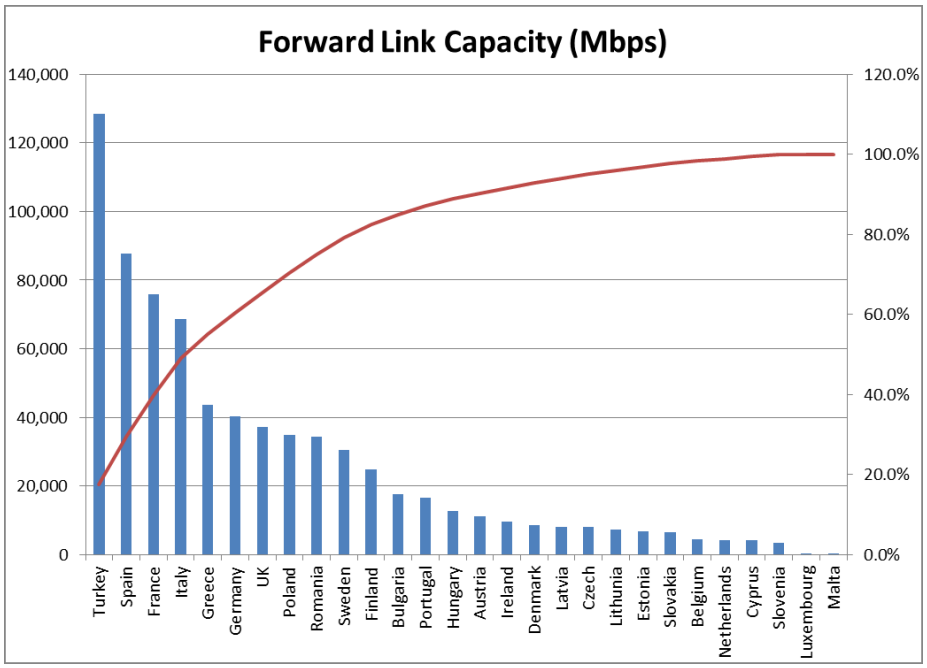


Figure 2-15 : Forward link capacity per country (baseline satellites)

The top four countries by supply benefit from 49% of the available capacity and the top ten around 80%. This means the top 4 countries could be served by a single satellite. More interestingly the top four countries by revenue have 44.5% of the supply; the top five have 49.5% of the supply.

This suggests therefore a single BATS 2020 baseline satellite could be configured to service top five countries much more cost effectively than a pan-European solution. This would need the user beams on the first satellite to be focussed on these five countries, and the beams on the second to be focussed on the remainder. In D5.2 it was shown that the satellite design requirement of having homogeneous coverage was not ideal and the satellites should be designed to better fit the predicted demand with some beams having more capacity than others.

On the second satellite the next five countries by revenue would account for 53% of that satellites calculated revenue, and the next ten account for 67%. The top fifteen countries account for 94% of the total calculated revenue across both spacecraft, the top ten countries account for 90%. All these figures are based on the baseline calculations in D5.2. From this one can conclude that:

- By building relations in ten countries (out of the twenty eight) BATS would have a viable market potential for the launch of the two satellites;
- A phased approach to market development on current HTS prior to the BATS satellite offers a viable development path (this will be explored later in this deliverable);
- The satellite coverage of each phase might need to be adjusted to suit the phasing of countries.

2.3.4 Service cost implications

The primary benefit from moving to a single satellite addressing the top five countries is that the satellite fill factor could be better. On inspection however this is not the case, the fill factor increasing very slightly from 75% for the EU27+T to 76% for the top five countries. This shows that the use of relatively small spot beams evenly spread across these countries has much the same loading as spreading the same spot beams across the continent.

There is no significant ongoing cost benefit on an ongoing basis. There are significant gains that reduce the barrier to market entry including:

- Significant reduction in the number of in-country partners required initially;
- Significant reduction in the number of different parallel marketing campaigns needed.

2.3.5 Business Implications

There are several business concerns and implications regarding the service to be provided by BATS.

The first business requirement is to identify the market in which the BATS service operates. BATS is a service addressed to under-served areas, thus the competition is not clear and may not be based on existing technologies. Therefore it is heavily dependent on any kind of disruptive technology that could provide the same data rates without the inherent issues that BATS service can face, such as the heterogeneity of multiple access satellite links and the synchronization between these. What we can clearly have seen and predicted is that Digital Subscriber Line (DSL) fixed lines are not a competitor. Fibre optics as well are very unlikely to be developed in these areas due to the high infrastructure cost needed to build those networks, at least in the BATS timeframes. Cellular based Long Term Evolution (LTE or 4G) also will need to invest a vast amount of money in these areas to be able to provide these high speeds (see for example section 3 of D5.2 where this was analysed in detail).

A possible source of competition that could threaten the project would be any disruptive technology or approach that could use an alternative way to provide internet services at speeds that would be in accordance with the 2020 objectives. An example of a source of competition would be enhanced LEO constellations covering the whole earth or drones or balloons that could be used as base stations providing ultra-high speeds with the use of higher frequencies or optical technologies. One major concern here would be how soon these kinds of disruptive technologies would be mature enough to be provided to the final user and what would be the price. In the case of BATS, this is a plausible system that can be provided to the end user at reasonable prices without the need of any giant technological leap. To conclude, the current situation is that BATS seems to be a lone player without any competitor in what was identified as addressable market. Another major concern with leo satellites is that they will spend a major part of their orbit of areas with low demand such as mid-ocean and underdeveloped land areas. Earlier LEO constellations were proved immature and there is not a single example of a successful constellation. On the contrary huge initiatives with ambitious goals, such as Iridium, Globalstar, Orbcomm and others had to file for chapter 11 as they were overtaken by realistic approaches such as Geostaionary Earth Orbit (GEO) satellite networks, cellular networks and the evolution and expansion of fixed line networks that had adopted more rational business models. This competition is analysed in more detail in section 2.8.1. The key point being that BATS is a development of existing technologies that can offered at affordable pricing and therefore BATS is potentially a lone player in an addressable market.

The main business risk to BATS is future entrants copying the BATS approach to some degree. The way BATS as a service will be introduced to different markets may need some kind of protection and political support especially from attempts to copy the model, both at a local government level as well as central political support from the European Union, since the mission is not solely business, but has a huge underlying social impact.

Another important aspect is the business model to be followed. The wide variety of countries involved might need a mixed approach depending on which would be the appropriate model for each country. For some countries the Virtual Network Operator (VNO) lead model would be more appropriate whereas in other countries a Satco lead model would be the case. This will depend on the current business relationships and current opportunities on a local level. There is enough flexibility in terms of designing the service model on a per country basis.

It is important that the BATS consortium has partners covering every aspect of BATS needs in terms of supplying services and equipment. The fact that in this project there are satellite operators, MVNOs, satellite manufacturers, equipment manufactures minimizes the risk lying on the BATS suppliers' side, since all suppliers (satellite services, terrestrial services, satellite manufacturers, equipment manufacturers) have a common goal, to see BATS successfully rolled out in the European market.

As far as customers are concerned, one of the main challenges of the project is to make the service affordable for a wide part of the EU27+T populations that belongs to the addressable market. A commonly used framework for assessing competition is the Porter five forces analysis (you might start reading at [15] or [16]). This can be summarised in the following diagram (Figure 2-16) and then analysed for the forces on BATS in Figure 2-17.

Figure 2-16 : Five forces porter analysis

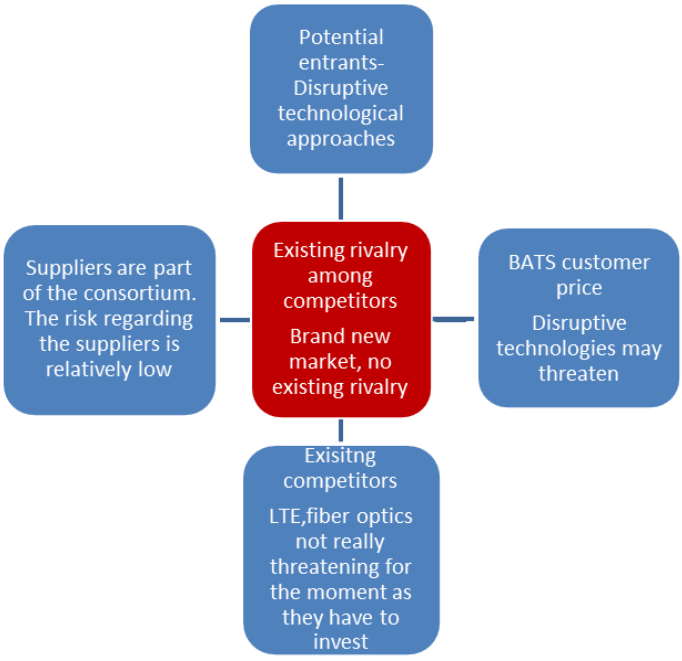


Figure 2-17 : Forces on BATS service

The identification and the separation for each element of the five forces Porter analysis is a daunting task since BATS is a service with the ambition to operate in a really complex business environment. The analysis to follow will provide a clear view on each of the five forces that affect the business environment.

Potential entrants:

- This is a very difficult market to enter. Companies operating in all EE + Turkey markets are very few and the regulations for entering are strict. The investment requires a vast amount of money and the return for remote and underserved areas is uncertain. Investors are reluctant to invest in projects like these since profits are not assured and they are expected in the long term. The government subsidies somehow are trying to attract and stimulate different technological solutions as well. Local competitors may be a source of competition as well as technological evolution, e.g. LEO constellations of some hundreds or thousands of satellites dedicated to broadband services are a potential threat. A threat like this is OneWeb initiative (with all the concerns identified above) – please see section 2.8.1 where this is reviewed in detail.

Buyers:

- The customers of the service are having a limited bargaining power due to the fact that their access to broadband resources is limited. Their upper limit concerning the money expenditure on broadband is their income. This is something that has been already addressed in D5.2 with the take-up analysis.

Suppliers:

- The value chain in BATS is real liable to the service implementation model that will be selected to provide the service. There is a variety of value chains has been already presented in D5.1. It shows the value chain for the satco lead scenario is shown. In this scenario the main suppliers are DSL, LTE and satellite service providers and the IUG/ING providers. The BATS service is provided by a VNO led by the satellite service provider. Some of the main industry players in satellite platform, IUG and ING manufacturing, satellite operators and VNOs are among the team designing the BATS service.

Substitutes:

- An expansion of the LTE technology or investment on fixed infrastructure could threaten a BATS service. Though, this is not likely to happen soon, since a vast amount of money is needed and the expected Return on Investment (ROI) is not high. Possible government subsidies for infrastructure expansion concerning LTE or Fibre optics should be taken into account. One web initiative is also a potential threat. Any disruptive technology could act as a threat especially in the mid and long term (2025 mission and beyond) however if the BATS service is good the churn away from BATS is likely to be slow.

Existing rivalry among competitors:

- BATS is an innovative service providing a broadband solution via multiple routes (satellite, DSL, mobile). The main competition is the threat of substitution by a single evolved technology as described in the threat of substitution section. Since the business model concerns a beyond the state off the art service, it does not face fierce competition for the moment, but as already mentioned, in a fast paced changing environment any threat coming from disruptive technological approaches can create competition or completely outdate a solution.

As already noted a single launch of the BATS service across all EU27+T countries does not seem feasible. It would however be possible to launch a BATS service as a complement to the standard satellite broadband service. This can be done in countries with a good reseller who can bring enough volume to justify a relationship to buy the low cost wholesale broadband; or perhaps invest in the INGs at a suitable data centre and use the satellite broadband to overlay the end user's own limited broadband.

Then this would then be followed up by the staggered launch of the phase 1 BATS satellites and associated ground segment. As this is a large investment different funding paths must be explored.

2.4 Costs for 2016 Service

2.4.1 Rationale

Given that:

1. A prototype IUG has been developed and an initial product may be available;
2. High throughput broadband satellites cover the region (for example Hylas 1 and 2).

The question is, can these be combined somehow to create a service in 2016 that allows the BATS concept to be launched to grow the market, develop the concept and to create some brand awareness at least in certain markets and via resellers.

2.4.2 Requirements

For an early service launch it is not practicable to launch a customised new satellite system as this needs some years to be provided; the use of existing satellites that are providing broadband services is however realisable. This means that until the 2020 baseline satellite network is introduced, the service would use existing satellite network infrastructure. The related costs will as a consequence be as the costs of the current HTS broadband access networks.

Since there is no new satellite, there is no need for gateways and backbone networks, meaning that current satellite infrastructure will be used therefore there is the need for a large capital investment at the outset.

The use of existing VNOs and local partners (for example AVANTI has a long list of partners for many European countries) could introduce BATS service by investing only in IUGs and INGs. The rest of the investment can be implemented by 2020, when the complete baseline BATS network will be implemented.

The following map shows the home countries for some Avanti's active partners in Europe (Figure 2-18). This should be compared with Figure 2-13, this shows a good match for phase 1 and indicates where relationships are needed for phase 1. Not all the organisations in the phase 1 countries may be appropriate for the BATS concept if they don't have terrestrial networks in place.

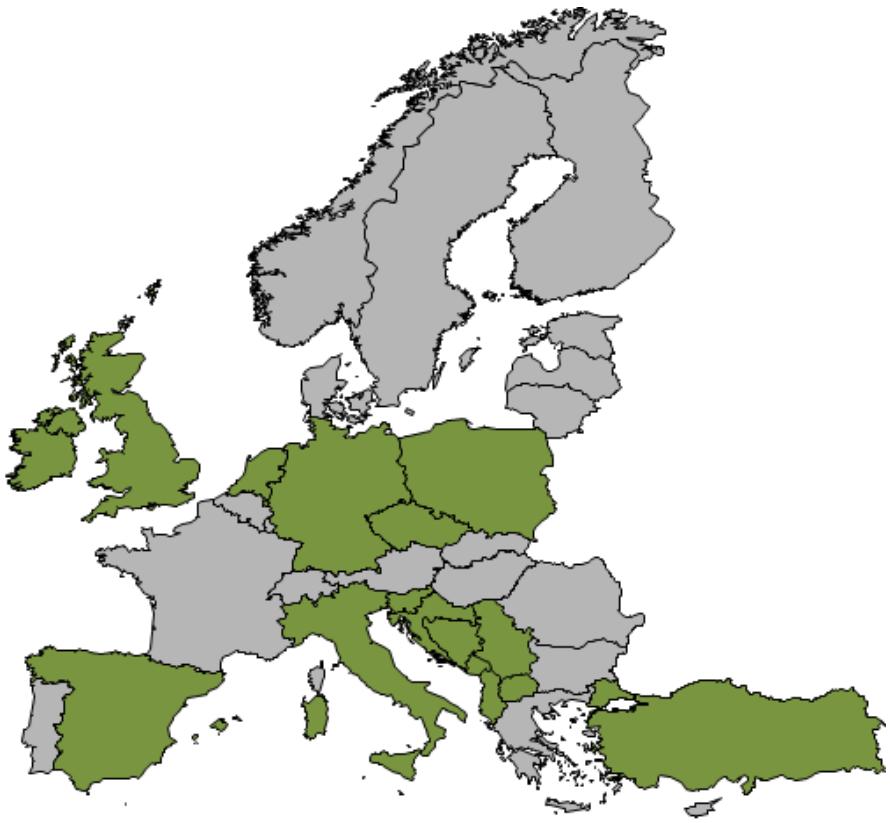


Figure 2-18 : Home countries for some active Avanti resellers in Europe

BATS can be introduced in the market in different phases which will be further explored in section 2.6. The 2016 deployment might well be in a single country initially. An early introduction will for sure prepare the ground for the larger deployment to follow in 2020 and the enhanced mission in 2025.

2.4.3 Space segment

The space segment for an early service launch is clear that should be the capacity of existing satellites in order to provide broadband services as described by the BATS project.

The following assumptions have been made to determine a representative cost:

- 1000 premises spread equally across the Hylas 1 European coverage and Hylas 2 beam 17 (Western Turkey);
- Initial ramp up of 250 per quarter;
- Supported as standard Avanti wholesale service with 3 year minimum service lifetime;
- Bandwidths derived from D5.2 data for 2016 (and analysed in Figure 2-1 to Figure 2-4 inclusive) as follows;
    - 700 premises requiring 0.5Mbps = 350Mbps forward link,
    - 300 premises requiring 0.3Mbps = 90Mbps forward link,
    - Totalling 440Mbps forward, and
    - Return 1/6th of this at 60+15 = 75Mbps total.

At an indicative cost of €1k per month per Mbps this would lead to a service price of €500 per VSAT per month.

The preliminary data from the fifty field trial sites suggests however usage will be much lower. If one looks at the usage for August, the average usage is 15GB per month but not all homes were active. See also section 5.3 that also has similarly low mean monthly download figures from the end of the trial.

If one takes a figure of 16GB and compare this with the D5.2 figure of 81GB per month (Western Europe, 2015). This suggests we can reduce the cost to 16/80 (20%), leading to a **monthly cost of €100 per month** for the satellite capacity service related to a BATS like service in 2016. This will be used below to calculate a business orientated service.

In certain areas lower costs have been achieved for similar services; for example the BD UK (Broadband Delivery UK)) satellite service pilot has a range of services from £20 per month with a 10GB cap and £40 per month with 40GB cap (see [7], noting these prices exclude VAT at 20% to be consistent with the other prices quoted in this study). A consumer service may be derived from this kind of cost base.

2.4.4 CPE

VSAT

The use of Avanti's current standard VSATs has been assumed – these are the HN9600 and they are described in BATS D6.4. This allows the use of shared resources such as forward links, hub equipment and traffic management systems. The Hughes VSATs are supported on all beams at the time of writing. A wholesale cost of €300 ex UK depot is reasonable.

Alternative VSATs can also be considered depending on the gateway, for example Avanti supports consumer VSATs from Gilat and Newtec on some beams and the more business use orientated iDirect modems on more beams.

IUG

From the analysis in D5.2, a cost of €200 is assumed ex France factory for the 2016 lower volume device.

2.4.5 Service plans and target markets

The current public published costs for wholesale DSL in the UK is summarised in BATS D5.2 table 9-11. Using the same data as the previous section we can estimate the total terrestrial bandwidth required to be in the region of (700 x 0.12 + 300 x 0.4) x 23/80 = 59Mbps for the 1000 sites.

Therefore if all 1000 sites were in the UK the monthly costs would be (£);

5.88 + 6522 / 1000 + 40 * 59 / 1000 = £14.79 or around €20 per month.

A connection of £39.77 (€54) also applies. These costs exclude the copper phone line which for this analysis is assumed to be available.

Therefore the direct costs per home to provide this service are:

a) An upfront investment of €300 (VSAT) + €200 + €54 (DSL connection) + €200 (Installation) making a total of €754;

b) A monthly cost of €145 (satellite) plus €20 making a total of €165 per month (£120).

Looking at commercial satellite business broadband these offer 15Mbps to 20Mbps and vary between €55 and €300 depending on monthly data allowance; with a €450 up front charge (for example see [3]). The BATS service is not specifically usage limited however this analysis is based on a comparatively low monthly usage and some form of control may be needed when the detailed service design for a launch offer is completed.

The BATS service has two key differentiators from standard satellite broadband:

- Low latency for smaller traffic;
- Inherently high service availability (if either link fails the other will still carry traffic).

Looking at this from a different perspective; adding the BATS concept to the existing service might add a little over €20 to the service cost. It is quite possible that some businesses would pay this premium for the BATS benefits.

2.5 Investment

2.5.1 Funding options

In theory at least there are multiple different ways to finance a satellite and service launch including:

- Cash payment;
- Private finance, typically through bonds or equity investment;
- Public finance;
- Public private partnership;
- Funding end users (a specific public finance method).

Let us briefly consider each of these in turn.

Cash payment

Where a company (for example Apple) or individual (illustrated for example as the founder and owner of a major multi-national organisation) has sufficient cash reserves to finance the project on their own then they can self-finance the project. This is highly unlikely to be the case for BATS.

Private investment

There are many routes for limited companies to raise funds for investment in projects. They can borrow from investment banks, the interest rate incurred and the payment term agreed will tend to vary on the organisation's credit rating and the perceived risk of the project. They may also raise funds through sell off equity in their organisation through the sale of stocks and shares.

An example of such investments can be read at [9] which details how Avanti mixed loans and equity sale to invest in its Hylas 4 project.

Public finance

In this case the government (be they regional, national or European) can finance a project using public funds or through government borrowing. Since the banking crisis of 2008 funding has slowed down and selected projects have tended to more selective, either using funds on critical projects or by leveraging their investment to underwrite commercial investment. One relevant example of this will be considered in section 2.5.2.

Public Private Partnership

Such a partnership (a PPP) is a government service or private business venture which is funded and operated through a partnership of government and one or more private sector companies. In the BATS case the PPP borrowing is incurred by the private sector vehicle implementing the project however the project risks are seen to be reduced by the public sector involvement. There are multiple PPP models that may be applicable, for example PFI (private finance initiative) and joint ownership.

Voucher scheme

One current study, BRESAT [10], is defining the guidelines for successful deployment of satellite broadband to support the EU so it reaches its 100% broadband coverage. This recommends a "Voucher-plus scheme" to cover the upfront costs. In BATS this would allow the costs of the VSAT and IUG to be addressed. This would not however finance the satellite launch.

Voucher+ schemes also allow the option of some contribution to the monthly tariff charges. This study suggests the voucher should be set around €400 to cover the equipment and connection costs with significant subsidies of up to 50% of service charges in poorer regions. This subsidy should be supplier and technology agnostic. The following graph (Figure 2-18) illustrates a typical price elasticity curve. The purple bar shows for a given price needed to finance the service the addressable market is just under half the total, the blue and green bars show that if the scheme covers half the price then the addressable market would increase to around 80% of the total.

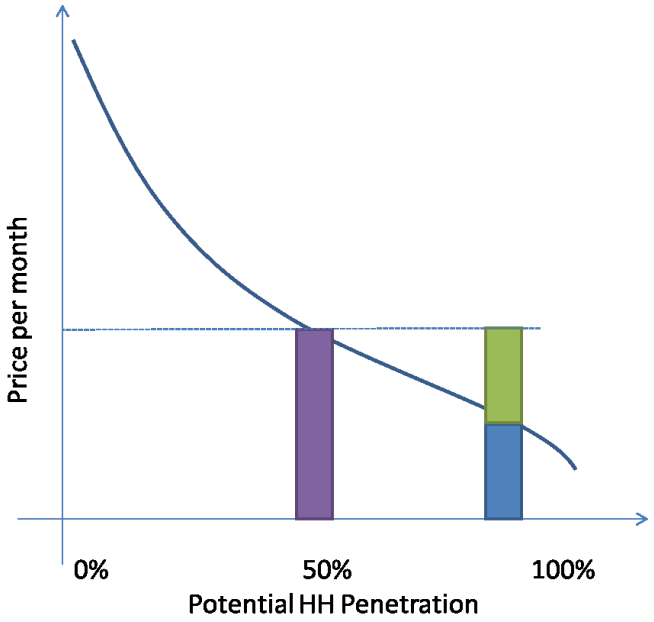


Figure 2-19 : Illustrating how a Voucher+ scheme increase addressable market.

Therefore this monthly subsidy has the impact of increasing the affordable market for BATS as it effectively increases the maximum ARPU a region can afford in the model used in D5.2. This can be used to increase take up in areas where the BATS service is less affordable thus increasing the overall satellite fill which in turn will reduce the overall cost per site. Guarantees of such funding would reduce the risk profile and improve the chances and cost of raising the necessary capital. The model used in D5.2 could be modified to predict the impact – however as the funding is likely to vary significantly by region no specific cases are illustrated.

It can also be noted that schemes such as structural funds for regional development may also have a role to play in financing such schemes.

2.5.2 Funding for Europe, the "Juncker plan"

As described in [11], the EC presidency has set an investment plan for Europe. This states that:

> "*The European Commission expects the Investment Plan will mobilise at least €315 billion in additional investment in Europe over the next three years. The EU will provide €21 billion in initial funding – a €16 billion guarantee, to be authorised via an EU Regulation - and the European Investment Bank's (EIB) own resources (€5 billion). The fund will be set up within existing EIB Group structures, allowing it to start quickly and to benefit from the EIB's experience.*
>
> *The* [European Fund for Strategic Investment] *EFSI will have two main focuses: Infrastructure and Innovation (managed by the EIB), and SMEs (managed by the EIB and the EIF).*"

Further details are provided in [12]:

> "*The Investment Plan focuses on removing obstacles to investment, providing visibility and technical assistance to investment projects and making smarter use of new and existing financial resources. To achieve these goals, the plan is active in three areas:*
>
> - *mobilising investments of at least €315 billion in three years*
> - *supporting investment in the real economy*
> - *creating an investment friendly environment*"

Support for digital infrastructure projects is specifically mentioned as an eligible project area. The EC then reference the EIB web page [13]. They provide a very useful guide [14].

The following points are particularly noted in the context of BATS:

- The EFSI has €21B to offer specific cover losses on investments by the EIB which is expected to €315B of investment;
- Investments available for companies of up to 1000 people;
- The fund is demand driven for any EU infrastructure projects including cross-border projects with no set quotas for geography or sector.

Such investment support is ideal to de-risk the commercial investment in an infrastructure project like BATS. The impact will be considered in the following section.

2.5.3 A possible way forward

If investment in the cost of the core network and space craft could be supported by the investment plan for Europe then the basic infrastructure would be available.

Then national schemes appropriate to each country supporting the end user such as the voucher plus scheme then the number of households that could benefit from a BATS service would exceed the figures calculated in D5.2.

There may also be a role for research and innovation funding to further develop the IxGs for volume commercial deployment in consumer service.

2.6 Satco lead BATS

2.6.1 A ten year model

In order to understand the scale and timing of the investments needed to develop the core network in tandem with building relationships with organisations in each country an indicative project plan is needed.

To generate the project plan the following narrative has been used:

> *This plan starts with a trial service starting in 2016 (in line with section 2.4) in a single country. This country should be one that is forecast to have high demand for the BATS service and where the satellite company already has a strong relationship with a suitable partner. Capacity would be provided on existing HTS capacity and use first generation IxGs.*
>
> *This pilot service would then expand to a few more countries in 2018 that are have high demand for the BATS service and where the satellite company already has a strong relationship with suitable partners.*
>
> *If both these phases are successful then this would move to full service in 2018, probably expanding to other countries. An upgraded lower cost IUG would be launched. At the same time planning for the full BATS service would commence.*
>
> *The phase 1 satellites would be planned and then the first satellite would be built and launched in 2020 to cover the countries identified above in section 2.3.3. In tandem gateway locations would be found, the gateways and VSAT equipment ordered and the backbone network built. This would be supported by new IUGs built to a consumer grade and the INGs would be virtualised for installation in suitable servers at the edge of the backbone network.*
>
> *Finally the phase 2 enhanced satellites would be launched from 2015 onwards with all the supporting elements required.*

2.6.2 The indicative project plan

In creating the plan some assumptions have been made. The satellite go ahead is decided as late as possible, their development aligns with other major programs and the timescales do not include vendor selection and contractual agreement. The hub and VSATs would use near standard systems for the time which by 2020 would support full NGA speeds. The gateway would use suitable existing locations and identified after satellite design. Finally the backbone network relies on standard and available infrastructure,

An indicative project plan is shown in Figure 2-20 below.

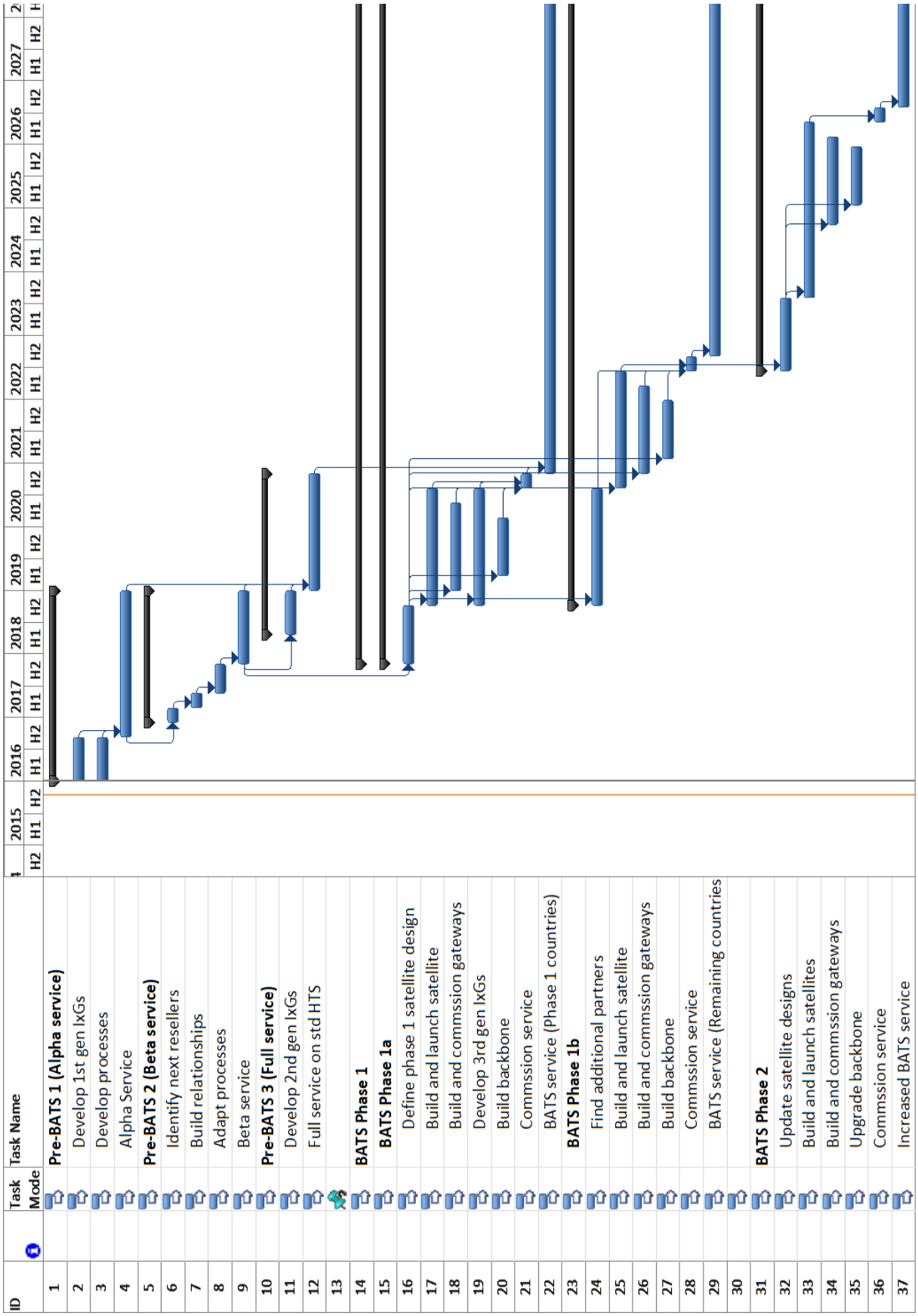


Figure 2-20 : Indicative 10 year BATS project plan

2.6.3 Major investments

With this providing a framework showing key events an investment plan can be derived. The following points were observed in creating this:

1. The costs used are in this are as per D5.2 unless otherwise stated;
2. The satellite spend will be split as 20% during design and 80% spread evenly across the build and launch;
3. The hub and VSATs have no development costs included in this assessment, the hub costs incurred evenly over build and the VSATs costs incurred in year of deployment;
4. No development costs included for the gateway systems and their initial costs are incurred evenly over build period;
5. Similarly the backbone connection costs incurred evenly over build;
6. The IxGs development costs are included and the unit costs for INGs are added to gateway;
7. The unit costs for IUGs added to VSAT CPE costs and incurred in year of deployment.

In this scenario the first six investments would be borne by the satco, the seventh would be borne by the in-country partners. If they managed the stock rotation well then their overall outlay would be low. The best partners will be companies who already have terrestrial network assets so that there no major investments are required.

The following graph (Figure 2-20) shows the scale of investment required for the satco to deliver the BATS phase 1 satellites in a staggered fashion.

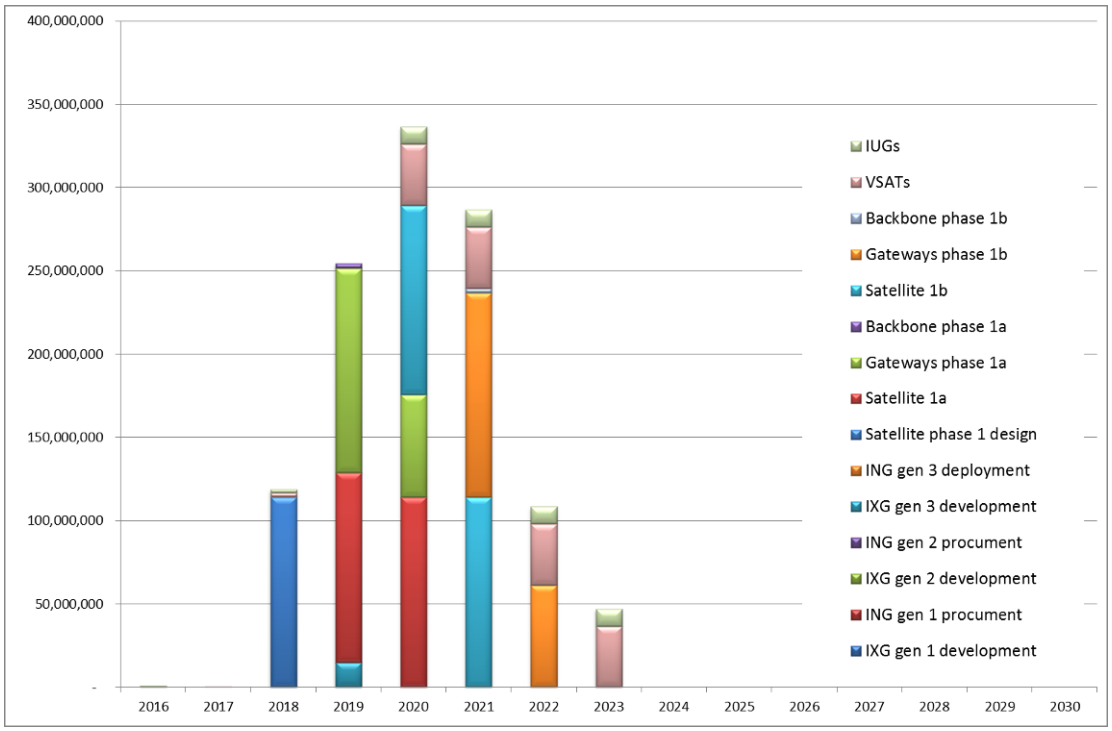


Figure 2-21 : Indicative capital investments (€).

Table 2-5: Indicative capital investments (k€).

K€	2016	2017	2018	2019	2020	2021	2022
IxG gen 1 development	300						
ING gen 1 procurement	10	40					
IxG gen 2 development			300				
ING gen 2 procurement			25				
IxG gen 3 development				15,000			
ING gen 3 deployment					250		
Satellite phase 1 design			113,960				
Satellite 1a				113,960	113,960		
Gateways phase 1a				122,667	61,333		
Backbone phase 1a				2,888			
Satellite 1b					113,960	113,960	
Gateways phase 1b						122,667	61,333
Backbone phase 1b						2,888	
Totals	**310**	**40**	**114,285**	**254,514**	**289,503**	**239,514**	**61,333**

The total investment by the satco to cover spacecraft, IxG development and backbone network from 2016 to 2022 for this cost model totals €959M. The spacecraft and backbone investment would have to be financed by the satellite company offering the core BATS service. The IxG investment could also be made by the satellite company, it could also be made by the manufacturer who would recover these costs through unit sales.

The baseline scenario considered in D5.2 had just a little less than six hundred thousand homes served by these phase 1 satellites. Over ten years this equates to just €13.59 per home per month excluding the cost of financing this investment.

If one uses the same 6.5% cost of money and 15 year period as in D5.2 (namely 6.5%) this equates to a long term figure is €23.30 per home per month for the core network cost recovery (using the baseline data rates and 0.6M homes, if one uses the baseline-50% figure of 1M homes this reduces to €13.71). Note that this assumes the higher data throughput per user in the baseline business case and the same demand levels hence the same satellite fill figures. A one percentage point increase (to 7.5%) in the cost of money results in an increase of €3.50 per month in the costs. This shows how the Junckers plan for strategic investment in European infrastructure (section 2.5.2) can assist a BATS service deployment by minimising the cost of capital investment.

This suggests the scale of investment is realistic if the capital can be raised at an affordable rate, this means that the risk profile is acceptable to the lending organisations.

Underwriting the risk is an area where support schemes can be extremely beneficial. This aligns well with the findings of section 2.5.2 looking at leveraging European level support for major infrastructure projects.

2.6.4 Country partner investments

In support of this the partner organisations in each country would need to have systems in place to offer traditional xDSL services to their regions of interest. This means there would be no major investment in equipment and management systems to offer the terrestrial components of the BATS service.

There would of course still be some investments to launch the new service and to manage this. These can be minimised by providing the BATS service interface as standard such as the MTOSI (Multi-Technology Operations Systems Interface) defined in D5.1.

2.7 Value chains

Each link in the value chain adds margin and hopefully this is in reasonable proportion to the value that link adds. In the case of the BATS service being offered to hundreds of thousands of households in markets where competition has driven the price expectation down (see D5.2 section 2.4.2 for some predictions of reasonable price ranges) there is a need to keep the costs to a minimum. Apart from good engineering this requires that the business model minimises margin stacking. A possible chain is shown in Figure 2-23 below.

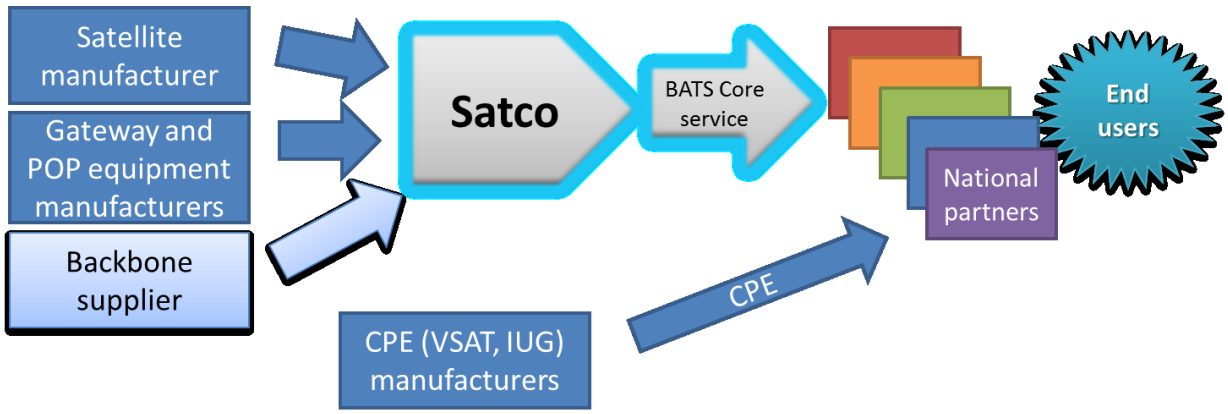


Figure 2-22 : Possible value chain for a satco lead project.

2.8 Potentially emerging competition

There is significant coverage in the technical press about new means to provide Internet access services in rural areas; two of these will be considered in this section:

- **LEO satellites** – several hundred satellites forming a mega-constellation;
- **HAPs** – balloons, solar powered unmanned aerial vehicles and similar.

This section will make a preliminary assessment, each area warrants much greater analysis in their own right.

2.8.1 LEO mega-constellations

The following table summarises the commonly known initiatives [17] to provide broadband access services using LEO satellite constellations. Constellations targeting backhaul and fibre replacement services are excluded.

Table 2-6: LEO Satellite initiatives.

System	Orbit	Number of satellites	Launch	Main characteristics
OneWeb	LEO (1200km) 88.5° inclined circular orbits	648	Starting 2018	Ku/Ka band 8Gbps per 150kg satellite Second generation launch 1600 satellites from2025 Target user terminal $200 Qualcom and Virgin initial funders

System	Orbit	Number of satellites	Launch	Main characteristics
SpaceX	LEO (1100km)	4,000	>2020	Ka band, includes Google funding
LeoSat	LEO	80-140 78-108 [18]	>2020	Ka band , under definition by TAS Good polar coverage, targeting maritime, oil and gas, trunking and Enterprise
XinWei	LEO	>32	>2020	Wang Jing of Nicaraguan canal fame is the promoter
Samsung	LEO	4600	-	Paper by US executive (see [21]. Each satellite 1Tbps, indications of 2028 timeframe.

This list excludes two MEO fleets (**O3B** with 12 satellites in operation, and **LaserLight** who promote a 2018 launch), both of whom target high bandwidth trunking services. It should be noted that O3B have had significant take up by large cruise liners to provide Internet to their passengers.

The following screenshot (Figure 2-23) [19] reports an Analysys Mason summary of three key LEO constellations in April 2015.

	OneWeb	SpaceX	LeoSat
Champion	Greg Wyler, ex-CEO of O3b Networks (pioneer of MEO satcomms)	Elon Musk, founder of SpaceX	Vern Fotheringham, ex-CEO of Kymeta (solid-state satellite antenna company)
Partners and backers	Virgin Group Qualcomm	Google	None announced
Number of satellites	650	4000	80–140
Proposed operating band[1]	Ku band	Ku or Ka band	Ka band
Satellite manufacturer	To be selected from Airbus, Lockheed Martin, OHB, SSL and Thales Alenia Space	SpaceX (in new factory)	Not yet announced
Other details	Aiming to procure satellites for USD400 000 each; mass-market fixed terminals for USD250. Also planning specialised terminals for aeronautical and first responder markets	Appears to be aiming at mass market. Press reports indicate system cost of USD10 billion–USD15 billion	Aiming at high end users, 'top 3000 rather than other 3 billion'. Will use high-speed inter-satellite links to provide fixed point-to-point connections at up to 1.2Gbit/s. System cost stated to be USD2.5 billion–USD3 billion

Figure 2-23 : Screenshot of Analysys Mason data on LEO.

There is significant activity in the press and regulatory world with new filings for LEO and MEO constellations leading to the expression "*Signs of a Satellite Internet Gold Rush in Burst of ITU Filings*" being bandied about.

OneWeb

Perhaps the based defined solution looking at the publically available data, Airbus are contracted to build the satellites [21]. There will be 648 satellites in operation with orbital and ground spares. They are committed to ensuring they satellites return to earth after 25 years to comply with "orbital debris mitigation guidelines". This same article states the system will deliver over 10Tbps, this is not consistent with the 8Gbps per satellite figure quoted by ESA (648 x 8Gbps = 5.1Tbps).

According to another source [21], WorldVu (now OneWeb) has taken over the SkyBridge spectrum filing for satellites in a series of 20 circular orbits whose planes are inclined at 88.2° (see also [23]) and have just over 2GHz at Ku band.

Given the orbital inclination it is reasonable to assume the fleet covers the entire Earth. Assuming the earth to be a sphere with a radius of 6371km this has a total surface area of 510B km^2. The surface area of the BATS EU27+T countries is 5.2M km^2 which is about 1% of the Earth's surface area. This suggests only 1% of the OneWeb system capacity will be available over Europe, or between 50 and 100Gbps depending on the fleet's capability.

Given that these countries are bounded by Africa to the South and Eurasia to the East they may still benefit from spare capacity over the Atlantic and Artic oceans. The following figure shows how forty off 500km squares cover the study region (and a few other countries such as Albania), suggesting no more than double the area will be available traffic.

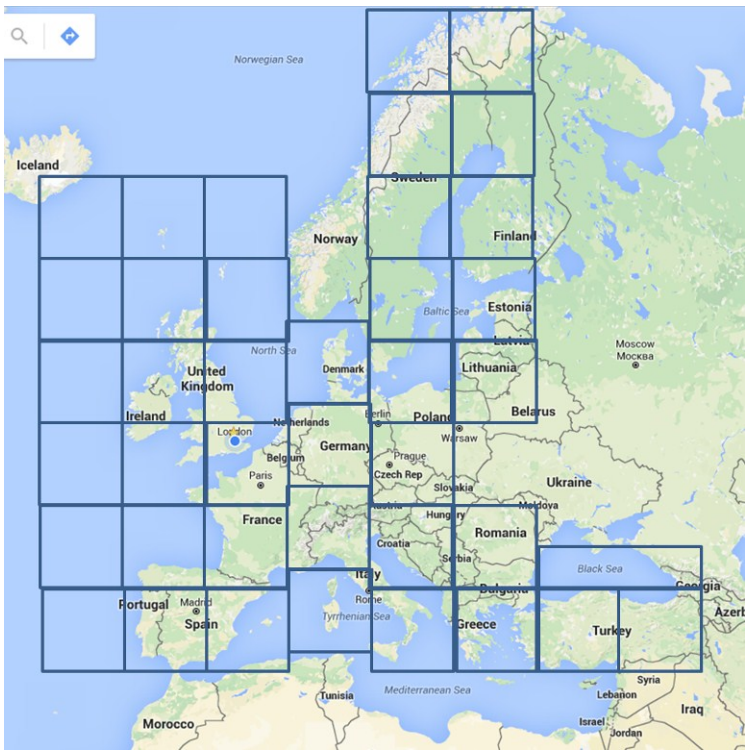


Figure 2-24 : Estimating total LEO coverage area over EU27+T.

Nevertheless this capacity is comparable to current GEO HTS capacity and **the OneWeb system offers significantly less capacity over Europe than the next generation HTS such as those envisaged for the BATS service**.

Many industry experts question the business case for LEO constellations, after all oceans cover 71% of the earth [24], and there are many areas on land that are scarcely populated, for example the deserts that circle the tropics. A fleet like the OneWeb constellation will spend much time over these areas where it much less likely to find significant numbers of

people requiring and able to pay for Internet access. For example, the following diagram (Figure 2-25) from the European Council Joint Research Centre [25] shows that there is relatively little ocean traffic south of the Equator.

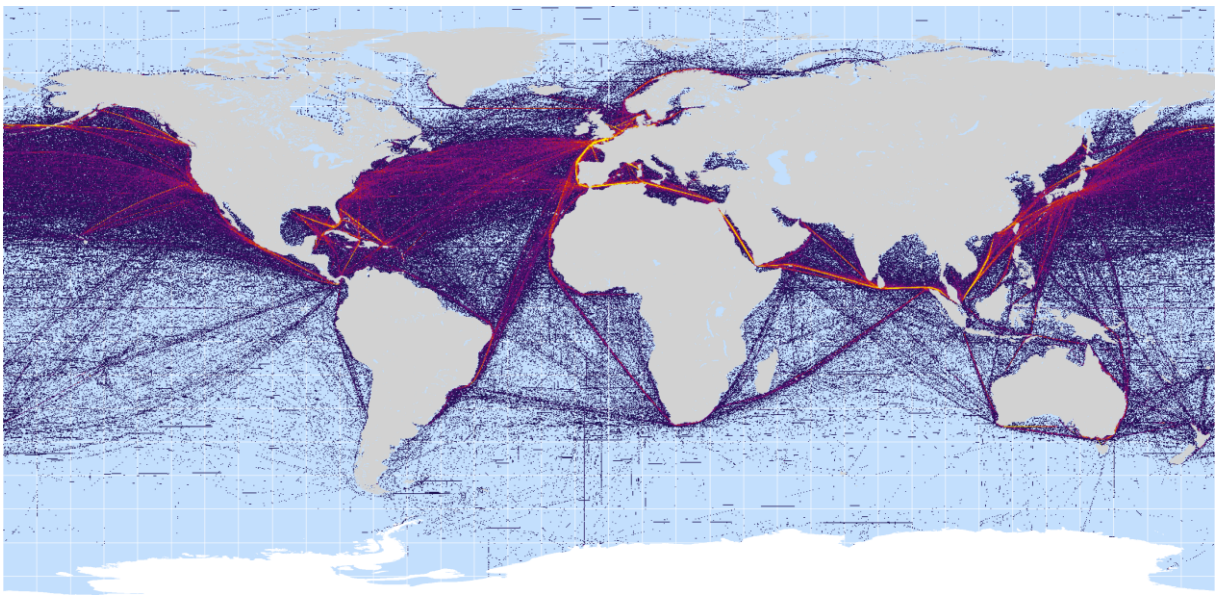


Figure 2-25 : Global shipping traffic.

Other LEO projects

There is less public domain information about the other mega-constellations. The Samsung paper looks at wireless demand in 2028 and considers how a satellite constellation can deliver comparable capacity [21].

The SpaceX project proposes around 4,000 spacecraft in LEO, with costs up to $10B being quoted [26] or $15B [27] at a possible orbit of 750miles (or 1200km). This organisation has the advantage of owning the launchers and may therefore at least drive this cost down by in house means. SpaceX will also build its own satellites. The more recent press tends to suggest this project is being worked on step by step and therefore a 2020 date seems very unlikely.

LEO constellations and BATS

LEO services such as OneWeb cannot deliver as much bandwidth over Europe as the BATS' phase 1 geosynchronous HTS. LEO can however deliver the low latency low bandwidth traffic. Therefore it is more likely that such a LEO service would be complementary to BATS rather than competing directly. Use of the LEO link in unserved regions instead of DSL for the low latency applications combined with the GEO link for the high bandwidth demand and multicast data.

2.8.2 High Altitude Platforms

A High Altitude Platform Station (HAPS – also High Altitude Pseudo Satellite) is defined in Radio Regulations (RR) No. S1.66A as "*A station located on an object at an altitude of 20 – 50 km and at a specified, nominal fixed point relative to the earth*" [29]. Wikipedia's description of a High Altitude Platform (HAP) is quite succinct "*a quasi-stationary aircraft that provides means of delivering a service to a large area while staying thousands of feet above in the air for long periods of time. A HAP differs from other aircraft in the sense that it is specially designed to operate at a very high altitude (17–22 km) and is able to stay there for […] several years*".

Looking at the radio spectrum (for example the UK Frequency Allocation Table [30]) – this specifically states services such as Mobile frequencies for 3/4G can be transmitted via a

HAP. In addition the bands 47.2GHz-47.5GHz and 47.9GH-48.2GHz is "*designated for use by high altitude platform stations*" subject to certain conditions.

There has been two well reported acquisitions in this field (for example [31]):

a) Google acquired Titan Aerospace in March 2014;

b) Facebook acquired Ascenta around the same time.

Little has been written about Google's plans for Titan Aerospace though it has been working on a project called "Loon", of which more below. Ascenta were a small UK company and who are linked to Facebook's Connectivity Lab as part of the Internet.org initiative. Facebook is however working with Eutelsat to provide HTS based services in Africa (for example [31]) suggesting that drone based delivery does not scale well at this time.

Project Loon

Google has been pushing its balloon based HAP project called Loon with experiments in the southern hemisphere. They use their social media platform (Google+,[32]) and their corporate web site [33] to provide some interesting information.

Originally looking at using the unregulated Wi-Fi bands to deliver Internet access, its thrust seems now to be to use these balloons to supplement cellular services (voice and data using LTE) in remote regions working with local cellular service providers (CSPs). A balloon may provide service for different CSPs as it floats between 18km and 25km over their regions. For example they claim "*Project Loon has signed agreements with three mobile network operators - Indosat, Telkomsel and XL Axiata - to begin testing balloon-powered Internet over Indonesia in 2016*". The balloons are expected to stay 100days in the stratosphere, the equipment is solar powered and covers a circle of around 80km.

European Initiatives

Thales [34] and Airbus [35] are both looking at HAPs.

Thales' development is named the Stratobus which is "*autonomous stratospheric platform, midway between a satellite and a drone*" and it is a "*5-ton airship, operating at an altitude of about 20 kilometers (above the airspace dedicated to air traffic and the jet stream), that can host payloads of 250 kg and provide 5 kW of power. It will be 100 meters long, 33 meters maximum diameter, and offer a lifespan in the stratosphere of five years*". It claims to be the only HAP capable of remaining stationary (for example the Loon HAPS migrate in the winds in a controlled fashion). They are some years away from building the first prototypes and no commercial product will be available until 2020 at the very earliest.

Airbus' Zephyr is further advanced with test flights being reported in 2014. Originally developed by Qinetiq and is now part of the Airbus High Altitude Pseudo-Satellite (HAPS) programme. The Zephyr 7 is a much smaller platform that the Thales system. The focus of Zephyr is primarily military and related governmental applications.

HAP and BATS

At the current time there do not seem to be any plans to use HAP as the delivery platform for broadband access services to households. Facebook has elected to pursue a HTS approach for Africa and Google's Loon project is focussing on supplementing 4G service coverage in very remote regions providing access to smartphones and similar devices.

2.9 Conclusions

Viable plan identified for satco lead initiative

A viable plan can be foreseen by phasing the approach to focus on the target countries initially and by growing the service on standard satellites. This plan is dependant on working with partners in these countries and others that already have terrestrial infrastructure that falls short of the NGA targets in some of their service areas.

BATS needs HTS

There are good reasons for maintaining focus on the use of HTS in geosynchronous orbit to deliver services to households in the unserved and underserved regions of Europe as LEO based solutions can't provide sufficient capacity and HAP based solutions focus more on access to smartphones rather than households. BATS provides a good solution to use HTS capacity with a good latency for latency critical applications.

Phased service launch process is recommended

The BATS satellites need not be launched at the same time especially if the first was focussed towards the top few countries (measured either by demand or revenue). The satellites should be designed to better fit the predicted demand with some beams having more capacity than others. This has little impact of the cost per home per month already calculated in the BATS deliverable D5.2 for a variety of scenarios. The feedback from the trials suggests the 50% bandwidth models are likely to be closer to what is needed than those based on the full bandwidth demands. Depending on the actual traffic levels in 2020, how focussed the sales process is and the satellite service company margin a wholesale price of between €20 and €25 seems reasonable.

Support for strategic investment

Government support to de-risk the capital expenditure investment in satellites and core network will keep the costs to a minimum. A one per cent increase in the cost of money (from 6.5% to 7.5%) adds €3.50 to the average cost per home per month.

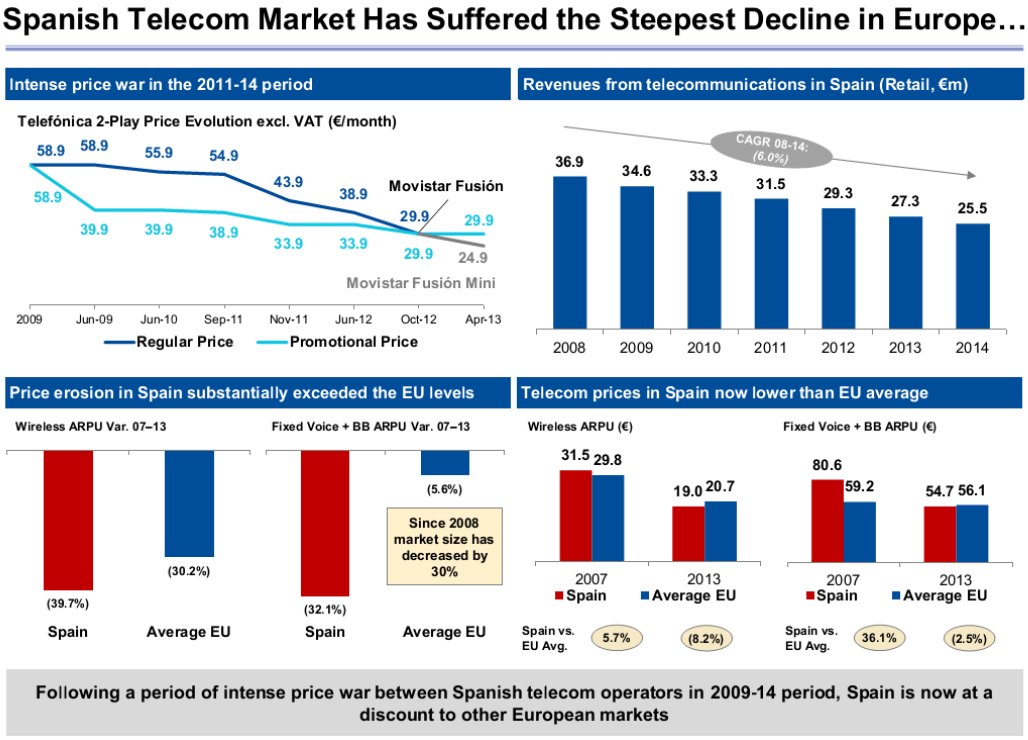
Voucher schemes

A voucher scheme to support the end users in underserved regions will significantly grow the potential target market in the country or region where this is made available. This has been illustrated but not modelled as the amount of funding will tend vary significantly by region and by country depending on the specific circumstances.

3 Service delivery costs in Spain (VNO Lead)

3.1 Overview of the Spanish market in 2015

The Spanish market in 2015 is one of the most "converged" markets in Europe. This global trend has been accelerated in Spain by the economic crisis, which forced the incumbent (Telefonica) to reduce prices due to skyrocketing churn and which ignited a global "convergence" price war by market players.

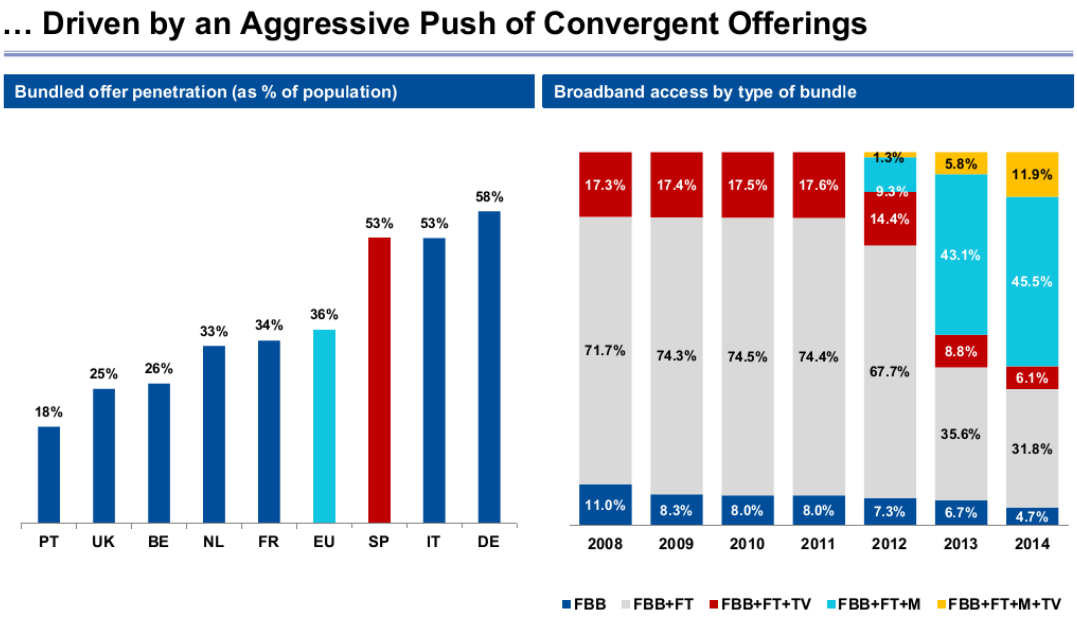


Source: R internal report

Figure 3-1: Spanish market decline

Until 2012 only cable operators had a competitive convergent offer in Spain. Due to the reduced coverage of cable networks in Spain, below 50% of the total market and with an average penetration of 30% of said coverage, this cable market position never reached the critical mass needed for Telefonica to react.

However, the economic crisis in Spain increased churn from Telefonica not only to cable but also to low cost DSL operators, and finally, after many nominal price reductions, Telefonica launched a converged offer codenamed Fusion, based in a 40% discount if all products, fixed+ TV +mobile, were combined in a single package and contracted at the same time.



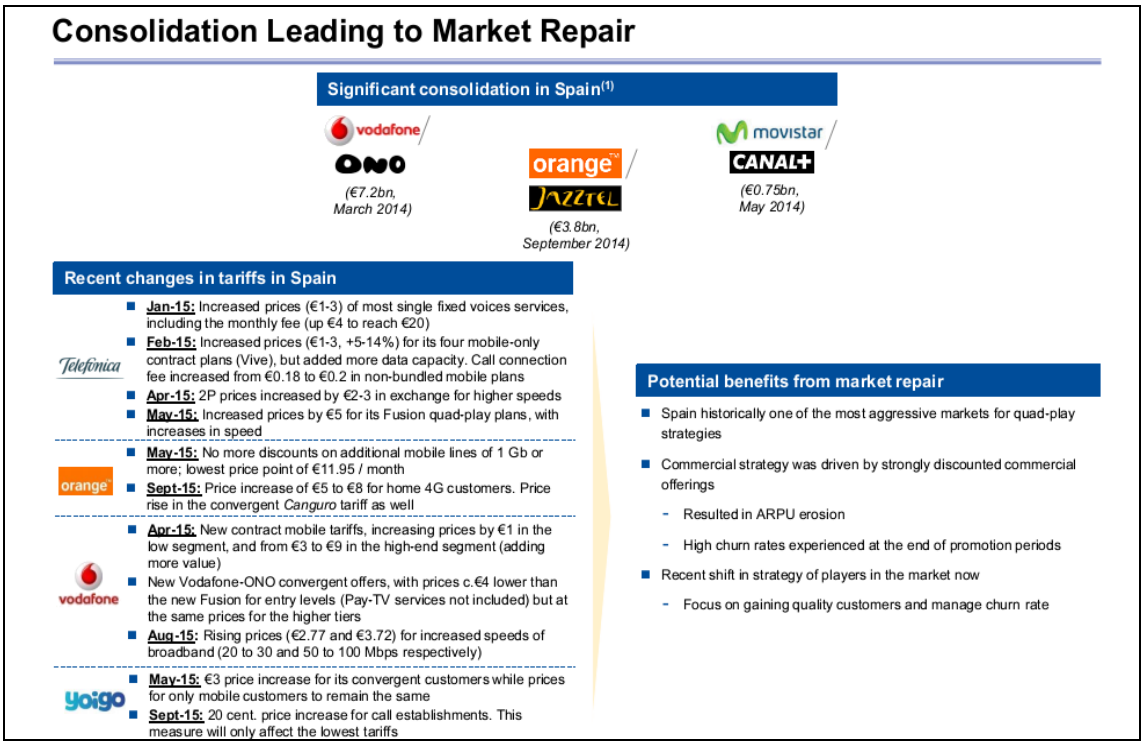
Source: R internal report

Figure 3-2: Service bundling in Spain

After the launch of the incumbent converged offer all market players needed a convergent offering and re-positioning. This repositioning of all operators led to several moves:

- Mobile only operators, like Vodafone and Yoigo, found themselves out of a future "converged marketplace". The reaction of Vodafone was to acquire cable assets (7.1Billion purchase of ONO in 2014) in order to obtain both a new fiber network and TV assets. Yoigo remains on sale to this date but no one wants to purchase it.
- DSL mainly operators (Orange and Jazztel) had to develop a complete TV and mobile offering. The combination of 3 low margin services (indirect broadband, indirect mobile and indirect TV) was too difficult for Jazztel who was acquired by Orange also in 2014. Orange had the advantage of owning a mobile network, so it had more margin on mobile that a pure MVNO.
- Telefonica purchased the main content player and satellite network (DIGITAL+), combining in one shot premium content rights and a TV satellite service for areas out of their new fibre optic network coverage.

So after a few years of converged offerings three national converged operators have emerged in Spain: Telefonica, Vodafone and Orange. All of them provide fixed telephony, broadband, mobile and TV in a discounted single package. Alongside, it is expected that the three remaining small and independent cable operators (Euskaltel, R & Telecable) merge themselves (and perhaps with Yoigo) in order to configure a national fourth player. Euskaltel and R already announced their intention to merge in July 2015, during the time of editing this document.



Source: R internal report

Figure 3-3: Market consolidation leading to recovery

Convergence has extended into the content rights arena, with Telefonica acquiring wholesale football rights and offering football viewing only in converged packages. When customer premises locate outside fibre network, football right viewing by satellite TV is combined with mobile and DSL.

A typical rural DSL customer with DSL low speed that wants to watch football has only 2 options:

- Get a package from Telefonica and watch football on TV, through satellite
- Get a broadband package from other operators and watch football on PC or mobile phone not on TV.

In BATS areas, it is not possible to get a broadband package from non-Telefonica operator and viewing football by satellite contract. That combination is not commercialised. The result is that if you are a BATS customer and you want to watch football on HD TV, your only bundled option is Telefonica.

3.2 Convergent offerings in BATS areas

Convergent packages are designed mainly for NGA networks. Below we show a real strategy being deployed in Spain in the summer of 2015.

Figure 3-4: Quad (4) play base package September 2015

This is the basic 4 play offer, which includes, for 65€ /month:

Fixed telephony;

- Fixed call flat rate,
- 550 minutes to mobile phones,
- 30Mbps broadband by fibre;

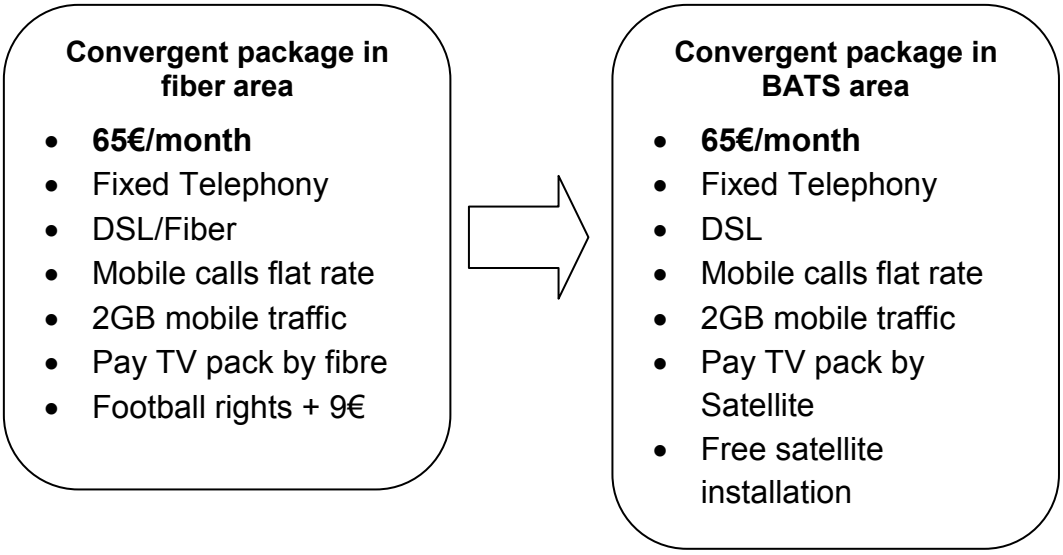
Mobile telephony;

- 2GB data allowance,
- Unlimited calls to fixed and mobile;

TV;

- Basic package with 40 fibre delivered HDTV channels (FOX, NG, AMC...),
- OTT service, as an addition.

However, those packages have to be tuned for non-fibre areas. In the next graphic we find the strategy being applied for non-fibre areas:



VAT included in all cases

Figure 3-5: Quad (4) play package for non-fibre regions

The price remains the same in both packages, and appropriate changes are applied according to the type of network coverage in the customer premise. DSL speed is whatever is found on the spot, with price unchanged with the broadband DSL speed variation. There is no fixed bandwidth cap.

Decision: We will take this offer as the main competitive offer to consider in a BATS business case. This offer sets a floor for the four play BATS service of 65€.

If a BATS area customer wants to remain with its non-incumbent DSL operator but desires to have the TV package, it has to pay the TV satellite installation (100€) and, on top of that, a 20€ premium for the price of the same TV package, compared with the bundled product. On top of that, more for football viewing. So, there is a strong incentive to remain with the bundled operator.

It is relevant to note that neither Vodafone nor Orange have TV rights out of their fixed networks. There are only two Over the Top TV (OTT) players that supply football rights by OTT networks, for a 20€/monthly price.

3.3 BATS product definition

To create any Business Plan a first step is to define the offering. Different possibilities, listed in Table 3-1 below, have been analysed for a BATS commercial service.

Table 3-1: BATS Service options in Spain.

Code	Service name	Value	Incremental revenue	incremental margin
A-BATS	Naked BATS	Broadband offering combining DSL and Satellite	Base case	Base case
B-BATS	Mobile BATS	A-BATS + 3G/4G phone line;	+9	+3
C-BATS	Bundled BATS, fixed & mobile	B-BATS + fixed and mobile calls (1 mobile line)	+26€	+14€
D-BATS	Bundled BATS, fixed & Mobile and TV package	C-BATS and + basic TV package	+12€	+6€

We see that D-BATS can supply 23€ of monthly margin to pay for sunk costs in A-BATS. Further synergies can be obtaining adding to the mix more mobile lines or bigger TV packages.

Decision: In our business case, we will allow BATS contracting only in D-BATS case, in order to pay for the high cost of equipment and the high cost of having enabled satellite and DSL costs at the same time.

Analysing the service recurrent costs, we find the naked BATS has a floor cost of 68.2 € (including the baseline BATS satellite core costs of €33.04 per month described in section 2.2.1 as this has been used throughout as the reference). This fact alone already suggests that Naked BATS is not the strategy to follow, as customers will compare the price of a convergent offer, with mobile, fixed service and TV content, with the price of a simple broadband offer without voice.

Therefore, we follow our strategy of convergent against convergent. We add to the figure for the naked Bats recurrent costs the incremental cost of having a quad-play product and we find that the gross cost of quad-play BATS is 95.47€. The price for this service should (cost + margin) be 118.45 € monthly.

Table 3-2: D-BATS service costs and margin.

Quad play BATS	Service Costs (€)	Net margin (€)
Total recurrent costs		
Naked BATS	68,2	0
d-BATS	+24	
Service	+3.27	
Total recurrent costs	95,47	
Price		
Total for D-Bats	118,47	23

A engineering point of view will tell us that the price for D-BATS is 118.47€, with a net margin of 23€ (19.4%), net margin percentage more or less in line with a indirect low cost fixed operator, in the low end. However, we find the market price for D-BATS to be 65€/month. That is the price of the Telefonica converged offering with 1 mobile line and TV package in BATS areas. Of course we can charge a premium for the remoteness of BATS areas, taking into account the probability of bad DSL service in those areas. We judge that that premium can´t be higher than 20€.

So, our market price for D-BATS is monthly 84.9€. Customers will compare this 84.9€ with 65€ or less. We can argue that we provide satellite installation and an increased speed over DSL. This price has a gross cost of 68.2€ (explained later and not counting yet support and general Opex) so it is barely what we need to cover costs. We will see that to make BATS service profitable further reductions have to be applied to the BATS recurrent service costs.

Comparing this price with a regular price in cable areas, the equivalence we find is as follows:

Table 3-3: BATS versus cable service costs (€ per month).

D-BATS service	CABLE SERVICE	RURAL DSL SERVICE
84.9€ monthly vat included	88€ monthly vat included	65€ vat included
30Mbps	200Mbps	10Mbps
BATS native features; backup, reachability	NO	NO
Fixed phone line, unlimited flat rate	=	=
Mobile phone line, unlimited flat rate 1GB data allowance, 150 minutes flat rate	=	=
Premium TV package (no football)	Basic TV package (no football)	=

There is a difference, but is not an opportunitu killing one. The digital divide is being surmounted.

3.4 Cost elements

3.4.1 BATS provisioning cost elements

In our analysis, we have considered the following direct provisioning cost elements for the BATS service.

Table 3-4: BATS service provisioning costs.

Direct Service costs	Nature	Unit Price €
Installer cost (satellite)	CAPEX	150
Installer cost (IUG) (synergy) Same installer for satellite and IUG	CAPEX	0
SIM provisioning total cost (mobile phone line, not IUG)	CAPEX	11
Satellite equipment	CAPEX	300
IUG equipment	CAPEX	125
Commercial commission	CAPEX	185
Voice line activation cost	CAPEX	25
DSL activation cost	CAPEX	50
Naked line activation cost	CAPEX	9
		855

Prices in the above table are regulated or very streamlined. We see no room to get reductions in those prices.

According to this table, investment for each BATS customer is 855€.

We have considered a 500€ one–off grant from regional /EU governments for this business plan. This amount is consistent with observed current projects for satellite coverage of remote areas.

3.4.2 BATS recurring costs

The following table calculates the recurring costs associated with the BATS service.

Table 3-5: BATS recurring service costs.

BATS recurring costs	Nature	€ per month
satellite cost per customer base line	OPEX	33.04
fixed xDSL line cost per customer	OPEX	7.88
fixed Voice line cost per customer	OPEX	8.60
TV programming cost per customer	OPEX	6.00
Interconnection cost per customer (1 mobile phone line, mobile data & fixed phone line)	OPEX	12.68
		68.20

The non-satellite prices in the above table are regulated. The figure of €33.04 for the satellite is based on the analysis in D5.2. This figure has been refined for a variety of scenarios in Table 2-1, the directly equivalent figure being €29.68 for the highest bandwidth predictions and no focussing of sales + 10% margin. The impact of the different cost models later in section 3.

In this business case analysis, we find we need to apply a 33% reduction to this price in order to make BATS service profitable. This could also be achieved by a Voucher+ style scheme supporting this amount.

After this reduction, we will apply a sensitivity analysis to verify the impact of this element in the net cash flow generated.

Apart from those costs, we have included in our business case costs for IT support, Network Support and Structure. All those costs amount to 3.27€ per customer and we see no reduction potential in that figure.

3.4.3 Other relevant parameters for the business plan

In addition the following parameters need to be included.

Table 3-6: Other parameters for the business plan.

Parameter	Value
Churn	8.3%
VAT	21%

3.5 The business plan for Spanish regional DSL/VNO (Galicia)

3.5.1 The market

Main households in Galicia make a total of 1,259M units, of which 84.11% are residential and the rest are business premises (source: R internal data).

The initial version of this plan considers only the residential market, given that if this market is not profitable there is no point to try to complement it with business market. However, if we achieve to make this plan profitable, there will be a strong incentive to complement it with a business product, which will require stronger routers with more technical business functions. We have observed in the BATS Field trials, where most non SoHo (Small Office Home Office) business and public offices found that a simple router un-matched their requirements for VPNs and other similar business functions.

However, as there might be businesses behaving like a residential user (SoHo market) we decide to treat all units in the accessible Galician market as residential for the purpose of this business plan analysis, since non SoHo business users in BATS areas will be very limited as number of customers.

The accessible market for Galicia is 30% of the total market. This figure has been obtained from the Government of Galicia, office for the Galician Regional Plan for Broadband. This office has a detailed account of all population entities in Galicia and their network coverage, and this 30% (rounded) is the total number of units with DSL < 6Mbps.

We have considered a maximum BATS penetration of 15%, to be reached in 4 years. This low figure is due to the high price set on the BATS service and the existence of many empty premises in the market. We estimate that the empty premises are no less than 18% of the total coverage.

With these parameters, the progression of customer acquisitions, including churn, looks as follows:

Table 3-7: Predicted BATS subscriber volume.

		2016	2017	2018	2019	2020
Total Galician units	nº	**1,259,232**	**1,259,232**	**1,259,232**	**1,259,232**	**1,259,232**
Household	nº	1,059,232	1,059,232	1,059,232	1,059,232	1,059,232
business premises	nº	200,000	200,000	200,000	200,000	200,000
Coverage BATS Galicia	%	0%	30%	30%	30%	30%
accessible market BATs	nº		377,770	377,770	377,770	377,770
Penetration	%	0%	4%	8%	12%	15%
customers Galician BATs	nº	**0**	**15,111**	**30,222**	**45,332**	**56,665**
Households: second homes and empty properties are discarded. Principal Housing in Galicia (according to INE Census 2011: 1,059,233)						

Around 60.000 BATS customers in Galicia in 2020 seems quite a important figure for this price level. Surely important efficiency gains and cost reductions will have to be maintained during the project to keep this market share, avoiding churn to LTE networks. Those cost reductions will have to be compensated with service enhancements to keep the price level. More mobile lines, better TV packages and so on will have to be added to the BATS product during the years to keep the outlook of this business plan.

3.5.2 The outcome

In the preceding pages we have summarised all the investment and operational costs involved in the BATS service. The all-important parameter of the satellite recurring cost encapsulates not only the satellite network costs but also the local head end amortisation and support. Bearing this fact in mind, the outcome of the basic business plan is as follows in Figure 3-6:

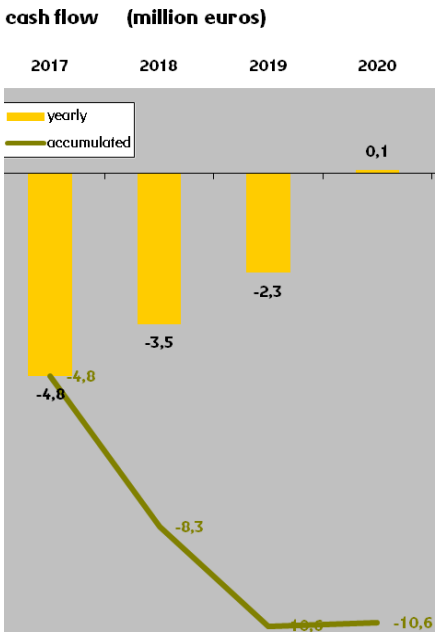


Figure 3-6 : Basic business plan findings for BATS in Galicia

Almost all customers are required to pay off annual investments + expenses in the 4th year. A slightly lower penetration and the project goes back to yearly red ink. This graphic represents that the project is in the limit of long term profitability, which can be further analysed using a sensitivity analysis.

3.6 Sensitivity analysis

We have set three parameters to be varied in our sensitivity analysis.

a) Increases in price with no new marginal costs attached;
b) Satellite costs: Reductions and increments in satellite price;
c) DSL costs: Reductions in regulated wholesale cost sought as part of the government support for NGA in

We combine those parameters in a number representing the net accumulated cash flow obtained from the project in 4 years. We then compare it with the initial cash flow obtained in the BP, -10.6M€, and try to take it to 0€, to find what changes have to be executed to level the cash flow.

The sensitivity model shows that:

- A further 35% reduction in the price used for satellite costs will be enough to level the business case;
    - This reduction will still provide 14,2€ of net monthly income for the satellite operator,
    - Given much lower bandwidth demands seen in field trials (at 20% of the expected levels) this reduction is realistic and can be achieved;
- A increase of price until 94.9€/month will also be enough to level the business case;
- There are many other combinations that achieve the same target. For instance;
    - 15% reduction in satellite price,
    - +5€ in final price,
    - +20 % increment in satellite price,
    - +15€ in final price;
- This model is not very much affected by the fact that we are operating under a non-incumbent model. The main point where we could save money is the mobile interconnection. Maximum savings there will be around 3-5€/month, which, although relevant, will not change radically the business model.

These findings can be compared with the core network costs for Spain in Table 2-1.

We are seeing lower traffic today than the AM predictions for Spain; therefore with some reduction in traffic throughput and a degree of focussed selling the required cost point can be achieved and indeed bettered. The basic business plan uses a figure of 34€ per month for the space segment and a cost between 15 € and 20 € seems realistic.

It can be noted that the similar cost models would be built by an incumbent telco such as Telefonica in Spain as many costs would either be regulated or tend to be similar. Given their larger size some additional economies of scale some small cost savings may be possible.

Table 3-8: Predicted BATS satellite cost sensitivity on cumulative cash flow (2020).

	ARPU w VAT	84,9	87,4	89,9	92,4	94,9	97,4	99,9	102,4	104,9	107,4	109,9	112,4	114,9	117,4
	ARPU no VAT	70,2	72,3	74,3	76,4	78,5	80,5	82,6	84,7	86,7	88,8	90,9	92,9	95,0	97,1
% reduction of satellite costs	-40%	-23,0	-20,1	-17,1	-14,2	-11,2	-8,3	-5,3	-2,4	0,6	3,5	6,5	9,4	12,4	15,3
	-35%	-21,4	-18,5	-15,5	-12,6	-9,6	-6,7	-3,7	-0,8	2,2	5,1	8,1	11,0	14,0	16,9
	-30%	-19,9	-16,9	-14,0	-11,0	-8,1	-5,1	-2,2	0,8	3,7	6,7	9,6	12,6	15,5	18,5
	-25%	-18,3	-15,4	-12,4	-9,5	-6,5	-3,6	-0,6	2,3	5,3	8,2	11,2	14,1	17,1	20,0
	-20%	-16,8	-13,8	-10,9	-7,9	-5,0	-2,0	0,9	3,9	6,8	9,8	12,7	15,7	18,6	21,6
	-15%	-15,2	-12,3	-9,3	-6,4	-3,4	-0,5	2,5	5,4	8,4	11,3	14,3	17,2	20,2	23,1
	-10%	-13,7	-10,7	-7,8	-4,8	-1,9	1,1	4,0	7,0	9,9	12,9	15,8	18,8	21,7	24,7
	-5%	-12,1	-9,2	-6,2	-3,3	-0,3	2,6	5,6	8,5	11,5	14,4	17,4	20,3	23,3	26,2
	0%	-10,6	-7,6	-4,6	-1,7	1,3	4,2	7,2	10,1	13,1	16,0	19,0	21,9	24,9	27,8
	5%	-9,0	-6,0	-3,1	-0,1	2,8	5,8	8,7	11,7	14,6	17,6	20,5	23,5	26,4	29,4
	10%	-7,4	-4,5	-1,5	1,4	4,4	7,3	10,3	13,2	16,2	19,1	22,1	25,0	28,0	30,9
	15%	-5,9	-2,9	0,0	3,0	5,9	8,9	11,8	14,8	17,7	20,7	23,6	26,6	29,5	32,5
	20%	-4,3	-1,4	1,6	4,5	7,5	10,4	13,4	16,3	19,3	22,2	25,2	28,1	31,1	34,0
	25%	-2,8	0,2	3,1	6,1	9,0	12,0	14,9	17,9	20,8	23,8	26,7	29,7	32,6	35,6
	30%	-1,2	1,7	4,7	7,6	10,6	13,5	16,5	19,4	22,4	25,3	28,3	31,2	34,2	37,1
	35%	0,3	3,3	6,2	9,2	12,1	15,1	18,1	21,0	24,0	26,9	29,9	32,8	35,8	38,7
	40%	1,9	4,9	7,8	10,8	13,7	16,7	19,6	22,6	25,5	28,5	31,4	34,4	37,3	40,3
	45%	3,5	6,4	9,4	12,3	15,3	18,2	21,2	24,1	27,1	30,0	33,0	35,9	38,9	41,8
	50%	5,0	8,0	10,9	13,9	16,8	19,8	22,7	25,7	28,6	31,6	34,5	37,5	40,4	43,4
	55%	6,6	9,5	12,5	15,4	18,4	21,3	24,3	27,2	30,2	33,1	36,1	39,0	42,0	44,9
	60%	8,1	11,1	14,0	17,0	19,9	22,9	25,8	28,8	31,7	34,7	37,6	40,6	43,5	46,5

Base case

In this table (Table 3-8) one can see a profitable range with a price of €82 per month and reducing the satellite costs by 30%. The analysis in D5.2 showed that a satellite cost reduction from the base case of greater than this could be achieved in Spain by focussing the sales.

The next table (Table 3-9) repeats this exercise looking at the impact of reducing the wholesale DSL costs; in this case reducing these by 30% and increasing the price to €86 shows a profitable proposition.

Table 3-9: Predicted BATS DSL cost sensitivity on cumulative cash flow (2020).

	ARPU with VAT	84,9	87,4	89,9	92,4	94,9	97,4	99,9	102,4	104,9	107,4
	ARPU without VAT	70,2	72,3	74,3	76,4	78,5	80,5	82,6	84,7	86,7	88,8
	-40%	-15,1	-12,1	-9,2	-6,2	-3,3	-0,3	2,7	5,6	8,6	11,5
	-35%	-14,5	-11,5	-8,6	-5,6	-2,7	0,3	3,2	6,2	9,1	12,1
	-30%	-13,9	-11,0	-8,0	-5,1	-2,1	0,8	3,8	6,7	9,7	12,6
	-25%	-13,4	-10,4	-7,5	-4,5	-1,6	1,4	4,3	7,3	10,2	13,2
	-20%	-12,8	-9,9	-6,9	-3,9	-1,0	2,0	4,9	7,9	10,8	13,8
	-15%	-12,2	-9,3	-6,3	-3,4	-0,4	2,5	5,5	8,4	11,4	14,3
	-10%	-11,7	-8,7	-5,8	-2,8	0,1	3,1	6,0	9,0	11,9	14,9
	-5%	-11,1	-8,2	-5,2	-2,3	0,7	3,6	6,6	9,5	12,5	15,4
	0%	-10,6	-7,6	-4,6	-1,7	1,3	4,2	7,2	10,1	13,1	16,0
	5%	-10,0	-7,0	-4,1	-1,1	1,8	4,8	7,7	10,7	13,6	16,6
	10%	-9,4	-6,5	-3,5	-0,6	2,4	5,3	8,3	11,2	14,2	17,1
	15%	-8,9	-5,9	-3,0	0,0	2,9	5,9	8,8	11,8	14,7	17,7
	20%	-8,3	-5,3	-2,4	0,6	3,5	6,5	9,4	12,4	15,3	18,3
	25%	-7,7	-4,8	-1,8	1,1	4,1	7,0	10,0	12,9	15,9	18,8
	30%	-7,2	-4,2	-1,3	1,7	4,6	7,6	10,5	13,5	16,4	19,4
	35%	-6,6	-3,7	-0,7	2,2	5,2	8,1	11,1	14,0	17,0	19,9
	40%	-6,0	-3,1	-0,1	2,8	5,8	8,7	11,7	14,6	17,6	20,5
	45%	-5,5	-2,5	0,4	3,4	6,3	9,3	12,2	15,2	18,1	21,1
	50%	-4,9	-2,0	1,0	3,9	6,9	9,8	12,8	15,7	18,7	21,6
	55%	-4,4	-1,4	1,5	4,5	7,4	10,4	13,3	16,3	19,2	22,2
	60%	-3,8	-0,8	2,1	5,1	8,0	11,0	13,9	16,9	19,8	22,8

Finally, Table 3-10 below compares the reductions needed to make a profitable service at the desired price of €65 per month. This shows different mixes of reductions make this possible; for example 50% SAT plus -35% DSL or 20%SAT, -60% DSL.

Table 3-10: Comparing satellite and DSL cost sensitivity on cumulative cash flow (2020).

		% reduction of satellite costs										
		55%	50%	45%	40%	35%	30%	25%	20%	15%	10%	5%
% reduction of fixed xDSL line cost per customer	5%	7,1	5,6	4,0	2,5	0,9	-0,6	-2,2	-3,8	-5,3	-6,9	-8,4
	10%	7,7	6,1	4,6	3,0	1,5	-0,1	-1,6	-3,2	-4,8	-6,3	-7,9
	15%	8,3	6,7	5,2	3,6	2,0	0,5	-1,1	-2,6	-4,2	-5,7	-7,3
	20%	8,8	7,3	5,7	4,2	2,6	1,0	-0,5	-2,1	-3,6	-5,2	-6,7
	25%	9,4	7,8	6,3	4,7	3,2	1,6	0,0	-1,5	-3,1	-4,6	-6,2
	30%	10,0	8,4	6,8	5,3	3,7	2,2	0,6	-0,9	-2,5	-4,1	-5,6
	35%	10,5	9,0	7,4	5,8	4,3	2,7	1,2	-0,4	-1,9	-3,5	-5,1
	40%	11,1	9,5	8,0	6,4	4,8	3,3	1,7	0,2	-1,4	-2,9	-4,5
	45%	11,6	10,1	8,5	7,0	5,4	3,9	2,3	0,7	-0,8	-2,4	-3,9
	50%	12,2	10,6	9,1	7,5	6,0	4,4	2,9	1,3	-0,3	-1,8	-3,4
	55%	12,8	11,2	9,7	8,1	6,5	5,0	3,4	1,9	0,3	-1,2	-2,8
	60%	13,3	11,8	10,2	8,7	7,1	5,5	4,0	2,4	0,9	-0,7	-2,2

3.7 Conclusions and findings

There are a number of ways to make a profitable business case in Galicia despite the baseline model showing a shortfall. These include the following:

- **Reduce satellite costs:** The model relies on the baseline wholesale costs of €33.04. In section 2.9 it was concluded that a wholesale cost of €20-€25 was feasible. Therefore by tending to focus sales and allowing for the reduced traffic demand the business case will close and a viable business can be delivered;
- **Eliminate the 3G/4G element:** These costs are not regulated. The product works well enough with a single terrestrial path; alternatively one could eliminate the xDSL component;
- **Lobby for DSL regulated cost reduction in BATS areas:** As these underserved areas are those where no realistic alternatives are available this may be something the regulators would look favourably at;
- **Obtain grants to offset the one time expenditure:** Along the lines of the Voucher+ scheme introduced in section 2.5.1 providing support both for the initial one-time costs and potentially the ongoing service.

It has been noted during this analysis that the similar cost models would be built by an incumbent telco, such as Telefonica in Spain, as many costs would either be regulated or tend to be similar. Given their larger size some additional economies of scale, some small cost savings may be possible.

4 Service delivery assessment for an incumbent lead scenario

4.1 Scope

This section makes an initial assessment of service delivery being led by an incumbent telco operator using the example of Turk Telekom (TT).

4.2 Deploying a BATs like service

Considering deploying a BATS like service in Turkey the key steps have been identified as following:

- Turk Telekom (TT) and Turkish Satellite service provider (TURKSAT) should come up with a mutually beneficial business case and a revenue sharing model;
  - Definition of the integration costs should be defined,
  - Service model and required SLA's should be defined as TT and TURKSAT are both ISPs,
  - Potential regulatory issues and conflicts with the upcoming 4G regulation need to be addressed since ISP activities are closely observed in Turkey;
- Turk Telekom has existing WiMAX deployments which are cost effective since they are funded by the government;
  - Pros/Cons analysis based on existing WiMAX deployments should be conducted in order to identify the shortcomings of the existing solutions,
  - Priority deployment areas and therefore the initial customer base where the WiMAX service is not preferable can as such be identified;
- The initial and early market size can be compared with the potential integration costs;
  - Potentially large initial integration costs would suggest a step-by-step integration of the service with an initial pilot before deployment would be favourable for TT,
  - An preliminary study suggest that the deployment of a BATS-like service targeting corporate customers would be more meaningful than residential customers,
  - Early deployment use-cases which would benefit such as mines, search and rescue sites (earthquakes, forest fires etc.), ski stations and marine operations should be explored,
  - The service could be integrated with TT's smart city pilots so that many smart city applications can benefit from the advantages of the ubiquitous connectivity that BATS would offer especially in rural areas.

Given that analysis in section 3 identified that there is no major difference between the case for an VNO and for the incumbent telco, no further analysis has been carried out. The more significant differences will be driven by national and regional factors such as:

- Wealth of households;
- Availability, quality and internal charged cost of the terrestrial broadband;
- National and regional political pressure and priorities.

The one area that this may benefit is that the incumbent should have access to high capacity next generation broadband costs (such as the virtual unbundled local access service discussed in D5.2 section 9.4.1) which will drive the costs and help their business plans which will tend to be the same as in section 3.

5 Business findings from field trials

5.1 Scope

The detailed findings are presented in BATS deliverable D7.1 “Trial Evaluation” sections 3 and 4. The trials are defined in detail in BATS deliverable D6.4 “Field Trial Testbed”.

This chapter (chapter 5) focusses on the business lessons learnt during the field trials. These are divided in to two groups:

- Service findings;
- Data volumes.

The first looks at how the BATS service was perceived during the field trials; the second considers the traffic volumes and proportions down each access link.

5.2 BATS Service

5.2.1 Need and interest

The following points suggest the market research that there is a real demand across Europe:

- In both Germany and Spain it was easy enough to find homes and businesses dissatisfied with their limited broadband service;
- In Germany one user was subsequently also offered a DSL/cellular hybrid trial which they also liked;
- In Spain the users had a pure satellite service for several months whilst the algorithms in the IxGs were fine-tuned and they were reportedly happy with this mature service;
- A number of users have expressed an interest to carry on with a satellite only service.

The triallists were asked about what they would be prepared to pay for the BATS service however the subsequent review of their feedback suggests the way the question was phrased and the timing indicates that their feedback on this point was meaningless.

5.2.2 Service stability

As noted in the section above the highest levels of satisfaction were for the mature and standard satellite broadband service. This is very reasonable given how important access to the Internet is for many people.

In their review of the user feedback, R noted that for the launch of a new well-known, tested consumer router it took 40 weeks before the number of calls to the help desk was down to a similar level as the established devices.

In the trials the IxG software was upgraded from version 7.1.12 to version 7.1.15 to fix one issue detected in the prototyping process. OneAccess noted that in further internal lab tests they had subsequently made more changes but not rolled this out to the field trial given the complexities of updating the prototype software in the field. This may well have contributed to the following issues that were reported:

- Data downloads being routed via the cellular link rather than the satellite link;
- Data downloads measured using Ookla’s speedtest.net website not achieving the same speeds as pure satellite links and on occasions varying significantly from time to time.

Whilst it likely these are issues than can be addressed by fine tuning the algorithms in these prototype systems this does represent the sort of instability that is not acceptable for a for a formal paid service.

5.2.3 Service definition

When formally defining a service for end users a lot of details are considered, defined and tested such as:

- Equipment and software releases;
- Device configurations;
- Operational systems processes and procedures;
- End user expectations and proposition;
- Go to market campaign;
- And so on…

These areas were all addressed however not in the detail that a full scale service to thousands of households. A number of areas where this became apparent such as:

a) **Service features:** Part of the Spanish small business customers service bundle includes VoIP which requires Class of Service (CoS) prioritisation. This feature was not ported in to the IxGs from the donor router software library as it was not specified as a requirement;

b) **End user expectations:** Initially in the absence of a formal briefing some were expecting to get a download performance similar to sat+dsl+cell speeds or the NGA speeds mentioned on the BATS website whereas they should have been expecting to get satellite download speeds with terrestrial ping times;

c) **Fault management:** A few tickets were raised which in a production environment would have been readily addressed via an integrated OSS used by the end user facing teams to query the device (such as VSAT or IUG) status and raise a ticket through to the right team.

In addition during the trial there were service elements that impacted on the end user experience that were not part of the trial. One example of this is that the Wi-Fi performance of IUG from the location it was installed in was different from before, perhaps worse in another room. Another example was the IUG end user GUI lacked some features the end users had had previously. Both these features could be addressed by formal product definition and evaluation.

End user speed tests

One final observation is that whenever an end user gets a new connection to Internet there is a very high probability that they will go to a site such as www.speedtest.net to measure their performance. It is important that system behaves correctly during such tests (neither behaving unstably as was seen during the BATS trials, nor over optimised to give overly good results and set expectations too high). Many service providers have their own end-user performance test sites.

System testing

An important part of this to recognise the services needs to be tested repeatedly before deployment, starting with a lot of lab tests, then a few alpha systems in representative locations, a limited end user test before wider scale deployment. A detailed review between each series of tests is essential and the focus needs to on the whole proposition not just the technical performance.

5.3 Data volumes

5.3.1 Germany

The following table shows the average data usage for the ten active sites in phase 2 from the 18 October to 24 November 2015.

Table 5-1: German data volumes (MB/day).

	Forward link (Bytes Out)			Return link (Bytes In)			
Active IUG	**TER**	**CEL**	**SAT**	**TER**	**CEL**	**SAT**	**FWD:RET**
lug36	165.65	12.32	1908.43	16.41	0.07	3.78	103.0:1
lug37	14.3	5.9	88.49	0.41	0.13	0.02	194.1:1
lug38	22.36	15.56	112.5	3.44	4.47	0.7	17.5:1
lug41	20.24	18.46	38.28	2.51	4.78	0.69	9.6:1
lug42	4.35	5.53	28.05	0.42	1.17	0.1	22.4:1
iug44	0	17.99	128.22	0	2.04	1.09	46.7:1
iug45	20.85	38.7	317.05	2.45	4.67	1.74	42.5:1
iug48	332.26	10.37	2053.4	50.44	0.04	23.22	32.5:1
iug49	24.56	12.79	140.58	4.84	3.01	1.29	19.5:1
iug50	3.11	3.49	38.97	0.19	0.75	0.15	41.8:1
Total	**607.68**	**141.11**	**4853.97**	**81.11**	**21.13**	**32.78**	**41.5:1**
Prop.n	**10.8%**	**2.5%**	**86.6%**	**60.1%**	**15.6%**	**24.3%**	

These figures equate to an average over these sites and this test period of **16.64GB downloaded per mont**h, of which **14.42GB** was **routed via** the **satellite**. This can be compared against the total Analysys Mason figure of 61GB/mo in Germany, and the BATS model predicting that 77% of the traffic would be satellite based in 2015 compared with the 86.6% measured.

It should be noted that upload traffic volumes reported are very low.

5.3.2 Spain

The mean values for daily data from 18 October to end November 2015 are:

- Download: 519.54 MB/day;
- Upload: 43.62 MB/day.

This **download equates** to **15.8GB/month**. This can be compared against the total Analysys Mason figure of 85GB/mo in Spain in 2015. The ratio between download and upload is 11.9:1. The download traffic per link is as follows;

- Satellite 54.5%;
- Cellular 26.8%;
- xDSL 18.8%.

There are a number of households where the cellular performance measured by the IUG was on occasions similar to the satellite. This suggests a more optimised implementation would see most of the cellular traffic routed via satellite, perhaps 75% to 80%. This is in line with the 77% used on the cost benefit analysis model which focussed on a satellite plus single terrestrial connection.

5.3.3 Overall

Three key findings have been:

- The measured traffic levels are significantly below the Analysys Mason usage figures for 2015 (measured to be around 20% of Analysys Mason levels for 2015);
- The return (upload) traffic levels are lower in proportion to the forward (download) direction than expected;
- The proportion of traffic being routed via the satellite link is roughly that expected.

5.4 Summary

The service findings can be summarised as:

- There is need and interest;
- End users value service stability above almost everything else;
- Detailed service definition required for each service;
- End user expectations need to be very carefully addressed;
- Tight integration between element providers and the lead organisation.

No real information on price elasticity can be seen given the small sample size, the nature of the trial and the issues addressed.

Traffic levels seen are significantly lower than the Analysis Mason figures. The proportion routed via satellite is reasonable consistent with the theoretical model in the D5.2 cost benefit model.

6 Commercial viability of BATS concept

6.1 VNO

VNOs, either fixed or mobile, base their commercial success on “service improvements” that allow them to capture niche markets, like value conscious customers, immigrants, customers that appreciate service over functionality, family-types different than mainstream and so on.

The BATS market is a niche market. It is defined on customer location and not on customer behaviour, but initially is likely to remain outside of the incumbent focus. Unless regulation forces incumbents to provide universal service beyond current DSL capabilities, BATS market size is too small for the incumbent’s typical yearly targets.

So, VNOs will always consider taking a look to the BATS market – the underserved locations. In a given country, there are two types of VNOs with enough skills and positioning to analyse the BATS market:

- The national challenger, which has enough resources, Government influence and skills to go for a national BATS service;
- The regional focused brand, which needs all the revenue possible in a given region to sustain its operations, and so will always be interested in capturing customers outside its current business inside their brand covered territory.

For VNOs, BATS is a high cost service to be used as a tool for capturing other services on that customer location. Mobile, POTS, content services, home automation, security...all those services will be linked to the BATS broadband proposition, and so a negative margin service can be turned on a profit making one. It makes sense because very few players can offer an alternative to those customers, which are also very conscious of the need of strong support.

For VNOs, the main driver for taking decisions on new broadband services are regulated costs, as VNOs are taxed by monthly payments to incumbents and backbone providers. VNOs consider not only current regulated prices, but also *the trend* of regulated prices. The wise strategy for VNOs is to anticipate trend regulation and capture customers still when the business plan looks not very much profitable, and so there is much less competition. Once regulated prices are clearly profitable, many more VNOs will enter and will find the customer base already entrenched.

BATS might be one of those cases. Today, urban customers are receiving 200Mbps and 350Mbps in early January 2016 [36]. Just 10 km away from those cities, many customers can only get 6Mbps or less. Remote customers, 200km away, are really worse off. Those remote customers in remote regions have only 2 options:

- Wait (endlessly) for the incumbent to deploy Fibre or 4G in their areas;
- Receive BATS-like offers though smart regulation.

VNOs will be very keen to win over those customers, and not only big national VNOs but also regional players and local players. All what they need is a regulation that recognises that a DSL line near a city, with a 10-20Mbps service, can’t have a regulated cost the same as a line remote away which provides 1-2 Mbps. Providing a bonus to those remote regions in form of smart regulation will make the BATS business case profitable enough for focused VNOs.

6.2 Satellite operator

Satellite broadband operators have been working with governments around the world to develop models to allow satellite broadband to deliver service to the more remote locations which do not have broadband and are unlikely to get any service in the foreseeable future. This process has been referred to as outside in, using satellite service in the most remote locations first.

A BATS like service allows satellites to help deliver service further towards the urban centres – to the under-served home and business. Such an opportunity is clearly interesting to satellite broadband operators.

Delivering the BATS service depends on good relations with in-country partners such as the VNOs above to provide the end user management and terrestrial service elements. By starting service with one or two such partners in key countries, perhaps with a conventional satellite broadband service to unserved home and certainly on existing satellite capacity, this allows the relationship to develop whilst delivering a good stable service. A variety of different flavours of BATS service can be trialled and brought into stable operation to grow experience. This can then be transferred to similar relationships in other key countries.

By doing this the service can be developing and showing clearly value before the investment decision is made for the full BATS service with satellites, gateways and backbone network. This inherently reduces the risk and would allow the satellite operator to create a detailed business plan based on initial service feedback and ongoing in country partner relationships.

This should aid access to good investment funds and the support from the EFSI could prove advantageous.

In addition the satellite service operator would have experience in a variety of different end user support schemes such as the Voucher+ and similar. This will help grow the service in not only the top ten countries but in others as well.

6.3 The Pan-European picture

Combining the two viability analyses a mutually consistent picture arises. The following diagram (Figure 6-1) illustrates how the monthly payments are distributed between the VNOs, their own service costs and the satellite service provider.

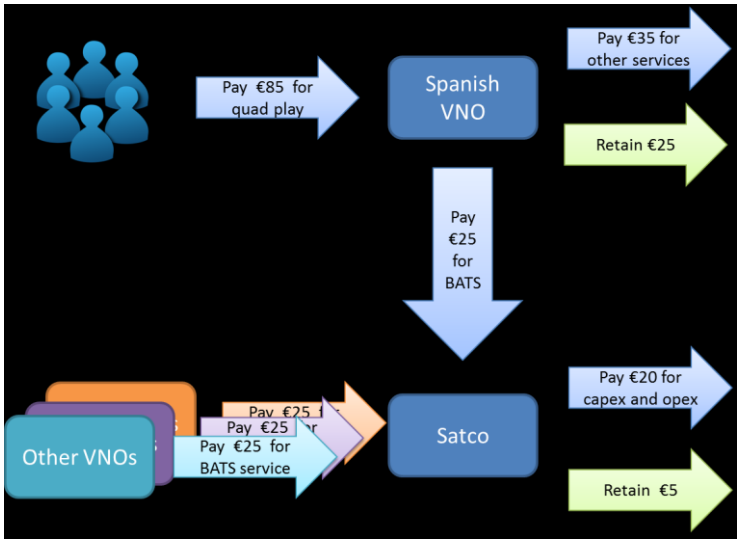


Figure 6-1 : Money flow in combined VNO / satco service model.

Of course the other VNOs may use different bundles and may also reduce the charge to the home by complementing with a Voucher+ scheme. In the Spanish example they may, for example seek to have a scheme that reduces the quad-play bundle by €20 per month to the €65 charged in well served locations in their coverage area.

This diagram represents the investment of €959M by the satco where the investments need to be repaid over 15 years at 6.5%, with 0.7M HH which equates to a monthly cost to the satco of €20. A gross margin of 20% has been assumed €25 per HH per month.

A single satellite operator would launch a wholesale core BATS service across the continent in 2016 and works with one or few partners in the key demand countries. A phased approach (illustrated below in expanding to other countries would follow along with launching the two BATS satellites at different times to cover different phases of full BATS deployment.

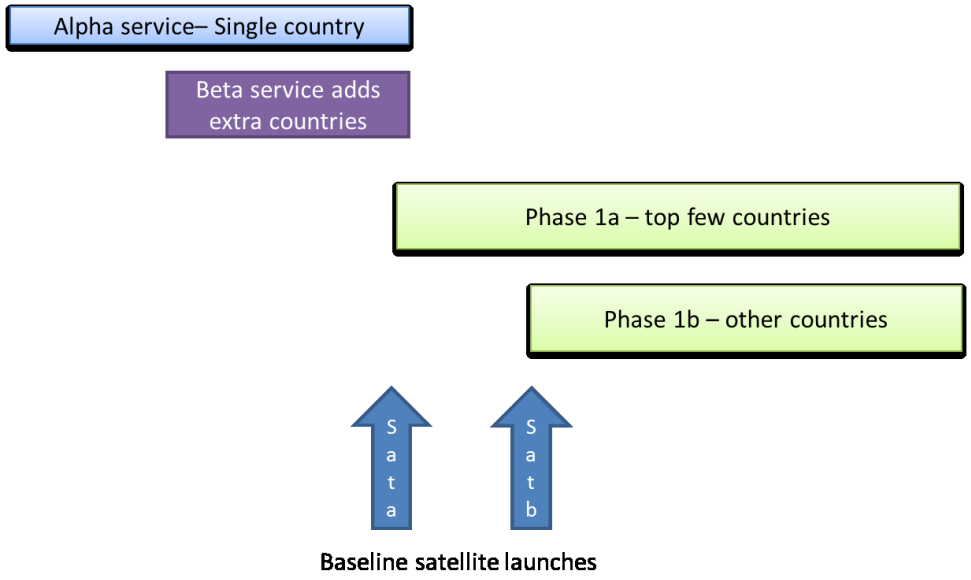


Figure 6-2 : Illustrating the phased service.

This allows a viable business path where risks and investments are controlled by working at parts of the coverage at different times. This will allow support for infrastructure investment and through local voucher schemes.

7 Key messages

7.1 Scope

7.1.1 Identifying the stakeholders

The purpose of this section of the document is to create a set of value propositions, each targeting a different class of stakeholder who needs to understand the benefits that BATS offers, in order to become an active supporter / provider / user of BATS. Many of the issues will be common to most of the stakeholder, but there will also be unique considerations for each of the stakeholders.

It is important to identify the stakeholders: these include the manufacturers of the different subsystems and components; operators of the satellite system and the BATS operator; investors of the capital required and investors in R&D; government as a regulator but also a possible source of subsidy to ensure that users in rural communities do not have to pay a premium for the service that city dwellers expect.

The following stakeholders are identified:

- **Government:** At various levels provide both support and regulatory environment;
- **Investors:** Provide the working capital to finance the project;
- **Research and development (R&D):** Provide the system enhancements needed;
- **Terrestrial services:** The DSL and LTE services that form part of the BATS service;
- **The BATS operator:** The organisation integrates the service and offers it the end user homes;
- **The end user:** Be they in the homes or small businesses served by BATS;
- **The satellite operator (satco):** Invest in the satellites;
- **Ground system operator:** Operates the satellite gateways and the backbone network;
- **Content delivery network**: Operates the content delivery network and may have peering arrangements with the ground segment operator or BATS operator;
- **Manufacturers**: The manufacturers of the satellites, ground segment and IxGs.

There is an important question about how the various stakeholders will cooperate to manage the delivery of BATS, on a shared responsibility basis. There is a parallel in the GSM The Memorandum of Understanding (MoU) Group that comprised the potential manufacturers of GSM infrastructure, of handsets, national operators, and the standards group. The MoU group enabled agreements to be reached about what services and functionality should be included in the initial roll-out (enabling the phased release of the standards), what geographical areas would be covered and how many handsets would be sold by the operators, by what dates, enabling manufacturing volumes to be set not only for the handsets, but also for the network infrastructure. There would have been a “Mexican standoff” without this clarity over demand for handsets and infrastructure, and the specification to be adopted. A similar arrangement may be needed for BATS, if there is no single organisation that is able to take on the commitment of leading the implementation, and taking on the risks associated with that leadership role.

In practice individual stakeholders may take responsibility for several parts of the BATS system.

7.1.2 The baseline stakeholder organisation

Figure 7-1 shows the situation where the Satco is also responsible for the Ground Systems, supporting a challenger BATS operator. This organisation has been shown above in section 2 and section 3 to be the best suited to service deployment. The BATS operator also includes the CDN service, although this is shown here as being bought in, rather than owned by the BATS operator. However, it may be very attractive for an existing CDN operator to extend their operation to include acting as a BATS operator.

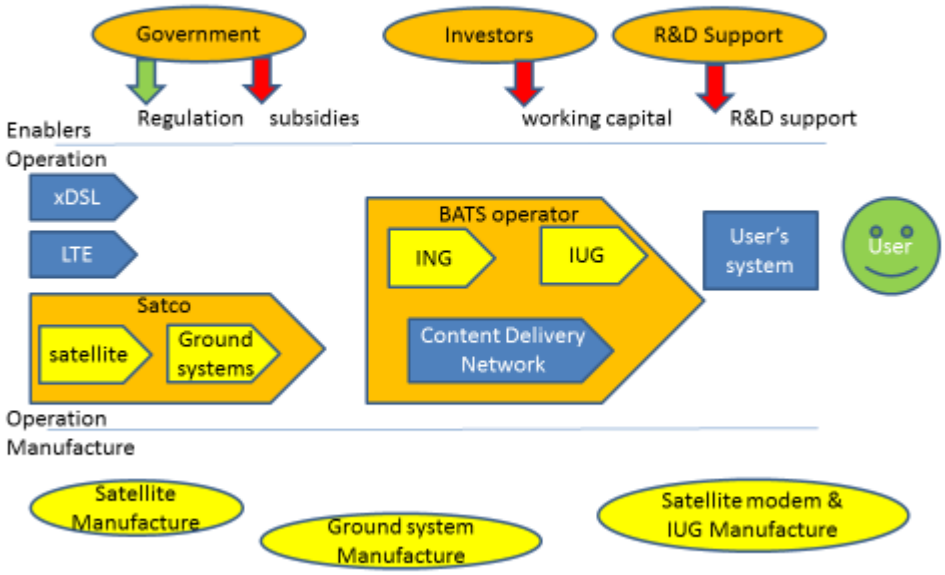


Figure 7-1: BATS Stakeholders – baseline organisation.

7.1.3 Other possible organisation mixes

Yet another combination of functions is shown in Figure 7-2 where the Incumbent operator is acting as the BATS operator. Note that the Incumbent also provides the xDSL and LTE, so these now become more strategic within the BATS system (hence the change in colour-coding). In this case the ING is operated by the Satco: an arrangement which might be used by the regulator to mitigate the potential that the incumbent may dominate this market. The CDN is shown as being independent in this case, again perhaps as a way to mitigate the influence of the incumbent.

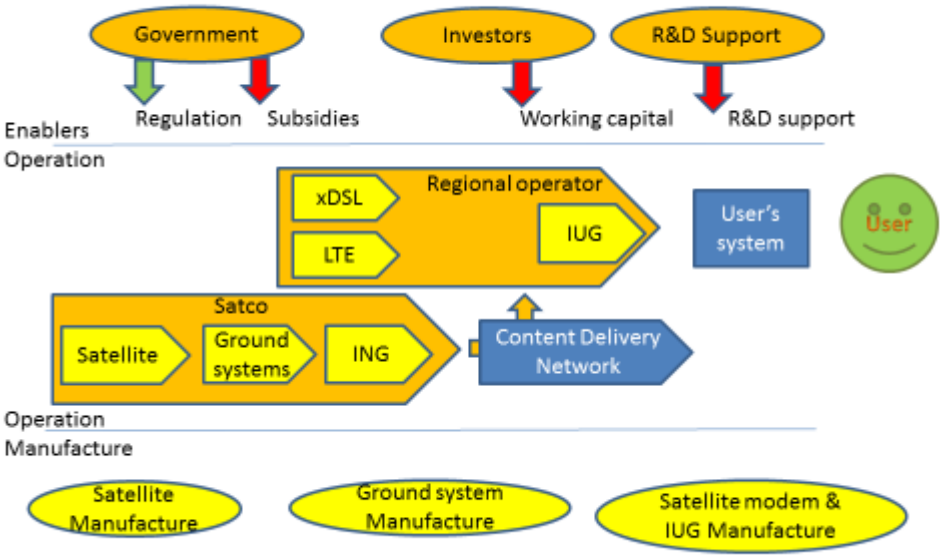


Figure 7-2: BATS Stakeholders – an alternative organisation.

Yet another distribution of ownership of BATS sub-systems is shown in Figure 7-3 where an established challenge has sufficient resources to be able to take on the provision of ground systems as well as BATS operation. An example of this configuration might be if the Spanish company R wished to act as a BATS operator and own for example the INGs. This implementation has the BATS operator also acting as the CDN.

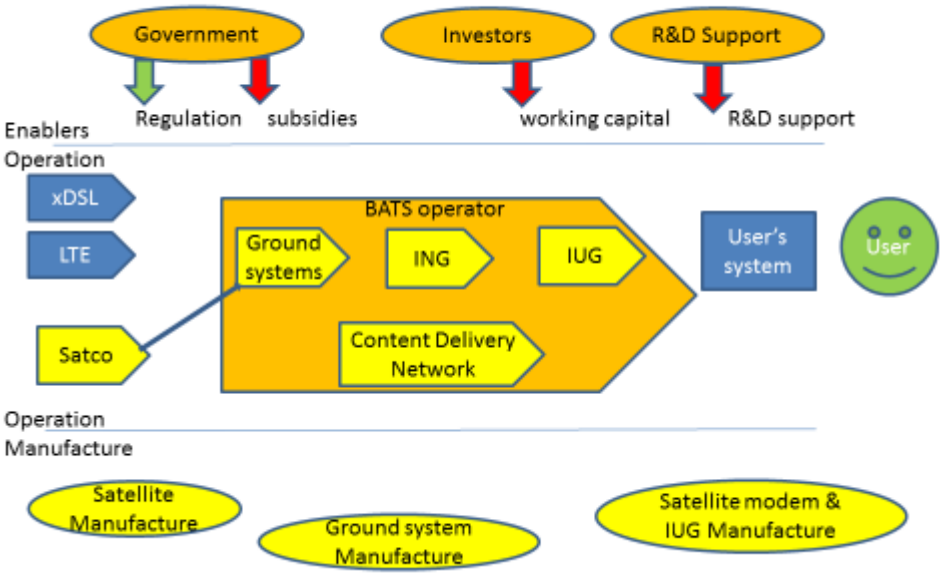


Figure 7-3: BATS Stakeholders – a variation on the baseline.

7.1.4 Methodology

Clearly the exact proposition to each of the operators will depend upon the extent of their responsibilities. The propositions in this document may need to be adapted to match the extent of the organisations interests. There is little value in describing all the permutations that may exist so in the following section the value proposition for the stakeholder of each of the elements is introduced. The issues that are of greatest concern to each stakeholder are identified first and then the value proposition that addresses these issues is presented.

The main issues for each of the stakeholder groups in Figure 7-1 are considered in the following sections; the propositions are then derived at address these issues.

7.2 End users (business and residential)

7.2.1 Residential and small business end user issues

The primary users of BATS are likely to be remote family homes. But people in remote locations are also ideal candidates to run businesses from their homes – especially in remote areas where there may be limited opportunities for conventional office, factory, shop or other service industry employment. So there is likely to be an increasing use by small / micro businesses. Support for economic growth in these communities is an important objective.

Key issues of concern will be:

- When can I have this?
- Performance, will this meet my needs, and be significantly better than services that I can access now?
- Costs?
- Level of disruption caused by the installation?
- Does this require changes to my existing home network?
- Stability and reliability of service – what happens when things go wrong?
- Managing change of plans?
    - Am I locked in to BATS if the incumbent operator provides a fibre-based access option?
    - What if I want to move house, or business premises: can BATS be moved to a new location?

7.2.2 Residential User End User Value Proposition

Broadband providing access to the internet will support many 21st century services that people increasingly rely on. As well as the obvious aspects of entertainment that is free from the constraints of the broadcaster's schedule, high performance broadband is required to support email, shopping, messaging and gaming. The promise of the Internet of Things, where smart white goods, smart power metering and endless opportunities to connect to smart devices is predicted to create new services that will all use broadband access. Whilst many of these services may individually require relatively low data rates, these all add up and reduce the bandwidth that remains for the other services being used at the premises. Slow broadband makes services like streamed video and gaming at best unattractive and often unusable.

Whilst the majority of these services are available via the mobile comms network, the mobile network coverage is planned to support the areas of densest population, as this gives the best return on investment. So many premises will continue to be outside coverage for the foreseeable future. Some mobile operators offer to provide a "femto cell" in the home to

provide local connectivity, but this in itself depends upon their being a good broadband connection to the home.

BATS is the ideal solution for underserved homes, typically in very rural areas, where there is only access to low speed DSL connection, and inadequate coverage from the mobile network. Use of BATS does not require any changes to computers and devices that are in use in the home.

BATS makes use of any and all of the communications systems (access technologies) that are available at the premises. BATS constantly re-optimises its configuration to give the best performance depending upon the real-time performance of each of the communication access services that are available. BATS is able to examine the communications traffic to and from the user's premises and determines which communications system works best. Tests have shown that the quality of experience for the user is almost indistinguishable from that provided by an optical fibre connection.

Everyone is concerned about their privacy and the security of their communications. BATS uses good quality encryption and actually makes it much harder for someone trying to intercept the communications because the information will have been split up, with some being passed over the DSL connection and other information being passed over the satellite. It is noted that the BATS system has to examine the data being handled, but this is simply to determine the nature of the transaction, not its content. The information gathered contains no personal data and is used locally and is not recorded or reported to any remote system.

Installation of BATS will typically be by the BATS operator can provide a full installation leaving the system when its performance has been fully checked. There may be the option that this can be undertaken as a DIY project, or by your own handyman to save on cost. There is of course remote support by phone for people who install and commission their own system.

Cost

BATS brings all the additional benefits of integrated broadband access to your home at a similar price to the equivalent urban services.

Contractual terms

The Terms & Conditions of BATS is similar to regular broadband connection services, such as a fixed xDSL connection. The Terms & Conditions include improvements on behalf of the end user to include a guaranteed base quality of service.

Guaranteed / or expected performance

The BATS service will guarantee a peak data transfer rate of a minimum of 30Mbps thanks to the integrated broadband access and automated optimal connection management systems.

You will access broadband services seamlessly regardless of the outages in terrestrial or satellite systems. BATS will optimally select the best broadband service for you.

BATS is future proof. It will enable you to increase your broadband usage significantly as your lifestyle changes. The performance is such that it can support business use, should a user prefer to work from home rather than travel in to work, which may be a long journey for many people living in rural areas.

7.2.3 Business User proposition

BATS will enable a small business to be able to access a fast broadband connection at any location. Increasingly businesses are constrained by the need for excellent communications. This creates problems for start-up companies trading from the entrepreneur's rural home, to farmers who could use high technology systems (eg milking parlours) if these can be connected to the internet. Some businesses need to be located next to natural resources,

such as a water mill by a stream rather than close to modern infrastructure. BATS enables the user to have the broadband service delivered to their location, wherever it is.

Note that BATS will not provide sufficient capacity for an organisation with more than a certain number of employees on the site depending on the service plan.

Cost

BATS brings all the additional benefits of integrated broadband access to your business on-the-go with no additional cost. You will access broadband services seamlessly regardless of your location. BATS will optimally select the best broadband service for you including satellite.

Contractual terms

The Terms & Conditions of BATS is similar to regular broadband connection services, such as a fixed xDSL connection. The Terms & Conditions include improvements on behalf of the end user to include a guaranteed base quality of service.

Guaranteed / or expected performance

The BATS service will guarantee a minimum of 30Mbps thanks to the integrated broadband access and automated optimal connection management systems.

You will access broadband services seamlessly regardless of the outages in terrestrial or satellite systems. BATS will optimally select the best broadband service for you.

It is also recognised that the needs of a small business can vary and as the business develops they may need to move to new premises. Although BATS is provided as a permanent robust installation, it is eminently suitable to be moved very quickly to a new location. With self-install kit as an option the customer is able to manage their own recovery and reinstallation of a BATS system if the business needs to move its location.

Everyone is concerned about their privacy and the security of their communications. BATS uses good quality encryption and actually makes it much harder for someone trying to intercept the communications because the information will have been split up, with some being passed over the DSL connection and other information being passed over the satellite and potentially over an LTE network if that is available. It is noted that the BATS system has to examine the data being handled, but this is simply to determine the nature of the transaction, not its content. The information gathered contains no personal or corporate data and is used locally and is not recorded or reported to any remote system. It is gathered by analysing the meta-data associated with each traffic flow (the packet IP addresses, port number, object length, SIP data header and protocol type amongst others). The data in each packet is not analysed at all.

Additionally, as resilience is an increasing concern for many commercial organisations, BATS can be used in conjunction with a high speed connection. In this case all traffic would be routed over the fibre, but if that were to fail, then traffic would be instantly re-routed over satellite and LTE / ADSL to provide seamless continuity of service.

7.3 Content Delivery Network owner

7.3.1 Content Delivery Network owner: Issues

It is often stated that “Content is King!” but it is harder to know in 2020 who will the content provider be, and what relationship will they have with the other BATS stakeholders? How will their content be delivered and who will manage the delivery network. Today many operators use major Content Delivery Networks (CDNs) such as Akamai to move content towards the network edge and some organisations are large enough to justify their own infrastructure in some countries at least. Sometimes the CDN costs are borne by the content owner and sometimes by the broadband access service provider to reduce the cost of the Internet peering by reducing the bandwidth demands.

There is a strong trend for broadband services to be bundled with other services, often as a quad-play offer: Telephony, broadband, mobile and entertainment. BATS assumes the inclusion of a terrestrial xDSL connection, which will often include telephony. BATS may make use of an LTE (mobile) network, but bundling of a mobile 'phone would be a commercial rather than engineered integration. However, bundling of content creates some important opportunities for BATS. Even when content is not per se bundled it will be accessed.

With an intelligent content cache there are efficiencies in using multicast transmission which may be received simultaneously and stored by millions for IUGs. Use of an intelligent cache enables content to be made available immediately, giving very high quality of experience to the users, whilst minimising the transmission costs.

It is of fundamental importance that the any content that is cached is protected from copying (encryption), that only those entitled to access the content can do so (digital rights management and key management) and that each playout is reported to the content owner can understand their service delivery. The CDN typically manages not just the delivery of the content, but the way that the user interacts with the selection and media control systems. If caching is to be optimised, the CDN will need to be able to interwork with the cache within the IUG and the way that user controls are presented and interpreted. The IUG cache would be expected to interface to the normal caching protocols, for example ensuring the key management and play-out reporting remain between the end points. In essence the IUG edge cache would behave like a core network cache node.

7.3.2 Content Delivery Network owner: Value Proposition

BATS provides an excellent hosting environment with intelligent caching on the IUG, and multicast broadcasts that can be saved selectively on the local cache. There is scope for the CDN to provide personalised caching according to user preference profiles that can be pre-programmed or learned. This intelligent caching allows instant availability of previously broadcast material, with no delay and no additional communication cost. Satellite technology offers a genuine multicast capability (transmit once, receive many times) that is not widely available on fibre, xDSL or LTE broadband connections. Note cached files need not be limited to video; software updates and other widely used types of information can be downloaded in this way.

It is important that the CDN is closely associated with the BATS technology. The end user would access via their usual user interface; typically web or app based. Users will be able to stay with a service that they know and trust. Integration of the communications system with the CDN would mean that the broadband service is no longer a commoditised bit transport proposition. The BATS system would simply move to an edge cache complementing the core network cache nodes, something that is being envisaged for future networks such as 5G. The IUG cache would be transparent to the content delivery so that all the end content control, management and reporting would be maintained.

7.4 Incumbent Telco

7.4.1 Incumbent Issues

The incumbent is typically looking to sell large volumes of well-defined services. Ideally, "one size fits all" allows efficiencies in staff training, equipment stock levels, and volume procurement. They will normally avoid a (relatively) low volume service like BATS. To convince incumbent service providers to support BATS they will need to see that this is a service that will follow a standard installation plan (which it does), that it will be very reliable and can easily be integrated into their maintenance and customer-facing service management systems.

Their motivation to support will be higher if:

- If, as is likely, the national regulator expects them to roll-out a significant increase in the percentage of premises covered in a relatively short timescale, then BATS offers an immediate solution at any location that has a "land line" with limited DSL capacity;
- The government wishes to see this deployed, especially if they offer subsidies for the service;
- They are under pressure to provide universal coverage which ultimately requires “provision at any cost”: we need to show that a BATS type service in many under-served areas will be cheaper than the alternatives;
- There is a danger that a competitor could launch a BATS service which they could use as a bridgehead to launch other services that would target valuable markets share from the incumbent. The incumbent may want to get there first!
- If the incumbent may choose to prove the concept works at home before taking the BATS service into new countries, as a possible bridgehead for them to establish their brand as a challenger in other countries.

Service providers will expect there to be some competition in the supply chain, both to drive down costs and also to give security of supply, and to avoid there being a single supplier of a critical sub-system that could fail such that they had a major problem over equipment supply and ongoing support.

Power consumption and greenhouse gas emissions are a consideration for all operators.

7.4.2 The Incumbent's Value Proposition

Governments are tending to force the incumbent operators to extend their broadband coverages to most if not all their citizens via act of parliament. BATS will help the incumbent to extend their services to rapidly fulfil these regulatory requirements.

The complexity and diversity of the broadband access technologies is an important challenge for the incumbent operator since operation and management of each of these technologies brings additional costs and skills. An integrated service and management platform is paramount for incumbent operators by bringing a solution of type “one size fits all”. The BATS service has a proven MTOSI OSS interface. In the recent telecoms business where revenue increase experiences severe shrinkage, “one size fits all” type opex reduction solutions will be welcomed as a life-saver.

Currently, extending broadband services and/or their capacities requires months of instalment and testing process. A proven service like BATS will help the incumbent operators to increase broadband coverage easily in a short period time.

The power consumption of the network based equipment is lower than the power used in providing broadband communications using either optical fibre / VDSL or 3G / LTE mobile networks.

7.5 Challenger

7.5.1 Challenger's Issues

There are three categories of challenger:

- An incumbent in one country bringing BATS into another country, as a challenger in that country;
- An existing telco (including cable and mobile network operators) challenger that uses BATS to reinforce its position or as a new service to be added to its portfolio;
- A new company, or more likely an established company that decides to diversify into providing broadband communications. They might choose to enter this market in response to an opportunity with a strong supporting business case.

The challenger and their brand will be dependent upon the perceived performance of the BATS service if they are using this create new niche. They will need assurance that the equipment will work flawlessly and that their customers will be entirely satisfied. The challenger must manage cash-flow and stock levels, so will need good forecasts of take-up. The cost to add the BATS functionality needs to be clear and at a level that can be included in their service bundles.

Service providers will expect there to be some competition in the supply chain, both to drive down costs and also to give security of supply, and to avoid there being a single supplier of a critical sub-system that could fail such that they had a major problem over equipment supply and ongoing support.

One threat to the marketing of the BATS is that BATS service may be installed at an underserved location, but then the incumbent subsequently introduces lower-cost, higher performance terrestrial communications (fibre or LTE based) to the premises. Under these circumstances the customer may decide to switch away from the BATS service to use the incumbent's new service.

Power consumption and greenhouse gas emissions are a consideration for all operators.

7.5.2 Challenger's Value Proposition:

For the Challenger, BATS provides a way to provide a service performance that is not available from the incumbent’s portfolio. This may be as a completely new service or as an extension to an existing set of services. Consider the case of R in Galicia.

R is a good example of a challenger: R is a commercially successful cable operator with commercial success and strong regional branding. R is a challenger with a wide market position in its territory, having reached number one market share in 4-play services. However, as a fibre-Hybrid Fibre Co-ax (HFC) operator, there are many spots and even sub-regions where fibre economics make it impossible to deploy R’s network and where R relies in Telefonica’s network to provide telco services which are limited to slower DSL speeds.

Customers in those “indirect areas” receive the marketing of the fibre operator but find their services reduced to the old DSL speed. So, as a high speed operator, the BATS promise is well received at R in order to gain market share in those indirect areas, to complement business services and to include it as a component of the cable bundle. BATS is part of the promise of “cable speed without wires” which fits well with the marketing of cable operators. R is an MVNO operator and also owns 4G regional licences in 2.6GHz band, thus having several options to supply the wireless component of the BATS service.

BATS would be a new service inside R's portfolio, designed specifically with three customer segments in mind:

- **Residential customers** in DSL areas with less than 3 Mbps, which are calculated as about 80,000 homes in R's coverage. Customers with more than 3 Mbps will be difficult to be sold in due to the BATS cost, and the less urgent need for improvement;
- **SoHo customers** in DSL areas with less than 6Mbps, which may require more speed and also the backup functionalities of BATS;
- **Enterprises** all around the territory, which may require to include remote locations in their VPNs or to provide backup accesses to many relevant points (banks, government offices, health points, rural training agencies).

For each segment, the BATS service will be included in different value propositions:

- **Residential customers:** BATS internet access service will be bundled with fixed telephony and mobile telephony. Pay TV television will be included depending on its performance through the BATS system, and it will be very important to find a place for TV inside the BATS bundle. Value added services like home automation and home security, relevant in rural areas, will be included as an option. Professional installation is a must for BATS service, due to the satellite component and the IUG configuration inside the home. In many cases, a Wi-Fi reinforced service will be needed due to the size of typical rural homes. BATS will be marketed as a high speed service from the company which provides high speed in urban areas;
- **Soho customers:** BATS internet access service will be bundled with fixed telephony and mobile telephony. Professional installation is a must for BATS service, due to the satellite component and the IUG configuration inside the customer premise. In many cases, a WIFI reinforced service will be needed to complement local SOHO coverage. BATS will be marketed as a high speed reliable service from the company which provides high speed in urban areas;
- **Enterprise customers:** BATS internet access service will not be bundled and will be offered on its own. Professional installation is a must for BATS service, due to its complexity. BATS will be marketed as an advanced technical solution to extend enterprise networks to remote locations in a reliable fashion.

The power consumption of the network based equipment is lower than the power used in providing broadband communications using either optical fibre / VDSL or 3G / LTE mobile networks.

The customer may decide to switch away from the BATS service to use the incumbent's new service if it becomes available. However the BATS equipment (antenna, satellite modem and IUG) can easily be recovered and reused at another location when that happens.

7.6 . Politicians & Regulators

7.6.1 Politicians' Issues

National governments understand the urgent requirement for high capacity (30Mbps) broadband in all parts of their countries. This is evidenced in the European Commission's Digital Agenda documentation. Any country or region that does not achieve universal broadband coverage is likely to suffer economic disadvantage compared to other countries and may suffer regional imbalances where more rural, underserved communities are left behind in the expansion of the knowledge economy.

Politicians have to promise radical improvements in the services that their constituents can access, in order to win support and votes. To be successful they should promise only those objectives that the people want, and ones that can actually be delivered. We need to assure them that BATS satisfies these two criteria.

Politicians set the policy and regulators enact the policy with their ability to permit, mandate and support the introduction of new technology to influence behaviours, both of incumbent operators and challengers.

However, politicians have differing priorities and BATS can be used to meet both socialist and capitalist agendas. Different political parties may favour the incumbent or the challenger, but either way the regulation of a BATS type service can be used as a motivator to achieve political objectives. Politicians of all persuasions will understand the need to deliver universal broadband service.

The major groupings are:

- Right wing (conservative), supporting completion and market forces (right wing);
- Left wing (socialist), supporting more equitable distribution of wealth (left wing);
- Green party – looking for more sustainable lifestyle (left wing);
- Politicians with Regional Focus;

  In all countries with democratic government there will be politicians who want independence or more autonomy for the region. In general these parties see their region as being disadvantaged by the national government, either because their economic activity is being held back, or more likely that there is inadequate support for a more rural area with lower economic activity. For these people BATS is an effective solution to levelling the playing field and ensuring that everyone is able to access good performance broadband whatever their location.

7.6.2 Generic value proposition for all politicians

The need for broadband access: The Digital Agenda for Europe [37] is part of the Europe 2020 plan. The strategy identifies five headline targets the European Union should take to boost growth and employment. There are 7 pillars that are designed to enable the Digital Agenda:

1) Digital Single Market;
2) Interoperability& standards;
3) Trust & security;
4) Fast & Ultra-fast broadband;
5) Research & innovation;
6) Enhanced Digital Literacy;
7) ICT Enabled benefits for EU Society.

The fourth pillar is a major part of programme and is the provision of fast broadband access: new services such as high definition television or videoconferencing need much faster internet access than generally available in Europe. To match world leaders like South Korea and Japan, Europe needs download rates of 30 Mbps for all of its citizens and at least 50% of European households subscribing to internet connections above 100 Mbps by 2020. The Digital Agenda aims to turn this ambition into reality by stimulating investments and proposing a comprehensive radio spectrum plan.

High speed broadband will support entertainment, education, social and commercial activities. Being attached to the network is rapidly becoming an essential utility service. Bringing broadband to underserved communities will be very popular with the electorate, and failure to deliver may result in an angry response from those people who believe that they are deprived because of lack of service.

7.6.3 Value proposition for right wing politicians

Universal access to broadband communications is a key enabler to economic growth. People living in remote rural areas may find it uneconomic to travel to employment at an organisation that may be many miles away. This typically results in people moving away from rural areas, reducing the amount of economic activity that is needed to sustain other people living in the rural area, or they may opt out of regular work, potentially increasing demand for state benefits to be paid. In either case there is a trend to creation of economic black-spots. Provision of broadband to these areas can reverse that trend, stimulating economic growth in areas where housing is relatively low cost, but has become unpopular because of the lack of local employment.

Broadband can also improve community spirit and local self-support by providing excellent communications within a local area. Cost of providing healthcare and social services should be reduced as the provision of reliable internet connection that will support the emerging telemedicine and telecare services. These services will enable people to be safely cared for at home, rather than in hospital and will reduce the number of unnecessary visits by nurses, because better information is available. The connected big society will function much more efficiently, making the idea of living in a rural location much more attractive.

The provision of the BATS service could be undertaken by challenger telcos with a clear focus on high speed provision of broadband communications to premises that are currently under-served by the incumbent telco. These installations will require modest state subsidy but it would not be popular if paid to the incumbent. By paying this to a challenger there is more competition and more pressure on the incumbent. There are major benefits for the end users of the BATS service, but there are also spin-off benefits from the motivation of the incumbent to protect and win back service that has been provided by a challenger.

Furthermore, the launch of the BATS service, with a unique selling point, by the challenger operator could be a key enabler for the challenger to excel on the service they provide and to develop and market new services based on the brand awareness generated by the provision of a BATS service.

7.6.4 Value Proposition for Socialist politicians

Universal access to broadband communications will support the caring society in rural areas, improving community spirit, local support and self-help by providing excellent communications within a local area. More effective healthcare and social services could be developed and offered that make full use of the reliable broadband connectivity. These services will enable people to be safely cared for at home, rather than in hospital ensuring that the right kind of care can be provided in a cost effective way based on information that could not be collected without the use of broadband. The connected big society will function much more efficiently, making the idea of living in a rural location much more attractive.

Broadband communications is also a key enabler to economic growth. People living in remote rural areas may find it uneconomic to travel to employment at an organisation that may be many miles away. This typically results in people moving away from rural areas, reducing the amount of economic activity needed to sustain other people living in the rural area, or they may find themselves in local employment where they do not deliver their potential. In either case there is a trend to creation of economic black-spots. Provision of broadband to these areas can reverse that trend, stimulating economic growth in areas where housing is relatively low cost, but has become unpopular because of the lack of local employment. Subsidising the roll-out of BATS may prove to be an excellent method for economic stimulation of an economically weak area, and should prove very cost-effective.

For example, if one looks at the baseline case used in BATS D5.2, and allowed the Greek government to support half the service cost, this would increase the number of end user households by 1% in 2020 to 593,736. The benefits vary significantly by country depending on how many NUTS3 regions have demand that can't afford the service and have spare capacity. The most significant impact modelled is in Turkey where a similar subsidy would increase the number of households by almost 50,000.

Provision and use of BATS is more expensive than the routine provision of broadband in an urban environment where much shorter access plant length is required but significantly cheaper than many alternatives on a per household served. For those locations where BATS is the most cost effective way to deliver broadband connection in the short term a modest level of financial support would enable users in traditionally underserved locations to receive a broadly equivalent service to that received in urban areas at the same cost. This vital rebalancing will ensure that people living in more remote areas are not disadvantaged.

The BATS service could be run as a separate venture or by the incumbent operator. If the incumbent operator receives the grant then they may prefer to use the grant to subsidise roll out of fibre, rather than the installation of BATS. Acceleration of the roll-out of fibre is to be encouraged, but not at the expense of delay whilst people could have been making full use of the BATS service. Setting strict targets for the time taken to deliver the service will ensure that BATS is used appropriately where service is needed urgently, even if this has to be recovered and redeployed to another site should an optical fibre derived service become available during the life of the BATS service.

The power consumption of the network based equipment is lower than the power used in providing broadband communications using either optical fibre / VDSL or 3G / LTE mobile networks.

7.6.5 Value Proposition for Green Politicians

BATS enables the Digital Agenda performance broadband communications to be provided on-demand without the need for new local infrastructure. This means that there is no damage to the local environment, no major construction exercises and no new overhead lines to be installed that might impair the views over an unspoilt area. The satellite dish is of similar size to a broadcast TV dish which can be installed with little visual impact at low level such that it has a clear view of the area of sky where the satellite is located. A related benefit of good broadband access is can reduce the amount of wasted journeys by the electorate.

The greenhouse gas emissions for the intended 15 year life of the system are less than would be emitted if an LTE mobile 'phone network was supplied to give the required capacity. The power consumption of the network based equipment is lower than the power used in providing broadband communications using either optical fibre / VDSL or 3G / LTE mobile networks.

In due course the progressive roll-out of optical fibre and LTE mobile networks may reach a household with a BATS installation. If the user wishes to switch to this alternative network then the BATS system can easily by recovered and installed elsewhere.

BATS can also play a key role in adapting to major incidents, for example flooding caused by climate change. The system can be solar powered and can provide an excellent service with communications direct to the satellite: this would be important if terrestrial communications were damaged by the major incident. Indeed some commercial organisations will want to install BATS just to give them the additional security of always available communications, should their primary communications system fail.

7.6.6 Proposition for Politicians focused on greater Regional Autonomy

Deployment of BATS is an important step to ensure that the potential of all people and organisations that are based in a region which is sparsely populated. BATS can be deployed very quickly, giving an immediate ability for people to become full members of knowledge economy. Ultimate deployment of optical fibre based communications will be a major long term goal, but BATS gives the ability to deliver the benefits of broadband access in the short term. The EU has identified high speed broadband access as a key enabler for the Europe 2020 Vision. BATS creates a way to ensure that everyone that wants to be part of the 21c knowledge economy can be full member, irrespective of where they choose to live.

Universal access to broadband communications will support the caring society in rural areas, improving community spirit and local self-support by providing excellent communications within a local area. More effective healthcare and social services could be developed and offered that make full use of the reliable broadband connectivity. These services will enable people to be safely cared for at home, rather than in hospital ensuring that the right kind of care can be provided in a cost effective way based on information that could not be collected without the use of broadband. The connected big society will function much more efficiently, making the idea of living in a rural location much more attractive.

Broadband communications is also a key enabler to economic growth. People living in remote rural areas may find it uneconomic to travel to employment at an organisation that may be many miles away. This typically results in people moving away from rural areas, reducing the amount of economic activity needed to sustain other people living in the rural area, or they may find themselves in local employment where they do not deliver their potential. In either case there is a trend to creation of economic black-spots. Provision of broadband to these areas can reverse that trend, stimulating economic growth in areas where housing is relatively low cost, but has become unpopular because of the lack of local employment. Economic stimulation of an area should prove to be much more cost-effective.

Provision and use of BATS is slightly more expensive than for routine provision of broadband in an urban environment. For those locations where BATS is the most cost effective way to deliver broadband connection in the short term a modest level of financial support would enable users in traditionally underserved locations to receive a broadly equivalent service to that received in urban areas at the same cost. This vital rebalancing will ensure that people living in more remote areas are not disadvantaged, and that their full potential can be unleashed.

The BATS service could be run as a separate venture or by the incumbent operator. If the incumbent operator receives the grant then they may prefer to use the grant to subsidise roll out of fibre over the installation of BATS. Acceleration of the roll out of fibre is to be encouraged, but not at the expense of delay whilst people could have been making full use of the BATS service.

Setting strict targets for the time taken to deliver the service will ensure that BATS is used appropriately where service is needed urgently, even if this has to be recovered and redeployed to another site should an optical fibre derived service become available during the life of the BATS service.

7.7 Supply-side Organisations

The implementation of the BATS type service will require many of the BATS partners to cooperate and to invest in creation of the new service. Each partner will need to see an attractive business case to justify their investment. Key stakeholder roles are:

- Development of the ultra-high capacity “1Tbps class satellites”;
- Investment in these satellites by the satellite service operator;
- Development and manufacture of the IUG and the satellite modems;
- Investment in the terrestrial infrastructure including Ground Stations and INGs by the service operator;
- Investment in customer service systems by the service operator (already considered in section 7.2 & 7.3.

The justification for investment by each of these stakeholders needs to be considered. in each case the issues to be considered will be:

- Potential market available;
- Cost benefit analysis – how much of the revenue will that stakeholder receive;
- Risks: lack of market take up at the intended price, competitor activities.

7.7.1 Spacecraft manufacturers

Issues

Considerable research and development investment will be needed to be able to manufacture and launch a communications satellite with the capacity that is required for BATS. Satellite manufacturers will need to see stability of the requirements and strong evidence of the number of these satellites that will be needed, together with assurance that the Satco will be able to fund the required investment.

Value Proposition

The traffic demand for satellite broadband is expected to grow six-fold in the next 5 years (by 2020). This is due to an increase in number of broadband subscribers (mainly driven by increasing broadband penetration rates and service take-up across the European countries), and a shift towards more bandwidth demanding applications and services during the coming years. In order to be able to serve this increasing demand, next generation High Throughput Satellites (HTS) will need to be able to offer both higher throughput and higher data rates, flexibility to adapt to traffic demand across the coverage area, and at the same time decrease the cost per transmitted bit. So the satellite manufacturers are already convinced of the need to develop HTS.

In addition, the appearance of the BATS Intelligent User Gateway (IUG) in the market is expected to ramp up the increase of traffic demand for satellite broadband as it will be addressed not only to areas without any kind of terrestrial broadband coverage, but also to areas in which the required data rates and availability will only be met by the integration of satellite and terrestrial networks. BATS does not require any additional functionality but does increase the size of the expected market and hence improves further the business case for developing HTS.

LEO “mega-constellations” are currently exciting a lot of interest in the satellite industry. The geography of Europe is such that the next generation of GEO HTS can provide the six-fold increase in traffic volumes needed whereas no LEO system currently being envisaged for the 2020 to 2025 timeframe can supply this. Please see section 2.8.1 for more detail.

7.7.2 Satco

Issues

The Satco has to purchase the satellite and gateways, and relies upon future revenue paying for this investment whilst making a sustainable business model. A major concern is the possibility that user take-up of the service may be slower than anticipated which could create major cash-flow challenges. They also need to be assured that the service life of the satellite will be sufficient to payback the investment and deliver a profit.

The different ways the satco can raise the capital necessary are considered in section 2.5.

Value Proposition

The BATS project has shown there is a very real need for a solution to provide service in under-served regions across Europe and that a hybrid satellite terrestrial solution can provide a viable solution.

The business case analysis has identified that a viable business plan can be foreseen that provides a viable return on investment over a fifteen year period. This is seen as a high volume low margin business to be able to meet required wholesale pricing which requires as much automation as possible, for example using standardised OSS interfacing to the MTOSI specifications. The investment of €959M detailed in section 2.6.3 where the investments need to be repaid over 15 years at 6.5%, with 1M HH (table 6-7 in BATS D5.2) has a cost of €13.71 per month). A high volume gross margin of 10% has been assumed elsewhere therefore the volume wholesale price would be €15.25 per HH per month. Of course there operational expenditures too, adding these leads to a cost per site in the region of €20 per month and a slightly larger gross margin may be needed.

To build the volume service will need to be started prior to the launch of dedicated new spacecraft. The ideal approach being to start a BATS like project being to start with one in country partner organisation to grow the proposition and develop the service design. This partner would need to have a brand that is well-known in the region(s) and who already sell terrestrial services. It should also be in one of the top few countries based on predicted BATS demand. They should also have god relations with the local and regional development authorities to be able to access a Voucher+ or similar scheme.

Once the product is implemented in the first country similar partners should be sought in the remaining top ten countries and service launched in several of these. At the same time detailed design of the satellites should commence. The first satellite focussed primarily on the top 5 countries and the second on the remainder both have non-homogeneous user beams to focus capacity where the demand is highest.

Funding for these satellites would benefit from support from a mechanism such as the EFSI to minimise the risk and therefore the cost of financing the satellites, the gateways and the backbone network.

The satco would also need to champion the development of the IxGs that would suitable and appropriate for the envisaged service and market volumes in the different phases.

7.7.3 Equipment manufacturers (IxGs/ VSAT/ hubs, antennas)

Issues

Equipment manufacturers need to make a profit on the equipment that they produce. That profit needs to cover materials bought, assembly cost, marketing and sales cist, plus the R&D investment. A larger volume and higher price helps to justify more R&D. So certainty about sales volumes and price sensitivity are key factors in de-risking and justifying the commitment to develop and manufacture new systems.

Other factors relate to competition, it is likely that the service providers will require second sourcing for all the subsystems used and hence competition. It may be that the licensing of IPR to a second supplier may be delayed until the service begins to take off. This situation encourages further investment in the product to ensure that it is superior to any competitor's product.

Further R&D is needed to develop cost reduced, energy optimised, systems that fully meet the user expectations. The R&D investment is easily justified if there are firm orders, but there is likely to be uncertainty on the size of orders until the viability of the service has been established.

There is a virtuous circle when there is evidence that there will be a real demand (ideally a firm order) for a large number of systems. The guaranteed large order justifies a higher level of investment which will create an improved product at a lower cost, which in turn will stimulate more demand.

Thanks to the dissemination activities, the interest from the market has been confirmed. While the Field Trials have raised significant limitations, it has been possible to progress the technology to address them and obtain a significantly superior solution. Interest has come from Satellite Service Providers (SSPs) but also from (fixed) Communications Solution Providers (CSPs) looking at new revenue streams to increase their Average Revenue Per User. The promise of increasing both the Performance and the User Experience is novel enough for them to ask to experiment the solution. While the size of this market is yet to be assessed, requests for the Evaluation Kit built have already been received. The main features are the same between the SSP and CSP market but the interfaces and the packaging, for example a one-way satellite system for low cost sites. A full definition of the product will be available by Q2 2016 before launching the development itself.

Value Proposition

The prototype IUGs and ING were based in adapting a pre-existing product. This allowed design work to concentrate on the novel features and reduced the amount of unproven equipment being used. Further development of these products is needed to be able to launch a service. Current designs of antenna and satellite modem could be used for an initial service launch.

An incremental development is foreseen, such that initial IUGs will deliver the basic level of functionality needed. Further development will be possible as profits come in from sale of the initial product. These later systems may offer better energy efficiency and more advanced control of the local cache.

With this approach, the development and manufacture of BATS IUG, and satellite modems will deliver an attractive business case.

The BATS project has created the environment to generate innovations that differentiate it and puts its output in a unique position on the market. It was the opportunity to patent innovations such as the Traffic Classification, Link Estimation and Traffic Distribution algorithms. Those functionalities implemented on top of the industry-selected MP-TCP multi-link solution is the main value proposition that will create the business from the project‘s output and a significant return on investment.

Given the number of HH envisaged (around 1M for the baseline satellite mission), this is a good size market for any VSAT manufacturer (a VSAT consists of the antenna, radio equipment and modem/router).

7.7.4 Provision and operation of ground segment systems

The BATS service will make use of dedicated satellite systems, satellite modems and Intelligent User Gateways at the user's premises, together with connection to any existing xDSL service of mobile 'phone service. The Satco will manage the investment in the satellite, and the users will purchase IUG, satellite modem and an antenna, probably with a modest amount of state aid.

However, we also need an organisation to invest in the Satellite gateway radio equipment, VSAT hub equipment and the INGs installed in the infrastructure. This is in addition to the investment that the incumbent telco will make to provide connectivity to their network.

It is not clear whether this investment will be made by the BATS operator, or a further actor in the supply chain. Possible options are shown in Figure 7-1 to Figure 7-3.

Issues

Provision of ground segment systems needs to be de-risked. There is a need for further development of ING technology, potentially to include additional signalling between the ING and IUG that will enable the IUG to spend more time in standby with a wake-up message being sent by the ING if the user satellite modem needs to be revived from standby in order to receive multicast information.

The provision needs to be scalable such that more equipment can be installed in a timely way as demand is seen to increase.

If the BATS service provider in a country also owns its own network in that country, for example R, then it would be expected that they would make the necessary investment in the ground segment needed to implement BATS, buying in sub-services from others where appropriate. However, if BATS is to be provided by a Virtual Network Operator, then they would need to have an organisation to provide the ground segment systems. If there is not a good business case for such an organisation, then this places restrictions on the ability of a VNO to provide a BATS service.

Ground system may be within the responsibility for a BATS operator in each country. It includes Satellite gateway radio equipment, VSAT hub equipment and the INGs installed in the infrastructure. INGs are the main service element to be managed by the BATS operator. It is a critical element that supports all user types, including government offices in rural areas connected to the BATS system,

As it is a key part of the service quality, and as it will have to be paid by users anyway, it is advisable not to introduce a new margin segment in the chain, by making the ground system a responsibility of the main BATS operator in each country. In a big country, it is possible that a BATS operator who has created a ground system creates also a wholesale service for distributors, but this role alone (to be a provider of a ground system) is too small as per country basis to be sustainable A pan European ground system provider, a role that could be assumed by a specialised business telco-like entity like CDN providers is another possibility. However, again this introduces a profit entity in the chain. A better option could be a joint group of national operators that act in a coordination forum to support the whole ground segment system.

Value Proposition

The investment in the ground segment for BATS is easily justified for an incumbent offering BATS, as they will be using the network that they have installed for other purposes. Where BATS is being offered by a challenger, the incumbent may be called upon to provide the ground segment systems, or parts of these systems on a wholesale basis. Such business should still be profitable.

The investment for ground systems can be also be justified if major satellite and DSL operators collaborate. Major satellite operators may have already invested in systems to provide bundled Internet and Satellite TV services, as in the cases of the satellite operators in Turkey. This collaboration can be easily extended to provide BATS service by distributing BATS capable devices and closer integration.

7.8 Investors

7.8.1 Issues for investors

Capital funding will be required to support several stakeholders that have been identified in the value chain. Some of this may come from company resources or from government grants but banks, pension funds, private equity funds etc may all need to be invited to provide investment capital. Any organisation that has to invest capital will need to see a high probability of a significant return on their investment, together with low risks that the service might fail technically or commercially. The external investors will be unable to influence directly the success of their investment. So they must see evidence of strong customer demand for the service and little evidence of any significant competitive threats.

They also need evidence of maturity of the technology, successful trials of the technology and strong capabilities, no weak links, and diversity of supply. If the business case is not yet robust, then it may be appropriate to turn to the European Commission to invest in the further development of the concept to the point that it has and much lower risk level, that is acceptable to the potential investors.

7.8.2 Value Proposition to Commercial Investors

The BATS project addresses the demand for and commitment to deliver next generation access (NGA) in 2020 and focusses on the needs of the underserved. This is consistent with the generally held approach of using satellite to deliver service at the edge and move this away from the edge towards the centre to meet the expanding terrestrial NGA networks.

The BATS core network investment including the spacecraft meets the criteria for the European Fund for Strategic Investment in providing infrastructure in support of the EC NGA directive. This will ensure the investment risks are minimised. Using the figure of €959M and a loan with a rate 6.5% per year over 15 years results in a total cost of €2 467M, a total return of €1 508M.

Satellite fill rate will be maximised as there is a demand to deliver the NGA service; improved by using a phased launch of capacity to fill the first satellite capacity with a few key partner in the countries with the highest demand; and by working with partners who can access local Voucher+ schemes to remove the initial cost barrier to purchase for the end users and keeping the ongoing service cost as affordable as possible.

LEO “mega-constellations” are currently exciting a lot of interest in the satellite industry. The geography of Europe is such that the next generation of GEO HTS can provide the six-fold increase in traffic volumes needed whereas no LEO system currently being envisaged for the 2020 to 2025 timeframe can supply this. See section 2.8.1 for more detail.

7.9 Summary

Key messages have been identified for the following stakeholders:

- End users;
- Content delivery network owners;
- Incumbent and Challenger operators;
- Supply side organisations;
- Investment community.

In summary, the following key messages can be noted:

- There is demand for next generation access broadband at an affordable price;
- This service is required for both social inclusion and local wealth generation;
- BATS can deliver such a service in underserved regions at a price that a satellite operator in partnerships with a terrestrial operators can sustain;
- BATS requires a pan European commitment with local partners who offer terrestrial service;
- BATS benefits from both infrastructure investment support and local inclusion programmes;
- HTS satellites are needed to provide the density of data traffic calculated as LEO satellites cannot provide this.

8 Summary and conclusions

8.1 Summary

8.1.1 Service delivery assessment – satco lead

By their nature HTS requires the use of satellite gateways to maximise throughput, the BATS analysis also requires the use of gateways with one or more resellers selling service plans to end users. In addition a backbone network to POPs with INGs is required to combine the satellite and terrestrially routed data.

A review of the cost sensitivity of the satellite design was held. This found that:

e) The cost savings to serve a reduced number of countries with the 2020 baseline satellite design will be minor if the initial design is retained (2 satellites);

f) The link budget analysis is not conservative and the scenarios used are based on predicted major improvements;

g) The satellite and launch costs are best estimates from team and include predict reductions in space hardened components and in launch costs.

If a single satellite was launched the costs would nearly halve, but if the fill factor was the same then the cost per household served would not change significantly. A 25% increase in satellite costs would result in a 10.4% increase in service costs, the same level of increase in gateway costs would result in a 9.8% increase in service costs.

The backbone costs are based on the best estimates. If less user beams are required then less gateways and backbone connections are required. However as this is a relatively large number of gateways if one halves the number of user beams one halves the number of gateways and the cost per household served would not change significantly. A 25% increase in backbone operating costs would lead to a 6.4% increase in service costs.

As no satellite operator has a credible consumer brand and the costs to create across the EU27+T would be prohibitive the BATS satellite operator would need to work with partners in each country. These partners would need to bring the brand recognition, service management systems along with the terrestrial parts of the hybrid access network. This analysis found that building relationships with partners takes time and effort on both sides, and that a few countries tend to dominate demand. This led to proposed plan to stagger service launch across a number of phases. Targeting first the countries with greatest demand and need for BATS, and starting these relationships prior to launching any new spacecraft. Accordingly an initial analysis on a 2016 service cost has been made.

A variety of different funding schemes were analysed and it was found that use of a scheme such as the European Fund for Strategic Investment to minimise the cost of money along with regional use of Voucher+ schemes to help the end users would maximise the effectiveness of the BATS service across all countries. The timing of these investments was analysed against a phased deployment of BATS was calculated.

The implications of new entrants using LEO satellites or HAPs was considered. LEO services such as OneWeb cannot deliver as much bandwidth over Europe as the BATS' phase 1 GEO HTS. LEO can however deliver the low latency low bandwidth traffic. Therefore it is more likely that such a LEO service would be complementary to BATS rather than competing directly by using the LEO link in unserved regions instead of DSL for the low latency applications combined with the GEO link for the high bandwidth demand and multicast data. At the current time there do not seem to be any plans to use HAP as the delivery platform for broadband access services to households. Facebook has elected to pursue a HTS approach for Africa and Google's Loon project is focussing on supplementing 4G service coverage in very remote regions providing access to smartphones and similar devices.

8.1.2 Service delivery assessment – MVNO lead

This analysis looked at the Galicia region of Spain as a representative example of such a delivery.

The Spanish market has seen a major move to a convergent or multi-play delivery of telecom and (TV) media delivery driven at least in part by the impact of the economic crises. A typical converged package retails for €65 (the Fusion package in September 2015) and this sets the price expectations. . A maximum uplift of €20 could be sustained making the maximum price for the bundle of €85.

The business model for providing a similar service was created to deliver a similar package using BATS to provide the high speed Internet access. A variety of different BATS bundles was identified and the D-BATS case used for the analysis. This would provide broadband Internet with mobile phone service, fixed phone line and a basic TV package. Based on the baseline cost assumptions for the core BATS service this would cost just over €95 and would be expected to be sold at around €65 to €85.

A variety of assumptions are built in to the mode based on comparable work such as government grant towards the initial customer premise one-off costs, the churn and so on. Detailed regional data on the Galician market was used in terms of the number of households, the proportion residential, the number of these empty and the proportion with DSL service below 6Mbps. The roll-out to this market was assumed to take four years.

From this a cash flow analysis showed that without cost reductions the business plan showed a negative cash flow. The sensitivity analysis showed that a reduction in BATS core network costs consistent with more focussed sales and lower than the baseline traffic levels (consistent with usage levels during the trials) would help the business case breakeven. Reductions in the wholesale cost of DSL in the regions and/or support towards service costs using the voucher+ scheme would make a viable business plan.

8.1.3 Field trials and the business case

The service findings can be summarised as:

- There is need and interest;
- End users value service stability above almost everything else;
- Detailed service definition required for each service;
- End user expectations need to be very carefully addressed;
- Tight integration between element providers and the lead organisation.

No real information on price elasticity can be seen given the small sample size, the nature of the trial and the issues addressed.

Traffic levels seen are significantly lower than the AM figures. The proportion routed via satellite is reasonable consistent with the theoretical model in the D5.2 cost benefit model.

8.1.4 Commercial viability

Complementary viable solutions can be seen for the in country operators and a satellite operator.

A phased approach starting in a single country in 2016 is needed. Given that the current prototype IUG has been implemented on a small business grade router the service would start with a consumer service using a simpler solution such as protocol based routing implemented in a standard consumer router; complemented by a business service using a more developed and commercially tested IxG implementation. The latter being required to provide a road map to the proposed 2020 implementation.

This would be then developed by adding more countries and more developed customer premise IUGs.

This would generate the relationships and demand to justify the investment in satellites and ground segment.

8.1.5 Key messages

The commercial viability requires the cooperation of several stakeholders within the supply chain. Thirteen roles have been defined within and supporting the supply chain including operators, manufacturers and the political environment. In practice some stakeholders will take responsibility for several of the roles in the supply chain.

Representative separation of responsibilities have been considered within section 7, where we present the key issues that potential stakeholders are expected to consider when taking on a role, together with the value proposition that should convince potential stakeholder to take responsibility for their part of the BATS supply chain.

8.2 Conclusions

8.2.1 Service delivery

Satco lead

A viable plan can be foreseen by phasing the approach to focus on the target countries initially and by growing the service on standard satellites. This plan is dependant on working with partners in these countries and others that already have terrestrial infrastructure that falls short of the NGA targets in some of their regions. These partnerships should be developed well before new satellites are launched to develop the systems, technologies and relationships.

There are good reasons for maintaining focus on the use of HTS in geosynchronous orbit to deliver services to households in the unserved and underserved regions of Europe as LEO based solutions can't provide sufficient capacity and HAP based solutions focus more on access to smartphones rather than households. BATS provides a good solution to use HTS capacity with a good terrestriallatency for latency critical applications.

The BATS satellites need not be launched at the same time especially if the first was focussed towards the top few countries (measured either by demand or revenue). The satellites should be designed to better fit the predicted demand with some beams having more capacity than others.

Government support to de-risk the capital expenditure investment in satellites and core network will keep the costs to a minimum. A voucher scheme to support the end users in underserved regions will significantly grow the potential target market in the country or region where this is made available.

A wholesale price in the range €20 to €25 per month has been concluded as reasonable depending on detailed assumptions and requirements.

VNO lead

There are a number of ways to make a profitable business case in Galicia despite the baseline model showing a shortfall. These include the following:

- **Reduce satellite costs:** The model relies on the baseline wholesale costs of €33.04. Using the focussed sales assumptions in D5.2 sees a reduction to €17.87 (a 46% reduction). Further reductions may result if the traffic levels are lower than the baseline model which seems likely from the 20% traffic levels seen in the field trials;

- **Eliminate the 3G/4G element:** These costs are not regulated. The product works well enough with a single terrestrial path; alternatively one could eliminate the xDSL component;
- **Lobby for DSL regulated cost reduction in BATS areas:** As these underserved areas are those where no realistic alternatives are available this may be something the regulators would look favourably at;
- **Obtain grants to offset the capital expenditure:** Along the lines of the Voucher+ scheme introduced in section 2.5.1 providing support both for the initial one-time costs and the ongoing service.

Telco lead

The analysis in section 3 identified that there is no major difference between the case for an MVNO and for the incumbent telco. The larger differences will be driven by national and regional factors such as:

- Wealth of households;
- Availability, quality and internal charged cost of the terrestrial broadband;
- National and regional political pressure and prioriities.

8.2.2 Field trials

It is clear from the trials that an integrated service is of interest as long it is correctly defined, communicated, implemented and tested.

The data usage levels seen in the trials suggest that some reduction in volumes for 2020 is realistic.

8.2.3 Viability

To be ready for a full service in 2020 with new next generation HTS at least one in country operator in one of the key BATS demand countries and satellite operator need to work together to develop an initial service. It is likely that a simplified service will be implemented initially for the consumer along with a further developed IUG for business.

8.2.4 Key messages

There are many different messages for the many different potential stakeholders identified. The common themes are that BATS;

- Offers a stable next generation broadband access service solution for underserved regions;
- Has a viable phased business plan acceptable to satellite operators and terrestrial operators;
- Is competitive financially and environmentally with identified alternatives.

8.3 Outputs and future work

The key outputs from this will be with the exploitation plans; especially for Avanti, OneAccess and R (in alphabetical order and not significance).

9 References

[1] The View from JUPITER: High-Throughput Satellite Systems – Hughes.

[2] Avanti products, http://www.avantiplc.com/products-partners/products .

[3] http://avonlinebroadband.com/business-broadband/.

[4] http://ec.europa.eu/languages/policy/linguistic-diversity/official-languages-eu_en.htm.

[5] http://ec.europa.eu/public_opinion/archives/ebs/ebs_225_report_en.pdf .

[6] http://ec.europa.eu/eurostat/statistics-explained/index.php/GDP_per_capita,_consumption_per_capita_and_price_level_indices .

[7] http://www.ispreview.co.uk/index.php/2015/06/30mbps-bduk-satellite-broadband-pilot-begins-in-n-ireland-and-scotland.html .

[8] https://help.netflix.com/en/node/14164.

[9] http://www.avantiplc.com/sites/default/files/Completion+of+HYLAS+4+financing++Announcement+and+Q&A.pdf.

[10] http://www.cip-bresat.eu/ .

[11] http://ec.europa.eu/priorities/jobs-growth-investment/plan/efsi/index_en.htm.

[12] http://ec.europa.eu/priorities/jobs-growth-investment/plan/index_en.htm .

[13] http://www.eib.org/about/invest-eu/index.htm?lang=en .

[14] EIB Media background document 26 June 2015.

[15] http://www.quickmba.com/strategy/porter.shtml.

[16] https://en.wikipedia.org/wiki/Porter_five_forces_analysis.

[17] ESA Statement of work “Strategic positioning of the European/Canadian satcom industry”, AO-1-8480/15/NL/AD.

[18] www.leosat.com .

[19] http://www.analysysmason.com/About-Us/News/Insight/LEO-satellite-broadband-Apr2015/.

[20] “OneWeb selects Airbus to build 900 Internet satellites”, http://spaceflightnow.com/2015/06/15/oneweb-selects-airbus-to-build-900-internet-satellites/ .

[21] Mobile Internet from the Heavens, Farooq Khan, (Submitted on 9 Aug 2015) http://arxiv.org/abs/1508.02383.

[22] Spectrum filing wiki http://www.spectrumwiki.com/wiki/DisplayEntry.aspx?DisplyId=229.

[23] http://www.dailywireless.org/2014/06/02/fleet-of-leo-comsats-for-google/ .

[24] http://www.noaa.gov/ocean.html .

[25] http://forobs.jrc.ec.europa.eu/products/gam/images/large/shipping_laness.png.

[26] http://www.spacedaily.com/reports/Elon_Musk_Wants_to_Launch_4000_Satellites_to_Provide_Global_Internet_999.html.

[27] http://www.telegraph.co.uk/technology/google/11357291/Google-to-invest-in-SpaceX-internet-satellite-programme.html.

[28] http://www.bizjournals.com/seattle/morning_call/2015/07/elon-musk-expresses-new-caution-about.html.

[29] ftp://ftp.cordis.europa.eu/pub/ist/docs/ka4/mob_9th_high.pdf .

[30] http://www.ofcom.org.uk/static/spectrum/fat.html .

[31] http://techcrunch.com/2014/04/14/google-acquires-titan-aerospace-the-drone-company-pursued-by-facebook/ .

[32] https://plus.google.com/+ProjectLoon/about .

[33] http://www.google.com/loon/ .

[34] https://www.thalesgroup.com/en/worldwide/space/magazine/stratobus-halfway-between-drone-and-satellite.

[35] https://airbusdefenceandspace.com/newsroom/news-and-features/another-first-for-airbus-zephyr-7/.

[36] November 2015 advertised offers by R in Galicia.

[37] The Digital Agenda for Europe, http://ec.europa.eu/digital-agenda/ .

Note all links valid at the time of editing.