ANACOM AUTORIDADE NACIONAL DE COMUNICAÇÕES

# FINAL DECISION ON

## Wholesale markets for voice call termination on individual fixed networks

## FIXED TERMINATION COSTING MODEL

**– DECEMBER 2016 –**

**– PUBLIC VERSION –**

ANACOM

AUTORIDADE
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ANACOM AUTORIDADE NACIONAL DE COMUNICAÇÕES

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# 1 Introduction

## 1.1 Wholesale markets for voice call termination on individual public telephone networks at a fixed location – Price control obligation

In the framework of the analysis of wholesale markets for call termination on individual public telephone networks at a fixed location it is common to impose a price control obligation, with termination prices set on the basis of costs obtained from the application of a "pure" LRIC costing model. It is deemed in this context that this methodology fits the national reality, taking namely into consideration that, in a perspective of static efficiency, it involves a minor distortion of retail prices and, in a perspective of dynamic efficiency, it contributes to provide better competitive conditions in downstream retail markets between operators with different market shares, as well as to increase consumer welfare.

As regards the choice for a "pure" LRIC model, not only is it a practice adopted by other National Regulatory Authorities (NRAs) both for fixed or mobile termination, but it also finds support in the implementation of European Commission (EC) Recommendation[1] on the regulatory treatment of fixed and mobile termination rates in the EU (hereinafter EC Recommendation), and there seem to be no objective reasons or specific national circumstances for an approach other than the one already applied in the scope of mobile network termination.

As such, Autoridade Nacional de Comunicações (ANACOM) concludes that the "pure" LRIC costing methodology is the most appropriate costing option for the determination of fixed termination prices in Portugal, in the framework of an obligation for cost orientation of prices, thereby also ensuring consistency with the approach implemented at the time of the development of the costing model for the calculation of mobile termination costs. Naturally, the development of the model and respective parameters took into consideration national specificities and information requested from national operators, without prejudice to efficiency concerns which were naturally incorporated in the model, as follows from the application of the EC Recommendation, which is the reference for the implementation of the "pure" LRIC model.

In fact, the aforesaid Recommendation aims to harmonise at EU level the implementation of cost accounting principles in termination markets, establishing a common approach for

[1] Commission Recommendation of 7 May 2009 on the Regulatory Treatment of Fixed and Mobile Termination Rates in the EU, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:124:0067:0074:PT:PDF

voice call termination on individual (fixed and mobile) electronic communications networks, promoting efficiency and sustainable competition and maximising consumer benefits in terms of price and service offers.

For the purpose of the developed LRIC model, the EC Recommendation considers that the termination service provided to third parties is the relevant increment for calculating the cost of voice call termination on individual fixed networks.

NRAs are thus required to establish the difference between the total long-run costs of an efficient hypothetical operator providing its full range of services and the total long-run costs incurred by an efficient hypothetical operator providing the full range of services considered, except for the call termination service supplied to third parties. This difference consists of the incremental (or "avoidable") costs associated to the provision of the call termination service, which divided by the number of termination minutes, results in the value of the unit cost. The Recommendation thus excludes from this calculation any common costs incurred by operators in the scope of their activities, as well as other types of increments associated to the recovery of costs that are not related to the termination traffic.

It is important to note that fixed termination costing models are being implemented in various Member States in compliance with the EC Recommendation guidelines, many NRAs having taken (final or draft) measures based on coherent costing models that are compatible with the EC Recommendation, as developed in the market analysis document.

### 1.2 Development and implementation of a fixed termination costing model

ANACOM launched on 09/10/2012 a public tender in order to develop and implement a fixed termination costing model, having that project been awarded to the Analysys Mason Limited consulting firm (hereinafter designated as "consultant") on 05/03/2013.

It is important to emphasize that, in the time gap between the award of this work to the consultant and the draft final decision, ANACOM carried out, in addition to the necessary internal discussions, various interactions with stakeholders, so as to collect the respective opinions. In particular, the collection of operator information required for the model and the workshop held on 13/12/2013, opened to the sector in general, for the presentation and preliminary explanation of the characteristics of the hypothetical operator which this Authority intended to model, and open discussion thereon, stand out. Moreover, general

characteristics of the model that was developed were also the subject of a specific public consultation, on the methodological definition of the model to be implemented (hereinafter "Methodological Consultation"), which took place between 29/11/2013 and 15/01/2014[2], meant to collect contributions not only from fixed operators, as well as from the rest of the sector and other stakeholders, five contributions having been received, which were duly integrated in the respective report approved and published at ANACOM's website.

Still on the Methodological Consultation, it should be emphasised that some of the comments made by stakeholders in the scope of that consultation are invoked throughout the present document, although ANACOM does not intend to fully and faithfully replicate these contributions. Stakeholders may consult the report of that public consultation, as well as non-confidential contributions received, at ANACOM's website.

In this context, the fixed termination costing model that was being developed on the basis of assumptions made available for consultation, benefitted from the analysis of contributions received in the meantime, a more robust result being thus achieved.

Further to procedures described above, ANACOM approved, by determination of 10 July 2014, a DD on the fixed termination costing model and the Methodological Consultation report. ANACOM placed the DD for public consultation between 14.07.2014 and 05.09.2014, contributions from seven bodies having being received within the deadline, the positions of which were summarized in the "Report of the public consultation on wholesale markets for voice call termination on individual fixed networks – Fixed termination costing model (hereinafter, "DD Report"). This report is an integral part of this decision.

Upon analysis of replies and whenever justified, ANACOM decided to introduce some alterations to the model, although specific, so that it corresponded as much as possible to the national reality.

Subsequently, on 28/10/2016, and under paragraph 1 of article 57 of ECL, ANACOM notified the European Commission (EC), the Body of European Regulators of Electronic Communications (BEREC) and National Regulatory Authorities of other Member States of the Draft Decision it intended to take for this market and of the costing model developed for this purpose.

[2] Public consultation on the methodological definition regarding the development and implementation of a fixed termination cost model, available at http://www.anacom.pt/render.jsp?contentId=1182536

Observations from EC were received by communication of 29/11/2016, not having been received any observations from BEREC neither from National Regulatory Authorities of other Member States.

With regard to the developed costing model, EC "calls upon ANACOM to update its cost model without undue delay with a view to ensuring that fixed termination rates in Portugal are forward-looking and set on the basis of the most recent data available."

ANACOM notes that the update of the costing model for measuring the cost of the fixed termination service had already been provided for at a date prior to the aforementioned notification, the intention to update the model within a 2-year-period having inclusively been referred in the public consultation report and prior hearing on the market analysis.

Additionally, and in accordance with this Authority's activity plan, the work focusing on the update of the costing model which supports the regulation of wholesale fixed termination prices will start in 2017.

ANACOM wants the available model, for which fixed operators contributed with relevant information, to provide support to the implementation of a price control obligation on operators with SMP in wholesale markets for call termination on individual public telephone networks at a fixed location (Market 3[3]).

For this purpose, ANACOM presents the "pure" LRIC costing model, developed in collaboration with the consultant (vide Annex 1). The "Documentation accompanying the fixed BU-LRIC model" (vide annex 2) is simultaneously made available, in order to allow, both to fixed operators and to stakeholders in general, an adequate understanding of the different technical parameters which characterize the modelled hypothetical efficient operator.

Moreover, and in parallel with a more technical component of the model, the consultant prepared the "Conceptual approach for a fixed BU-LRIC" report (vide annex 3) so as to allow an understanding of the rationale at the root of the different assumptions on which the implementation of this model is based.

[3] Market 1 according to Recommendation 2014/710/EC of 09.10.2014 (http://eur-lex.europa.eu/legal-content/PT/TXT/PDF/?uri=CELEX:32014H0710&from=PT). Note that the DD was published prior to the publication of this Recommendation, at a time Recommendation 2007/879/EC was still in effect, reason why, in the scope of the present report, reference is made to markets according to the wording provided for in that Recommendation (http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2007:344:0065:0069:pt:PDF)

# 2 Concepts and assumptions of the developed costing model

## 2.1 Intrinsic model characteristics

Electronic communication networks developed by operators are complex systems, which are developed over time, incrementally, whenever it is deemed necessary. In that sense, the design of a network depends on different factors like, for example, the values of market demand, the services intended to be provided, the characteristics of the available technology or the demographic, geographic and orographic features of the area intended to be served.

Thus, a modelling exercise which intends to absorb the main features of above-mentioned characteristics will necessarily have to involve some degree of simplification of the underlying reality, though without moving away from the final objective of representing the national reality as much as possible.

In this sense, throughout this process, ANACOM, in close collaboration with the chosen consultant, was always concerned about balancing the benefits obtained by the increase of the degree of detail and precision introduced in the model, with the costs arising from its development, namely in terms of the necessary collection, validation and handling of the additional data and of the increased complexity of the model itself. ANACOM considers that the developed model reflects a good balance between the model development and maintenance costs and the modelled level of detail and precision.

## 2.2 General description of the model

Together with the consultant, ANACOM developed a costing model in order to apply the EC Recommendation in the scope of the regulation of the maximum price to be applied to wholesale call termination on individual public telephone networks at a fixed location (fixed termination market).

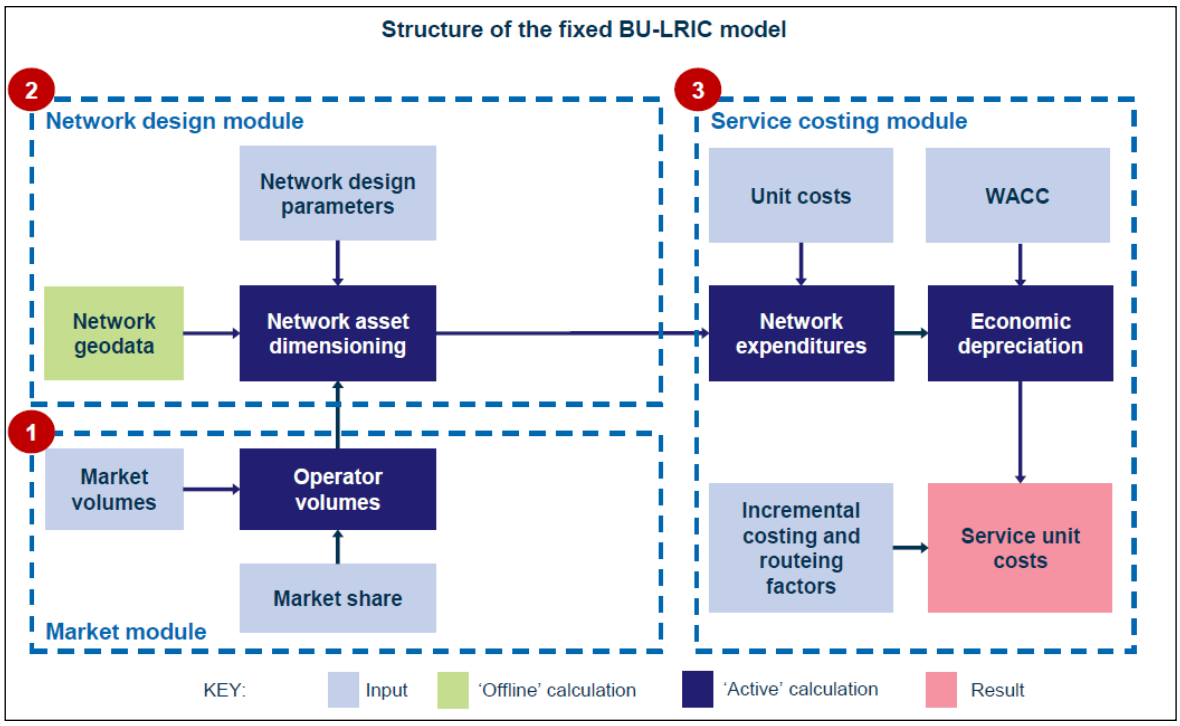
The EC Recommendation considers that the imposition by NRAs of a price control on wholesale voice call termination on individual (mobile and fixed) networks should be based on costs incurred by an operator that provides that service efficiently. This efficient cost should be obtained by using a costing model of long-run incremental costs (LRIC) based on the bottom-up methodology, which has the fixed termination service provided to third parties as the relevant increment.

NRAs must thus develop a bottom-up LRIC costing model which allows the calculation of the total long-run costs of a hypothetical efficient operator providing the full range of services taken into account and the total long-run costs of a hypothetical efficient operator providing the full range of services taken into account except for the voice call termination service supplied to third parties. This difference consists of the incremental (or "avoidable") costs associated to the provision of the fixed termination service, which divided by the number of termination minutes, results in the value of the unit cost of providing that same service.

In brief, the model (*vide* Figure 1) calculates the costs of an efficient operator in Portugal, modelling the network which would be required for the supply of all services traditionally offered by operators in this market.

Subsequently, the model calculates the costs of the efficient operator, considering the traffic of all services offered by the efficient operator, except for the fixed termination service provided to third parties.

**Figure 1 – General description of how the model works**




Source: "Documentation accompanying the fixed BU-LRIC model" prepared by Analysys Mason

The developed model is generally sub-divided into three main modules: (i) market module; (ii) network design module, and (iii) service costing module.

The market module aims to calculate the number of subscribers and traffic for the modelled operator. Historical data and forecasts are used in the determination of the number of subscribers and traffic per service and geotype (market volumes), as well as the market share defined for the modelled operator.

The network design module calculates the number of network assets to be purchased over the modelled period. This module uses geographical information to analyse and optimize routes (network geodata), using for the purpose a set of parameters (network design parameters) related to coverage, busy-hour traffic, switch capacities, network topology, etc. This module also uses results obtained in the market module, that is, the number of subscribers and traffic of the modelled operator, in calculations described above.

On its turn, the service costing module calculates the "pure" LRIC and/or LRAIC+ unit costs, on the basis of the number of network assets calculated by the network design module, as well as of the unit costs of equipment, WACC, incremental costs and routing factors.

The difference between costs calculated by the model (service costing module), for scenarios with and without termination, taking economical depreciation into consideration, the estimated evolution of fixed termination traffic and the estimated evolution of equipment cost, reflects the incremental cost of the fixed termination service provided to third parties, which divided by the volume of minutes of fixed termination traffic provides the cost per minute of that service.

It is important to emphasize that it is not generally possible to analyse in detail each of the technical characteristics implemented in the model in an isolated manner given that independent variables are not usually at stake, one or more variables showing in fact strong co-relation. In this sense, the description of how the constructed model works should be the subject of an integrated analysis.

Additionally, given that the complexity and technical depth of some of the modelled key factors could make the reading of this document difficult, whenever a more detailed model operation description is required, reference is made to technical documents prepared by the consultant, in annex to this Final Decision:

- **Annex 1** – The LRIC costing model developed in collaboration with the consultant, which is deemed to be the most appropriate for supporting the regulation of prices to be set in the scope of the price control obligation;

- **Annex 2** – The "Documentation accompanying the fixed BU-LRIC model" that contains more detailed information for an adequate understanding of the different technical parameters taken into account to characterize the modelled efficient hypothetical operator;
- **Annex 3** – The "Conceptual approach for the fixed BU-LRIC model", prepared by the consultant, which presents the rationale at the root of the different assumptions on which the implementation of this model is based.

## 2.3 Characteristics of the modelled hypothetical operator

The different principles to be considered in the development of the fixed termination costing model can be aggregated into four different dimensions, which were already the subject of public consultations referred to in section 1.2 – Development and implementation of a fixed termination costing model, which are related to:

- Operator;
- Technology;
- Services;
- Implementation.

### 2.3.1 Operator

#### 2.3.1.1 Type of Operator

The definition of the type of operator to be considered in the fixed termination costing model is of a fundamental importance in the subsequent determination, either of the structure of the model, or of the parameters to be used.

In this sense, four options were assessed with regard to the type of operator to be considered in the fixed termination costing model, corresponding briefly to:

- **Option 1 – Operators existing on the market:** The fixed termination costing model to be developed considers the particular characteristics of fixed operators designated with SMP in the wholesale fixed termination market, simulating for each of those operators the cost of providing this service;
- **Option 2 – "Average" operator existing on the market:** The fixed termination costing model considers the particular characteristics of fixed operators designated with SMP in the national fixed communications market so as to model a representative operator;

- **Option 3 – Existing hypothetical operator:** The modelled operator is defined on the basis of similar or derived characteristics of real operators operating on the market, except for specific hypothetical aspects, which are adjusted (for example, the date of entry). Thus, the fixed termination costing model considers a hypothetical operator existing in 2013 characterised by the roll-out of the core network infrastructure based on NGN/IP technology in 2009 (date in line with elements known about the implementation of that type of infrastructure by national networks), supported on a modern and efficient network architecture, the provision of services to the customers starting in 2010;
- **Option 4 – New hypothetical operator:** The fixed termination costing model considers a new hypothetical operator that entered the fixed communications market in 2013, supported on a network architecture based on the most efficient technology available on the date of entry.

The "Conceptual approach for the fixed BU-LRIC model" (*vide* annex 3, chapter 3.1), prepared by the consultant, presents in greater detail various aspects deemed to be relevant with regard to the type of operator to be considered in the fixed termination costing model.

As far as mentioned options are concerned, ANACOM considers that **Option 1 – Operators existing on the market,** with the underlying development of a fixed termination costing model, associated with each of the current fixed operators with SMP in the fixed termination market, which would be intrinsically influenced by historical data and investment decisions, as well as eventual inefficiencies that may exist, is not consistent with the EC Recommendation, which provides for the modelling of an efficient hypothetical operator, which is why this option was immediately rejected for the purpose of the ongoing development of the costing model.

With regard to **Option 2 – "Average" operator existing on the market**, ANACOM finds it highly unlikely that an "average" operator, based on data and historical decisions of fixed operators designated with SMP, should be representative of an efficient hypothetical operator, such as the one provided for in the EC Recommendation, which is why this option was also not taken into consideration in the ongoing development of the costing model.

With regard to **Option 4 – New hypothetical operator,** ANACOM believes that this option should not be adopted in the model to be developed, given that it assumes a

hypothetical operator that starts the activity immediately with a traffic volume corresponding to the minimum efficient scale, an assumption which is deemed not to correspond to the inherent reality of the entry of a new operator into the fixed communications market.

It should be emphasized that most replies received in the scope of the Methodological Consultation carried out on this subject, although safeguarding the possibility of a change of approach in the future, expressed their support for the option proposed by this Authority (**Option 3**).

In the opposite direction, a contribution was received which did not support that option, considering that the option for an existing hypothetical operator presents some limitations with regard to (i) sensibility to the network's roll-out date and start of commercial activity; (ii) consideration, as a result of technological evolution, of redundant assets; (iii) inclusion of economic depreciation, which implies that the result will be completely dependent on the use prior to 2013. In that sense, it recommended that the Regulatory Authority changed the proposal presented in the scope of the public consultation to that of a new hypothetical operator (**Option 4**).

ANACOM considers that a new hypothetical operator should somehow correspond to the reality of fixed operators active in the Portuguese market. In this sense, the Regulatory Authority considers that without modelling an existing hypothetical operator, that can be compared to current operators, a new hypothetical operator would be more speculative and would make the modelling more difficult in terms of the data to be supplied to the model. Consequently, the adoption of a new hypothetical operator would result in an approach out of step with reality, compared to the approach of the existing hypothetical operator, given that: (i) it would not reflect the technology evolution of the last few years; (ii) it would only model the future; (iii) it would be more difficult to justify the use of all nodes in fixed networks, and (iv) it would be designed to start costing calculations at a specific date. As such, the modelling of an existing hypothetical operator, using for this purpose an efficient mix of currently available technologies and implementation, guarantees greater correspondence to reality.

Contributions received, in the scope of the DD associated with this decision, included no specific comments with regard to the modelled type of operator, having those contributions generically agreed with the option for the modelling of an existing hypothetical operator.

Therefore, ANACOM maintains its position to take **Option 3 – Existing hypothetical operator** into consideration, as it deems this option to best correspond to the national reality, involving an operator that rolls out its NGN/IP network in 2009 (date in line with elements known about the implementation of that type of infrastructure by national networks), supported on a modern and efficient network architecture, and starts the provision of services to customers in 2010.

**Type of operator**

Having above-mentioned options been assessed, and taking into consideration contributions received in the scope of the public consultation on the methodological definition of the model to be developed and of the DD, ANACOM opts for the modelling of an existing hypothetical operator (Option 3), that rolls out its network in 2009 and, in 2010, provides services to its clients. Five years on from the activity roll-out, the minimum efficient scale is attained (*vide* section 2.3.1.4 – Achieving a minimum efficient scale), which allows an approach consistent with the historical development of fixed operators in Portugal.

This option is characterised by a network primarily relying on efficiency criteria, based on current and available technology, compared to criteria based on historical costs and subject to integrate any inefficiencies, and it also allows an approach consistent with fixed operators designated with SMP in Portugal.

Considering that the model to be developed necessarily involves the simplification of reality, ANACOM believes that it must provide for an existing hypothetical operator that rolls out a core network, of a national coverage, based on IP NGN technology, reflecting the technology available in 2009, so as to be able to carry voice traffic and to address the rapid increase of data traffic.

In the light of the above, the modelled operator will be a fixed operator based on a national core IP NGN network that started in 2009, that launched voice services in 2010, the core network design being associated to a specific choice of the access technology. Additionally, the core IP NGN network is considered to be operational in the long term, which is why the migration to another technology will not be modelled.

It should be mentioned that ANACOM sought to model an efficient operator in the perspective of the definition of termination costs in the time horizon as from 2013, however the possibility of assessing in the future the need for changes or adjustments

to the model is not to be excluded. As such, the Regulatory Authority does not consider it necessary to weight, in the version now under discussion, detailed chances of technological evolution, which would have but a low useful impact in the definition of prices intended to be controlled.

#### 2.3.1.2 Network coverage of the modelled operator

The construction and implementation of any communications network is associated to a given level of investment required to guarantee the geographical coverage that enables users to make and receive calls at any point of that network. Such costs are not, in principle, directly related to the network's traffic volume.

The EC Recommendation considers that the calculation of costs of voice call termination on fixed communications networks should consider a segregation of (fixed and variable) costs directly associated to fixed termination traffic, that is, between costs that result from an increase of termination traffic, and remaining costs the change of which is not dependent on the increase of fixed termination traffic.

As such, for the purpose of the developed model, only costs related to traffic volumes and, more specifically, those directly associated to the fixed termination service, must be considered in the regulation of the maximum price for this service.

ANACOM believes that the costing model should reflect the current coverage of the national fixed network, given that, historically, the national territory has been generally provided with electronic communications services, supplied over fixed networks, the ubiquity of which has been fostered either through natural commercial incentives, or through regulatory incentives in force. It is also highlighted that no operator is limited in Portugal with regard to the extension of its network coverage, reason why ANACOM considers that modelling a hypothetical operator with national coverage is the option that guarantees better correspondence to the national reality.

To this extent, it is worth emphasizing that all responses received in the scope of the public consultation with regard to the methodological definition of the model, although safeguarding the possibility of a change of approach in the future, expressed their support for the option proposed by this Authority, to consider fixed nationwide network coverage.

Contributions received, in the scope of the DD associated with this decision, included no specific comments with regard to the network coverage of the modelled operator.

In the light of the above, ANACOM maintains its position that, for the purpose of the fixed termination costing model, the modelled coverage should be nationwide, as this option is deemed to enable a better correspondence to the national reality.

**Modelled Coverage**

Taking into account contributions received in the scope of the public consultation on the methodological definition of the model to be developed and of the DD, ANACOM takes the view that, for the purpose of the fixed termination costing model, the modelled coverage should be nationwide.

#### 2.3.1.3 Minimum efficient scale

As far as the market share is concerned, the EC Recommendation is not as categorical for the modelling of fixed networks as it is in the case of mobile networks, where the approach recommended is to set that scale at 20% of the market share.

One of the parameters that contributes to the modelled operator's termination cost is its market share, reason why it is important to determine the evolution of such market share and the period in which this evolution occurs. The choice of how the operator's market share evolves over time shall necessarily influence results produced by the model.

In the scope of the public consultation carried out with regard to the methodological definition of the present model, ANACOM submitted to discussion the following alternatives to be considered in the efficient operator's model:

- **Option 1:** market share of 1/n for all retail and wholesale services in Portugal, where n is equal to the number of fixed networks operating in the Portuguese market;

- **Option 2:** market share of 1/n by geotype[4], where the definition of the value of "n" takes into account the diversity of networks with significant penetration acting in each geotype;
- **Option 3:** using the scale of the incumbent operator as a proxy for the scale of the modelled operator.

Taken the examined options into account, ANACOM considers that **Option 1** is not representative of the current state of development of the communications market, given that the large majority of operators of fixed national networks has not opted, so far, to be physically present in all the national territory. In that sense, a 1/n market share, where "n" represents the number of fixed networks operating in the Portuguese market, would model a situation where the number of active operators would be uniform throughout the whole national territory, which does not seem to correspond to the observable reality.

In **Option 2**, the use of the concept of geotype intends to group *concelhos* with similar characteristics, so as to simplify the modelling of the existing hypothetical operator and, as such, to make the model more agile. This option would enable, in particular, the modelling of different levels of competitive intensity in the national territory, bringing the model closer to the verifiable reality.

With regard to **Option 3**, ANACOM considers that taking the scale of the incumbent operator as a proxy for the scale of the modelled operator would lead to the error of bringing the model closer to this specific operator, which is not at all the purpose of the model. Besides, this would not be representative of the current reality, as it would consider that the market share of the modelled operator was uniform throughout the whole territory, failing to model the different levels of competition that exist in different areas of the country.

Responses received to the Methodological Consultation show a general agreement with the adoption of a 1/n market share per geotype (**Option 2**), despite some doubts that

[4] The use of geotypes allows regions (concelhos) with similar characteristics to be taken as part of the same geotype. This enables the consideration of different degrees of network weight and of competition according to the various modelled geotypes. For example, in Lisbon and Oporto, the traffic and the number of subscribers per exchange is much higher than in rural areas, therefore the average number of DSLAM and OLTs per node is higher in this type of geotype than in other geotypes. For the model under consideration, the classification of concelhos, that is, geotypes to be defined in the model, is based in the following criteria: Geotype 1: Greater Lisbon and Greater Oporto; Geotype 2: Concelhos with one or more fixed operators and one or more cable operators; Geotype 3: Concelhos with one or more fixed operators and no cable operator; Geotype 4: Concelhos in the Islands. It is noted that Geotypes 2 and 3 do not include concelhos of Greater Lisbon and of Greater Oporto (Geotype 1) or concelhos of the Autonomous Regions of Madeira and Azores.

were raised on aspects related to this approach. In particular, it was referred that the granularity of the geographical delineation of Greater Lisbon and Greater Oporto should be reviewed and adjusted to a more detailed analysis, analyses at municipality or parish levels being deemed to be the most appropriate for the determination of market shares required to achieve an efficient scale.

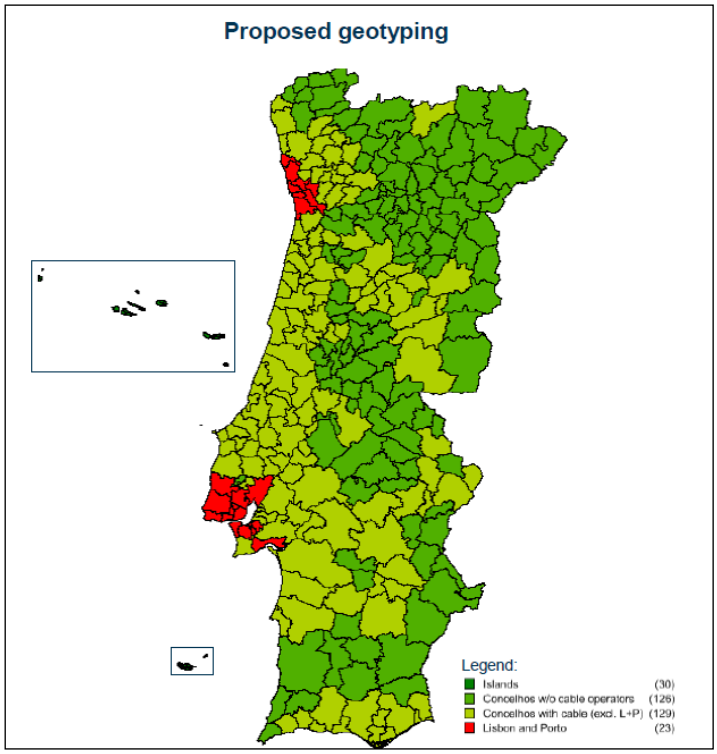
In addition, it was argued that **Option 2** would not be compatible with remaining options suggested at the time, namely as regards the market share proposed for geotype 3 (100%). It is highlighted further that it was suggested that market shares should reflect the number of operators present in each geotype and not only the number of networks.

Another respondent referred also that minimum scale values presented by ANACOM are unrealistic, taking into account the historical development of the electronic communications sector in Portugal, given that, all operators considered, operators other than the two major operators only achieve a joint share of 12.8% of the total fixed voice traffic in minutes. On its turn, this implies that only the two major operators "fit" in the minimum efficiency scales considered in the model.

With regard to the concept of geotype (Figure 2), some comments were made in the Methodological Consultation that indicate that this concept was not fully understood by all stakeholders. As such, it is highlighted that *concelhos* were **classified** in four geotype groups:

- **Geotype 1**: Greater Lisbon, Greater Oporto and areas in the Setubal peninsula with higher population density;
- **Geotype 2**: Mainland Portugal, except for geotype 1areas, where at least one cable operator is present;
- **Geotype 3**: Mainland Portugal, except for geotype 1 areas, where cable operators are not present;
- **Geotype 4**: Autonomous Regions of Madeira and of Azores.

**Figure 2: Geotypes**




Source: "Documentation accompanying the fixed BU-LRIC model", Analysys Manson

The inclusion of each *concelho* in the respective geotype is based on the following criteria:

- Number of fixed networks per *concelho* (for e.g. geotype 1 comprises areas with the largest number of fixed operators);
- Access technologies per *concelho* (e.g. cable operators are not present in geotype 3);
- Copper to fibre migration (e.g. 83% of homes passed with fibre in Portugal are located in geotype 1);
- Portugal's geographical diversity (this approach enabled the implementation of a different architecture in the Autonomous Regions).

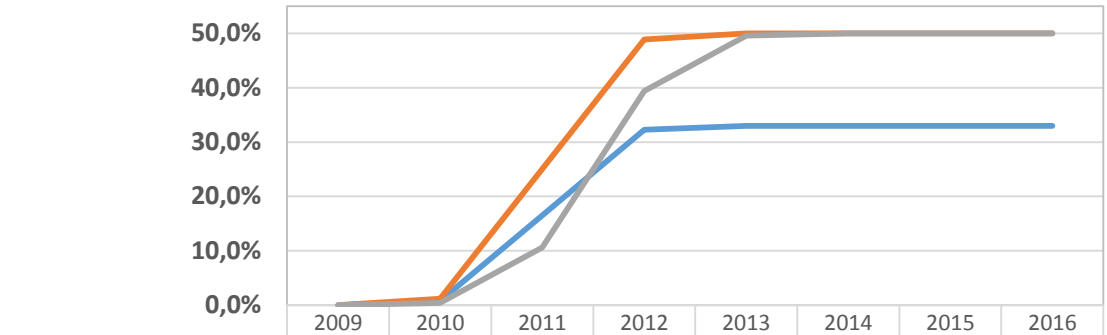
With regard to the issue of the granularity of the geographical delineation of the Greater Lisbon and Greater Oporto regions and to the fact that analyses at municipality or parish levels would be the most appropriate for the determination of market shares required to achieve an efficient scale, it is highlighted that, in the above split into categories, the analysis was performed at municipality level, which is considered to be appropriate for the purpose. In fact, the model provides for an identical classification for *concelhos* with similar characteristics.

With regard to the issue that it would never be possible to achieve a 100% share in geotype 3, given that by definition that market already presents an incumbent operator that makes the access network available, ANACOM considered this argument to be valid, having thus reviewed the approach presented in the Methodological Consultation. As such, the minimum efficient scale to be used in the modelling of the existing hypothetical operator for geotype 3 will be 50%, so that the presence of an incumbent operator is taken into consideration. The 50% market share reflects the situation where, in addition to the incumbent operator's network, there is also another operator with a wholesale offer in rural municipalities covered by NGN, therefore it is considered that this market share is reasonable in the long term.

With regard to the assertion that only the two major operators "fit" in the minimum efficiency scales considered in the model, it is recalled that, as the EC Recommendation refers, new entrants in fixed markets, by contrast, have the opportunity to achieve low unit costs by focusing their networks on high-density routes in particular geographic areas and/or by renting relevant network inputs from the incumbents. As such, there seem not to be, in principle, any reasons to follow an approach other than the aforesaid Recommendation, with its inherent logic of symmetry, just as in the case of mobile termination.

In the light of the referred change, Figure 3 shows an evolution of the minimum efficient scale for each geotype, being emphasized that for geotype 3 an additional year is required for the achievement of that scale, due to the fact that the area considered is much larger and less populated than the others, thus the time required to achieve the minimum scale is much longer compared to the remaining geotypes.

**Figure 3: Evolution of the scale of the modelled operator in each geotype**




| | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|---|---|---|---|
| Geotype 1 | 0,0% | 0,8% | 16,5% | 32,2% | 33,0% | 33,0% | 33,0% | 33,0% |
| Geotype 2/Geotype 4 | 0,0% | 1,1% | 25,0% | 48,9% | 50,0% | 50,0% | 50,0% | 50,0% |
| Geotype 3 | 0,0% | 0,4% | 10,6% | 39,4% | 49,6% | 50,0% | 50,0% | 50,0% |

Source: FTR model developed by Analysys Mason

Although most responses did not oppose the chosen option, some comments were made which showed that operators did not agree or had some doubts with regard to the options considered in the DD for the minimum efficient scale (as referred in the DD Report).

Having assessed the options considered, ANACOM considers that the choice of the "minimum efficient scale" variable should reflect the fact the Authority intends to model an operator present throughout the national territory and to reflect the diversity of operators and networks active with significant presence in each of the geotypes.

With regard to the issue of the granularity of the geographical delineation of the Greater Lisbon and Greater Oporto regions, it is highlighted that the division into categories was performed at municipality level, which is considered to be appropriate for the purpose. In fact, the model provides for an identical classification for *concelhos* with similar characteristics.

ANACOM considers that this approach decreases the complexity of the model and, simultaneously, addresses Portugal's geographical diversity.

Having contributions received in the scope of the DD been analysed, ANACOM has decided to maintain its view according to which the minimum efficient scale of the modelled operator should correspond to a market share of 1/n per geotype, as it meets the Portuguese situation, bearing in mind the characteristics of the national fixed communications market, for the purpose of the developed fixed termination costing model, where in the definition of the value of "n" the diversity of operators and networks involved in each of the geotypes is taken into account.

In the scope of a future review of the model, in the light of the evolution that may take place in the Portuguese market, this issue could be the subject of a reassessment.

**Minimum efficient scale**

Having above-mentioned options been assessed, taking into account contributions received in the scope of the public consultation on the methodological consultation of the model to be developed and of the DD, ANACOM considers that the choice for Option 2 –market share of 1/n[5] per geotype, where the definition of the value of "n" takes into account the diversity of networks with significant presence in each geotype, is the option that best suits the current context. As such, for the purpose of the fixed termination costing model, ANACOM considers that the modelled minimum efficient scale assumes the following values for each of the geotypes considered:

- A 33% market share (n=3) for geotype 1;
- 50% market share (n=2) for remaining geotypes.

It is emphasized that this option will somehow allow the modelling of regions characterised by different levels of competitive intensity and, while it is not the option followed by most recently developed LRIC models, it is not at all an unprecedented option, as evidenced by the model recently developed by the French Regulatory Authority.

#### 2.3.1.4 Achieving a minimum efficient scale

The minimum efficient scale of the hypothetical operator is associated to the time horizon this operator requires to achieve that scale (*vide* section 2.3.1.3 – Minimum efficient scale). The time horizon required to achieve a minimum efficient scale is directly related to the type of operator to be considered (*vide* section 2.3.1.1- Type of operator), reason why it is considered that the option for an operator that already exists will always imply a period during which the market share of the operator gradually increases until the market share considered as a minimum efficient scale is achieved.

Considering that the observation of the fixed communications market shows that operators gradually achieve market share, ANACOM took the view, in the scope of the public consultation on the methodological definition of the present model, that a time

[5] n=1 → Market Share (MS) =100%; n=2 → MS =50%; n=3 → MS =33.3%.

period during which the operator accumulates market share and achieves scale should be considered, having opted, for this purpose, to take into consideration a four-year period for geotypes 1, 2 and 4 and a five-year period for geotype 3 (*vide* Figure 3). Moreover, the model intends to simulate an existing hypothetical operator, assuming that it will operate in a competitive market, reason why it is considered that the defined market share (*vide* section 2.3.1.3 – Minimum efficient scale) would likely be achieved in the course of the time period considered.

With regard to the time horizon put forward by ANACOM in the aforesaid consultation on the achievement of the minimum efficient scale and, despite some contributions having agreed with the option proposed (a period of around four years), there were responses which considered that a period of around 4 years seemed to be, in principle, too short, especially when taking into account the minimum efficient scale proposed for geotype 3, one respondent having inclusively stated that the period of time considered for achieving the minimum efficient scale is completely unrealistic in view of the historical reality of the sector in Portugal.

Based on the experience of the consultant in this matter, ANACOM proposes a reduction by 50% of the minimum scale in geotype 3, compared to the option proposed earlier in the scope of the Methodological Consultation, and bearing in mind the presence in the market of an incumbent operator, the Regulatory Authority believes that the evolution of the minimum efficient scale in the time frames referred to above is realistic. As such, and more specifically, an existing hypothetical operator is modelled for which the minimum efficient scale is achieved in 2013 for geotypes 1, 2 and 4 and in 2014 for geotype 3. A broader time frame was considered for geotype 3, as it is likely that the development of the network, in *concelhos* of this geotype, will take place at a slower pace, as these areas are less populated compared to the others.

Contributions received in the scope of the DD, with regard to the achievement of the minimum efficient scale, do not generally oppose the chosen option, although some concerns were expressed (as referred in the DD Report).

In this respect, ANACOM believes that, throughout all this process, it focused on anchoring the construction of this costing model in the national reality, either in terms of historical characteristics and observable trends, or also in terms of the characteristics which, with some degree of security, are at the present time likely to be foreseen and whose impacts in the activity of the operator may also be reasonably foreseen.

With regard to the periods of time required to achieve the minimum efficient scale, an appropriate time series was taken into account, so as to allow the full recovery of costs and to exclude any residual value.

Having contributions received in the scope of the DD been analysed, ANACOM has decided to maintain its view that the achievement of the minimum efficient scale, for the purpose of the model of an existing hypothetical operator to be developed, requires a four-year period for geotypes 1, 2 and 4 and a five-year period for geotype 3, during which the market share of the operator gradually increases until the minimum efficient scale is achieved.

**Achieving the minimum efficient scale**

Taking into account contributions received in the scope of the public consultation on the methodological definition of the model to be developed and of the DD, ANACOM decided that the achievement of the minimum efficient scale, for the purpose of the model of an existing hypothetical operator to be developed, requires a four-year period for geotypes 1, 2 and 4 and a five-year period for geotype 3, during which the market share of the operator gradually increases until the minimum efficient scale is achieved.

### 2.3.2 Technology

ANACOM takes the view that the fixed termination costing model should be based, as much as possible, on efficient technological options that are available in the time horizon considered, position which is also adopted in the EC Recommendation[6], reason why technologies available in the period between 2009 and 2013 were taken into account.

#### 2.3.2.1 Network design

##### 2.3.2.1.1 Modelled access network

In accordance with the Recommendation, the demarcation point between traffic- and non-traffic-related costs is typically where the first point of traffic concentration occurs. Still according to the Recommendation, "in a PSTN network this is normally deemed to be the

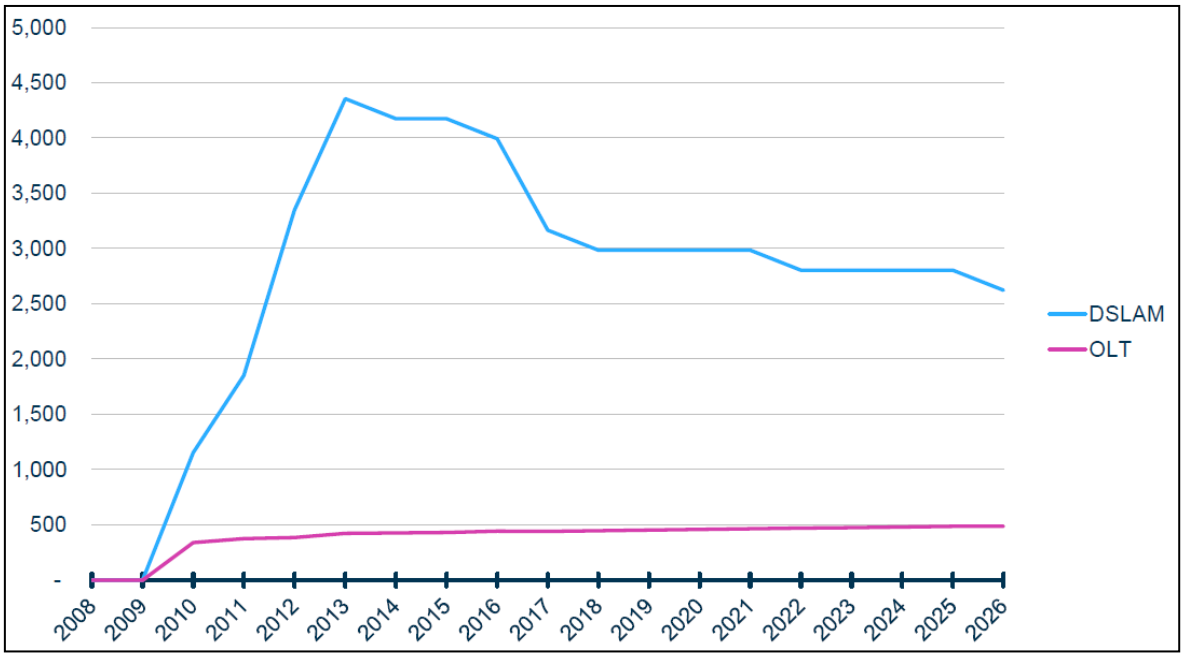
[6] Recital (12) of EC Recommendation: *"The cost model should be based on the efficient technological choices available in the time frame considered by the model, to the extent that they can be identified. Hence, a bottom-up model built today could in principle assume that the core network for fixed networks is Next-Generation-Network (NGN)-based".*

upstream side of the DSLAM/MSAN[7] line card in the (remote) concentrator, whereas in the case of a NGA/GPON network, it will be the upstream side of the OLT[8] line card".

As such, given that the purpose of the BU-LRIC model is to determine long-run incremental costs of fixed voice termination services, it is unnecessary to model the access network of the operator, since its impact on the fixed termination value will be null. However, the design of the core network is associated to a specific choice of access technology, therefore the latter should be taken into consideration to the extent that it defines the technology to be considered in the first network aggregation point.

The access network considered for the purpose of traffic accounting and type of equipment in the first traffic concentration point was based on the current state of network development in Portugal, the migration of copper networks to new generation networks having also been modelled, in line with the current evidence and expected medium- and long-term evolution. Figure 4 exemplifies such migration, having been found that as from 2014 the model assumes fewer DSLAMs due to migration to new generation access networks.

**Figure 4: Evolution of the number of DSLAMs and OLTs over time**




Source: "*Documentation accompanying the fixed BU-LRIC model*", prepared by Analysys Mason

[7] Digital Subscriber Line Access Multiplexer/Multi-Service Access Node.

[8] Optical Line Terminal.

It is highlighted that all responses received in the scope of the Methodological Consultation on the modelled access network were in favour of the option proposed by this Regulatory Authority. Additionally, one of the responses considered that the model should include the existence of a hypothetical operator with a converging fixed-mobile strategy, where mobile radio access technologies would also be considered in the determination of the incremental cost of the wholesale fixed termination service, which according to that same response, was already a reality in Portugal in 2009.

It is acknowledged that, under certain conditions, it would likely be more efficient to implement an access network based on mobile technologies in some specific rural areas. Meanwhile, in the particular case of Portugal, the large majority of households are presently covered by fixed network operators, being assumed that the access technology chosen by a modelled hypothetical operator would be fibre (bearing in mind the migration of copper lines to fibre). Moreover, evidence presently available shows that in the years under discussion main fixed operators operating in the Portuguese market preferred to make available fixed accesses (copper or fibre) to the detriment of a fixed-mobile strategy.

Contributions received in the scope of the DD associated with this decision do not include any comments with regard to the modelled access network. Therefore, ANACOM maintains its position in the sense that, for the purpose of the fixed termination costing model, the modelled access network is based on copper and fibre technology, taking into consideration the migration of copper networks to new generation networks, in line with the expected medium- and long-term evolution. In the scope of a future review of the model, in the light of the evolution that may take place in the Portuguese market, this issue could be the subject of a reassessment.

**Modelled access network**

Taking into account contributions received in the scope of the public consultation on the methodological definition of the model to be developed and of the DD, ANACOM believes that the access network considered for the purpose of traffic accounting and type of equipment in the first traffic concentration point is based on copper and fibre technology, taking into consideration the migration of copper networks to new generation networks, in line with the expected medium- and long-term evolution.

#### 2.3.2.1.2 Modelled core network

The Recommendation considers that "*the cost model should be based on the efficient technological choices available in the time frame considered by the model, to the extent that they can be identified. Hence, a bottom-up model built today could in principle assume that the core network for fixed networks is Next-Generation-Network (NGN)-based*".

The modelled operator assumes that there are five core network nodes, respectively located in Lisbon (three) and in Oporto (two), whereby each of the nodes contains an interconnection platform with other networks. Two of the core network nodes also support international interconnection. The modelled operator uses two types of resources according to the type of interconnection traffic, namely:

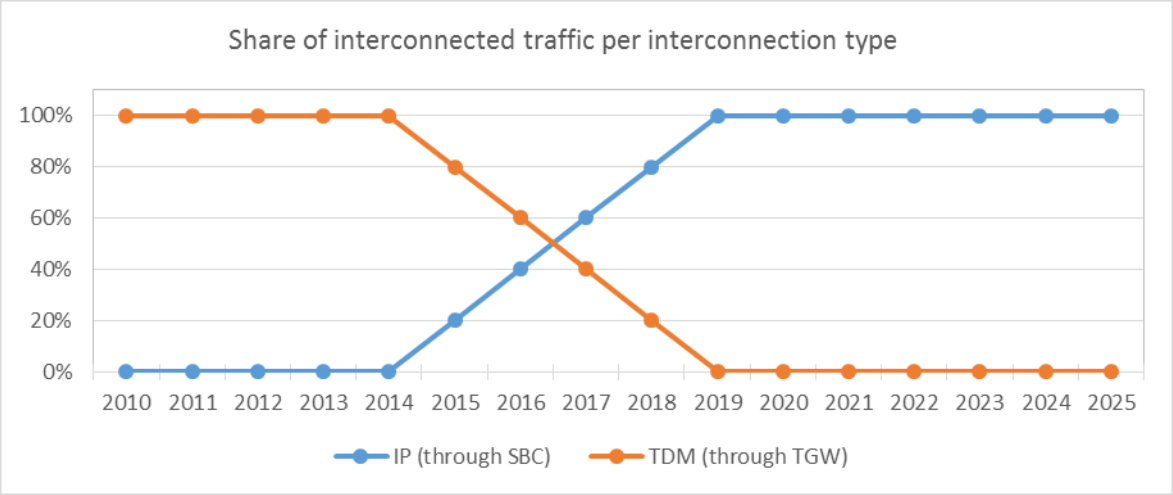
- **Trunking gateway (TGW)**: Converts traditional "TDM" voice into IP voice or vice-versa depending on the traffic direction and of interconnected networks;
- **Session border controller (SBC)**: Monitors IP interconnection traffic and manages the quality of service (QoS) of interconnection traffic. In this scenario, the interconnection is IP-based.

With regard to responses received in the scope of the Methodological Consultation, it is highlighted that one of them did not agree with the incorporation of Time Division Multiplexing (TDM) interconnection in the model. ANACOM considers that the incorporation of TDM interconnection in this model reinforces its correspondence to the national reality, given that, even where an operator opted exclusively for an IP-technology-based interconnection, that operator would always be required to rely on TDM interconnection on account of traffic from abroad, such as from Africa or Latin America. It must be added that in the present model, TDM technology is only temporarily considered for interconnection purposes and not for the purpose of routing or switching in an operator's own network, as the model considers a gradual migration from TDM to IP interconnection.

Contributions received in the scope of the DD associated with this decision do not include any comments with regard to the modelled core network. In view of the above, ANACOM maintains its position that, for the purpose of the fixed termination costing model, the modelled core network is based on IP BAP NGN, being simultaneously guaranteed TDM and IP interconnection with other networks. It is considered that in the commercial roll-out of the network in 2010 the interconnection is solely TDM-based, having started in 2015

the transition to IP interconnection at a constant rate until 2019, year in which interconnection will be fully IP-based (*vide* Figure 5). It is assumed that in this time period networks in general will evolve to fully IP-based interconnection.

**Figure 5: Evolution of IP and TDM interconnection**




Source: FTR Model developed by Analysys Mason

**Modelled core network**

Taking into account contributions received in the scope of the public consultation on the methodological definition of the model to be developed and of the DD, and in order to meet the Recommendation, ANACOM considers that a core network architecture based on IP BAP[9] NGN will be modelled, being simultaneously guaranteed Time Division Multiplexing (TDM) and Internet Protocol (IP) interconnection with other networks. Moreover, the transition of TDM to IP interconnection was taken into consideration, starting in 2015 and evolving at a constant rate until 2019, year in which interconnection will be fully IP-based.

#### 2.3.2.1.3 Modelled transmission network

The transmission network could in principle be modelled via a set of alternative technologies[10], however the IP/MPLS[11] solution is currently deemed to be the most highly developed technology, and appears to be the best solution for NGN-IP core networks.

[9] Broadband Access Platform.

[10] For example, NG-SDH; Ethernet/WDM; ATM over SDH, point-to-point STM microwaves, IP/MPLS over SDH and IP/MPLS over native Ethernet.

[11] Internet Protocol/Multi-Protocol Label Switching.

Notwithstanding, to ensure that the modelled operator maintains correspondence to the national reality and given the actual state of network transition in Portugal, it seems appropriate to take also into consideration the existence of transmission networks relying on SDH[12] solutions in some parts of the network that have still not evolved to an IP/MPLS over Ethernet solution.

With regard to responses received in the scope of the Methodological Consultation, it is noted that there was an entity that disagreed with the inclusion of SDH technology in the modelling of the transmission network. While ANACOM acknowledges that IP/MPLS over Ethernet is the most recent and efficient technology, the Regulatory Authority considers also, given that the vast majority of operators in the Portuguese market still resort to IP/MPLS over SDH, that the modelled operator should use both technologies, so that the present model may somehow be anchored in observable evidences.

Contributions received in the scope of the DD associated with this decision do not include any comments with regard to the modelled transmission network. In view of the above, ANACOM maintains its position that, for the purpose of the fixed termination costing model, the modelled operator will rely on a transmission network based on IP/MPLS over Ethernet[13] and also on IP/MPLS over SDH, given that this technology is still used by operators in the Portuguese market.

**Modelled transmission network**

ANACOM considers that the fixed termination costing model to be developed, despite seeking to replicate the national reality, must necessarily reflect the options that an efficient hypothetical operator would have adopted in the last few years in order to develop a network based on current and efficient technology.

As such, and taking into account contributions received in the scope of the public consultation on the methodological definition of the model to be developed and of the DD, the modelled operator will rely on a transmission network based on IP/MPLS over Ethernet and also on IP/MPLS over SDH, given that this technology is still used by operators in the Portuguese market. This will allow the modelling of a network that operates with both technologies and the consideration of different utilisation rates for

[12] Synchronous Digital Hierarchy.

[13] Type of local area network (LAN). Designates also the type of cable and the mode of access.

each of them, drawing closer to the observable and expectable reality.

#### 2.3.2.2 Demarcation of network layers

The Recommendation refers that the default demarcation point between traffic- and non-traffic-related costs is typically where the first point of traffic concentration occurs. In a public switched telephone network, this is usually deemed to be the upstream side of the DSLAM/MSAN[14] line card in the (remote) concentrator, whereas in the case of a NGA/GPON network, it will be the upstream side of the OLT[15] line card. ANACOM agrees with this perspective and placed it for consultation at the time of the public consultation on this theme.

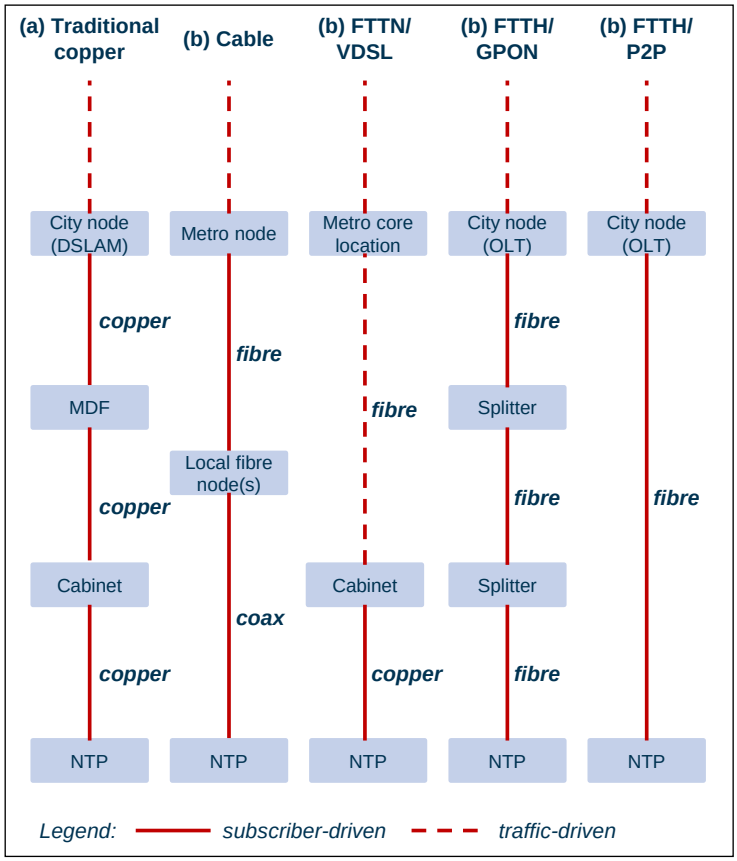
It is highlighted that all responses obtained in the scope of the Methodological Consultation referring to the demarcation of network layers were in favour of the option proposed by this Authority. Additionally, one of the responses requested clarifications, considering that figure 4.1 of Analysys Mason's document ("Conceptual approach for the fixed BU-LRIC model") was not entirely correct, and also required legends and/or explanations for the symbolism of solid and dashed lines. The response considered that in case the points of demarcation between the access network and the traffic aggregation/concentration network were intended to be represented, then case (d), the referred "FTTH/GPON" figure, should have been represented with a solid line up to the city node and case (a), "Traditional copper", should also have been represented with a solid line up to the city node. As regards case (b) "Cable", the segment between the metro node and the local fibre node should have been fibre optic and not coaxial cable.

Having consultants been confronted with the requested clarifications, the mistake in the figure presented was acknowledged, and corrected according to Figure 6 below.

[14] Digital Subscriber Line Access Multiplexer/Multi-Service Access Node.

[15] Optical Line Terminal.

**Figure 6: Options for network layers in the model**




Source: "Conceptual approach for the fixed BU-LRIC model" prepared by Analysys Mason

Contributions received in the scope of the DD associated with this decision do not include any specific comments with regard to the demarcation of network layers. Therefore, ANACOM maintains its position that, for the purpose of the fixed termination costing model, the demarcation point between traffic- and non-traffic-related costs is where the first point of traffic concentration occurs.

**Demarcation of network layers**

Having options mentioned above been assessed and, taking into account contributions received in the scope of the public consultation on the methodological definition of the model to be developed and of the DD, ANACOM believes that the demarcation point between traffic- and non-traffic-related costs is where the first point of traffic concentration occurs (figure 4.2 of Annex 3 "Conceptual approach for the fixed BU-LRIC model").

#### 2.3.2.3 Design of network nodes

The modelling of a hypothetical and efficient fixed communications network involves, *inter alia*, the identification of the type of equipment to be installed, as well as the respective amount and location. For the purpose of the fixed termination costing model to be developed, this should take into consideration the methodology laid down in the EC Recommendation, which advocates the adoption of a bottom-up methodology based on forward-looking long-run incremental costs.

Electronic communication networks are complex systems which are developed by operators over time, in an incremental manner, whenever they need to be adjusted to meet any changes in demand, reason why it would hardly be considered that current networks are perfectly optimized.

The design of a network depends, *inter alia*, on the specific nature of the ground, reason why the location of its elements is not always ideal on a theoretical point of view. However, considering that a model is a simplification of the reality and as the costing model is intended to be, as much as possible, representative of the national reality, the quantification and qualification of the different network components will take place by reference to the best information available on national fixed networks, which may be optimized to guarantee the necessary balance between the demand for efficiency which, in principle, will characterize a new entrant, and national specificities and constrains, somehow reflected in current fixed networks. The methodological options presented below were identified as being likely to be taken into consideration for the purpose of the design of network nodes. This theme is also developed in the document prepared by the consultant in annex 3 (page 20).

**Option 1 – Network currently installed**

The network design of the modelled hypothetical operator, based on this approach, consists of modelling the network considering the size and structure of a real fixed operator, without any type of adjustment to the number, location or performance of network nodes.

**Option 2 – Scorched node methodology**

For the purpose of the design of the modelled network, the scorched node methodology assumes the amount and physical location of the different actual network components, leaving open decisions on technology (equipment to be used in each of location and

connections between them), for the purpose of the implementation of an optimized network.

**Option 3 – Modified scorched node methodology**

The modified scorched node methodology is based on the scorched node methodology, which is adjusted, taking the existing topology and eliminating inefficiencies, thereby simplifying the switching hierarchy, or changing its functionality and that of network nodes.

**Option 4 – Scorched earth methodology**

The scorched earth methodology determines an ideal hypothetical network established from the outset with the ability to provide all services made available by the modelled operator, assuming that all network components to be considered are variable, that is, without any configuration or location constraints.

ANACOM considers that **Option 1 – Network currently installed** should be excluded as it is not likely that the modelling of an efficient hypothetical fixed communications operator, in the scope of the fixed termination costing model to be developed, results in a network topology that is identical either to any of the fixed networks of operators designated with SMP, or to a network equivalent to an “average” of existing networks.

With regard to **Option 2 – Scorched node methodology**, ANACOM considers also that this option should be excluded, namely because this methodology would hardly result in an optimized network configuration, given that it is based on the amount and location of actual network equipment, with its inherent historical legacy.

A more appropriate option would be, on the basis of the scorched node methodology, to allow some changes, such as simplifying the switching hierarchy and altering node functionalities, thereby increasing network efficiency and, ultimately, reconciling results obtained with elements provided by fixed operators designated with SMP (**Option 3 – Modified scorched node methodology**).

**Option 3** balances the need to introduce efficiency parameters in the model under development and the concern to guarantee that the model maintains, as much as possible, a correspondence to the national reality.

**Option 4 –** the **scorched earth methodology**, which is frequently acknowledged in abstract as the option that best incorporates the notion of efficiency in the development of this type of models, is however a more conceptual and theoretical approach, characterized by high levels of complexity as far as the network dimensioning is

concerned. As such, on account of its characteristics, this approach is also the one that departs furthest from reality, precisely because it does not consider the various practical constraints to the development of networks, like for example: i) constraints related to difficult duct routes; ii) scattered population centres; iii) architectural constraints; and, iv) coexistence of equipment owned by various operators in the same location with possible sharing of infrastructures. In addition, this approach is characterised by huge demands in terms of the necessary information, which could possibly not be available in a timely manner.

Contributions expressed in the scope of the Methodological Consultation, with regard to this principle, were generally in favour of the option provided for in the consultation document. Contributions received in the scope of the DD associated with this decision do not include any specific comments with regard to the methodology relating to the design of network nodes.

In view of the above, ANACOM maintains its position that the option for a modified scorched node methodology, as in the case of the mobile termination model, is the methodological approach that best achieves a balance between the need to address efficiency concerns in the model to be developed and not to introduce too much complexity in the practical development of the model.

As such, considering that a nationwide network is intended to be modelled, the number of access nodes to be incorporated in the model is 1669 (**Error! Not a valid bookmark self-reference.**), connected among them in a tree or ring topology, having in view the configuration of a fixed operator with national coverage. For levels L1 and L2 of the aggregation network, 166 and 25 nodes were respectively considered. For the core network level, as already referred in point 2.3.2.1.2, there are five core network nodes.

It is emphasized that, although the number of modelled access nodes may be highly influenced by the design of the incumbent operator's network, in close relation with its national coverage, the L1 and L2 aggregation levels considered in the model were amended so as to reflect a higher level of efficiency.

**Figure 7: Nodes of the modelled operator per network layer**

**[bci]**

**[eci]**

**Design of network nodes**

Having options mentioned above been assessed and, taking into account contributions received in the scope of the public consultation on the methodological definition of the model to be developed and of the DD, ANACOM believes that the approach described in Option 3 – Modified scorched node methodology, as in the case of the mobile termination model, is the methodological approach that best achieves a balance between the need to address efficiency concerns in the model to be developed and not to introduce too much complexity in the practical development of the model. Moreover, this methodology allows the correspondence to the national reality to be maintained as much as possible, taking into consideration various restrictions of fixed operators in the development of their networks.

### 2.3.3 Services provided

This section focuses on conceptual aspects related to the services to be included in the costing mode. It is structured as follows:

- Modelled services;
- Network traffic profile of the modelled operator;
- Retail and wholesale costs.

#### 2.3.3.1 Modelled services

The definition of the range of services to be considered in the developed model is directly related to how the model under consideration will determine the incremental cost of the provision of the call termination service.

The EC Recommendation indicates that the calculation of the cost of the fixed termination service should take place in an incremental manner, corresponding to the difference between the total long-run costs of an efficient operator providing its full range of services and the total long-run costs of that operator where it does not provide the call termination service.

In this respect, it should be noted that at the time of the public consultation on the methodological definition of the fixed termination costing model, responses received were generally in favour of the approach put forward by ANACOM. Contributions received in the

scope of the DD associated with this decision do not include any specific comments with regard to the range of services provided by the modelled hypothetical operator.

In view of the above, ANACOM maintains its position that the range of services of the modelled hypothetical operator will necessarily comprise all services currently provided by fixed operators designated with SMP.

**Modelled services**

Taking into account contributions received in the scope of the public consultation on the methodological definition of the model to be developed and of the DD, and bearing in mind that the stated objective of the developed model is to simulate a hypothetical operator, ANACOM considers that the range of services of the modelled hypothetical operator should necessarily comprise all services currently provided by fixed operators designated with SMP.

#### 2.3.3.2 Network traffic profile of the modelled operator

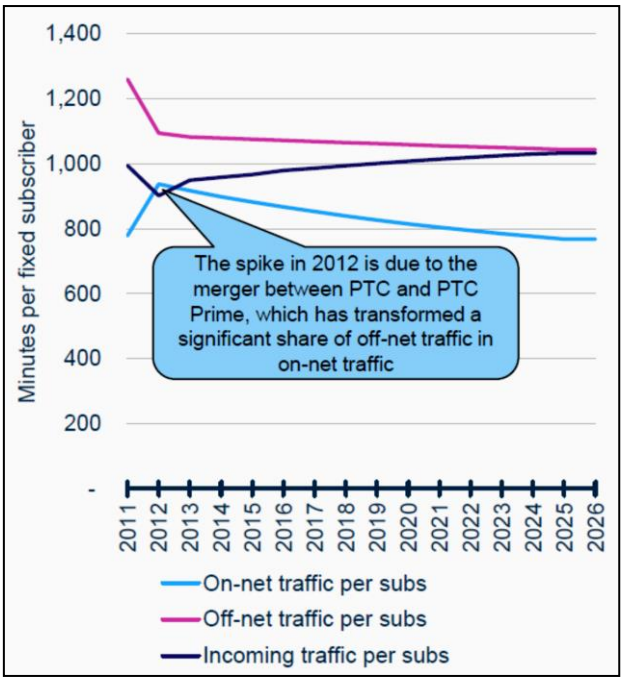
The traffic volume of modelled services is of particular importance in the development of the model, decisively influencing the dimensioning of the modelled network and, consequently, unit costs of services, which is why it is an important factor in the distribution of costs of the modelled network.

The estimate of global traffic volume is based on the effective evolution registered for fixed communications in known exercises, being estimated for the remaining period a growth rate in order to characterize its future evolution, whereby fixed call termination traffic on networks of the modelled operator is a proportion of the global volume of that service.

The methodology used to estimate voice traffic considers that the average value of voice traffic per connection is derived from historical data, being assumed for the future a decrease in the average value of on-net and off-net traffic per fixed subscriber, in line with recent observations, and an increase of incoming traffic from mobile networks and international connections during the modelled period (Figure 8) being expected to occur. Total fixed voice traffic in Portugal is achieved by multiplying the average traffic per connection by the number of fixed voice connections. The model assumes also a slight increase in mobile-fixed traffic, in line with market trends and industry forecasts.

Moreover, the model assumes a decline in the level of penetration of the mobile service, in line with forecasts of the Analysys Mason Research.

**Figure 8: Minutes per subscriber**




Source: "Documentation accompanying the fixed BU-LRIC model", prepared by Analysys Mason

With regard to the estimate of the number of fixed voice connections, the model used considers that the number of connections is driven by the number of households and by the level of penetration of fixed voice services in Portugal. The model specifically assumes a decline in fixed voice penetration, in accordance with forecasts of the Analysys Mason Research.

Relatively to broadband traffic, the methodology used to estimate the number of broadband connections per technology took into consideration forecasts of the Euromonitor International with a view to estimate the increase of the number of households in the period between 2011 and 2026, having been assumed a slight increase of broadband penetration, in line with forecasts of the Analysys Mason Research. The model assumes that the average amount of data consumed by NGA subscribers is higher than that for "traditional" broadband subscribers.

The Methodology used to estimate the average broadband data traffic level considered that backhaul requirements, in terms of data, are driven both by the number of non-NGA and NGA connections, and by the average traffic per type of subscriber, in other words, non-NGA or NGA. It is highlighted that the traffic per type of subscriber is derived from historical data.

With respect to multimedia services, the model estimates the number of pay-TV subscribers per technology considering that the main drivers for the growth of this service are the number of households and the service penetration. Just like the broadband service, estimates of the Euromonitor International were used to determine the growth of the number of households in the modelled period. On the other hand, estimates in terms of subscribers of this service were obtained on the basis of forecasts of the Analysys Mason Research, which were divided in four categories: 1) cable TV; 2) direct-to-home (DTH); 3) fibre-to-the-home (FTTH) IPTV and 4) IPTV xDSL. In this approach the number of pay-TV subscribers per technology is calculated by multiplying the total number of pay-TV subscribers by the share of cable TV, FTTH and xDSL subscribers. The number of VoD and OTT subscribers in Portugal during the modelled period is obtained on the basis of forecasts of the Analsysys Mason Research.

As referred earlier, having traffic of the various services been determined, a traffic profile was created with a view to dimension the modelled operator in terms of the required equipment on which the respective traffic must rely. This issue is further developed in the document prepared by the consultant in annex 2 (page 19).

With regard to the traffic profile, it is highlighted that at the time of the public consultation on the methodological definition of the fixed termination costing model, most responses received generally agreed with the approach put forward at the time by ANACOM, although an issue was raised regarding values presented for 2012, as there were some discrepancies between the information presented in the document under consultation and information on FTS statistics published at ANACOM's website, in particular as far as fixed voice channels and total originated traffic were concerned.

ANACOM acknowledged that there were some discrepancies motivated by the use of outdated information, reason why values used to populate the model were updated in conformity.

Additionally, ANACOM acknowledges that there is necessarily some uncertainty regarding the future evolution of modelled services, particularly when that evolution is planned for the long term. It is in fact for that reason that ANACOM deliberately opted to incorporate traffic estimates consistent with observations of the recent past, incorporating conservative growth estimates.

On this issue, it is worth noting that ANACOM believes, in the framework of a future update of the costing model, that not only current concepts and parameters could be

reviewed, but also traffic estimates and the respective evolution must certainly be updated in the light of developments registered in the meantime.

With regard to concerns raised in responses to the Methodological Consultation pertaining to the conversion of amounts of voice and data traffic in comparable units, it is to be noted that this concern was taken into consideration in the development of the present model. Thus, the voice compression algorithm used by the model, ITU-T Recommendation G.711 with 20-ms frames, implies a 95 Kbps voice call bandwidth.

The model generally considers that the traffic to be routed in each period is obtained according to the market share of the hypothetical operator and to the average consumption profile considered.

In view of the above, ANACOM reviewed values formerly presented, maintaining its position regarding the hypothetical operator's traffic to be considered for the purpose of the model, which must be estimated taking into consideration the observed average traffic volumes and profiles.

Contributions received in the scope of the DD associated with this decision, even though most responses did not oppose the followed option, included some remarks which demonstrated non-agreement or doubts with regard to options considered in the DD for the network traffic profile of the modelled operator (as mentioned in the DD Report).

ANACOM highlights that, in the construction of the model placed for consultation, the traffic forecast up to 2025 (values are maintained from 2026 onwards) was designed on the basis of historical trends of the last few years, therefore the change of those trends would only make sense if, and only if, there was relevant information that justified an inversion of the estimated trend. On the other hand, a possible positive impact of converging offers on traffic originated on fixed networks depends on factors, such as, for example, the type of calls included in packages – for example, if the package includes only calls to fixed networks and/or to the mobile segment of the group or to all mobile operators. It is noted in Portugal that traffic originated on fixed networks has maintained a decreasing trend, reason for which an alteration to the model is not deemed at this stage to be appropriate.

**Traffic profile**

ANACOM thus takes the view, on the basis of information collected by the consultant and of its proposal, that the overall traffic volume and, consequently, the traffic of the

hypothetical operator, to be considered for the purpose of the model should be estimated taking into consideration current average traffic volumes and profiles.

In terms of the traffic served by the modelled operator, the following traffic estimates were used for the period from 2013, taking into account NGA and DSL subscriber customers. After 2025, it is assumed that the traffic consumption stabilizes.

| | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|---|---|---|
| Voice traffic per subscriber (thousands of minutes/subs) | 2.00 | 1.98 | 1.95 | 1.93 | 1.91 | 1.89 | 1.87 |
| Fixed voice channels | 4,557,974 | 4,539,044 | 4,522,894 | 4,504,972 | 4,490,721 | 4,478,884 | 4,444,115 |
| Total origination traffic (thousands of minutes) | 9,136,707 | 8,976,848 | 8,831,263 | 8,690,376 | 8,564,131 | 8,449,419 | 8,298,299 |
| Wholesale termination traffic (thousands of minutes) | 5,373,215 | 6,154,270 | 6,180,892 | 6,201,530 | 6,264,108 | 6,284,346 | 6,283,267 |

| | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|---|---|---|
| Consumption per DSL broadband subscriber (GB/subs) | 302.5 | 361.5 | 424.5 | 491.8 | 563.8 | 640.8 | 723.1 |
| Consumption per NGA broadband subscriber (GB/subs.) | 559.6 | 668.7 | 785.3 | 909.9 | 1,043.1 | 1,185.5 | 1,337.7 |
| Number of DSL broadband subscribers | 1,309,393 | 1,256,451 | 1,255,141 | 1,251,407 | 1,246,025 | 1,240,108 | 1,230,415 |
| Number of NGA broadband subscribers | 1,007,489 | 1,195,214 | 1,315,954 | 1,433,022 | 1,546,159 | 1,655,781 | 1,756,458 |
| Total fixed broadband traffic (TB) | 937,447 | 1,224,034 | 1,529,477 | 1,874,418 | 2,261,113 | 2,692,975 | 3,163,402 |

#### 2.3.3.3 Retail and wholesale costs

The EC Recommendation refers that the calculation of the cost of the fixed termination service should take place in an incremental manner, corresponding to the difference

between the total long-run costs of an efficient operator providing its full range of services and the total long-run costs of that operator where the call termination service is not provided.

In the scope of the Methodological Consultation on this topic, stakeholders in general agree with the position taken by ANACOM so as to conclude that retail costs do not contribute to the determination of incremental costs of the wholesale fixed termination service.

Although a general agreement exists on the subject, one of the respondents took the view that an accurate definition of which costs should be considered for the purpose of fixed termination is required. In the perspective of this respondent, there are various costs that, at first sight, may seem to be disconnected from the fixed termination service or to be associated only with retail activities, but that, in fact, are related to this service, reason why they should be taken into consideration for the purpose of the costing model under development. This is the case, for example, of monitoring and traffic control systems, extraction platforms, handling and accounting of CDR's or of ANACOM fees due for relevant revenues associated with the fixed termination service.

As regards the possible existence of several costs that, at first sight, may seem to be disconnected from the fixed termination service or to be associated only with retail activities, but that, in fact, are related to this service, the model developed in the process of the determination of avoidable costs, such as invoicing systems related to the wholesale component, took these costs into consideration whenever the wholesale termination traffic volume was enough to lead to a broader dimensioning of one or more systems than the dimensioning considered without the termination service. In such case, the additional cost generated by the dimensioning of a higher capacity system results in the establishment of the wholesale fixed termination LRIC cost.

Contributions received in the scope of the DD, with regard to retail and wholesale costs did not express any general opposition to the option followed, although there were some reservations with regard to the option considered in the costing model (as mentioned in the DD Report).

With regard to the question of the inclusion in the model of costs resulting from regulation fees, due for relevant revenues associated with the fixed termination service, ANACOM maintains its previous position, according to which the incorporation of these fees would not have significant impact on the final termination value to be determined. As the

regulation cost is independent of relevant revenues of the sector, the variation of revenues implies on its turn the variation of the fee to be applied on those same revenues, reason why the amount to be borne by each operator would be much the same, especially taking into consideration the reduced weight of revenues of the wholesale fixed termination service in the total of relevant profits.

However, acknowledging the insistence of a stakeholder and so that the developed model corresponds as much as possible to the national reality, ANACOM agrees to incorporate regulation costs in the developed model, having been found, as explained in the DD, that "the incorporation of this fee would not have significant impact on the final termination value to be determined". In light of these values, it was deemed reasonable to assume for the purpose of the model a long-term value of 0.6% for the fee to be paid by bodies of step 2 (relevant revenues >1.500.000€) (*vide* point 3.2.3.3 of the DD Report).

In view of the above, ANACOM reviewed the model so as to incorporate regulation costs in the developed model.

**Retail and wholesale costs**

In this context, ANACOM believes that all costs arising from retail activities will have necessarily to be excluded from the establishment of fixed termination costs. Specifically, incremental costs associated with the provision of the wholesale fixed termination service, including costs related to regulatory fees, will be considered. Thus, all costs that do not vary with the increase of the considered traffic (see section 2.3.4.1 – Relevant increment) will not be taken into account for the purpose of the establishment of the "pure" LRIC value.

### 2.3.4 Implementation of the model

In this section, the conceptual aspects related to the implementation of services in the costing model will be discussed, structured as follows:

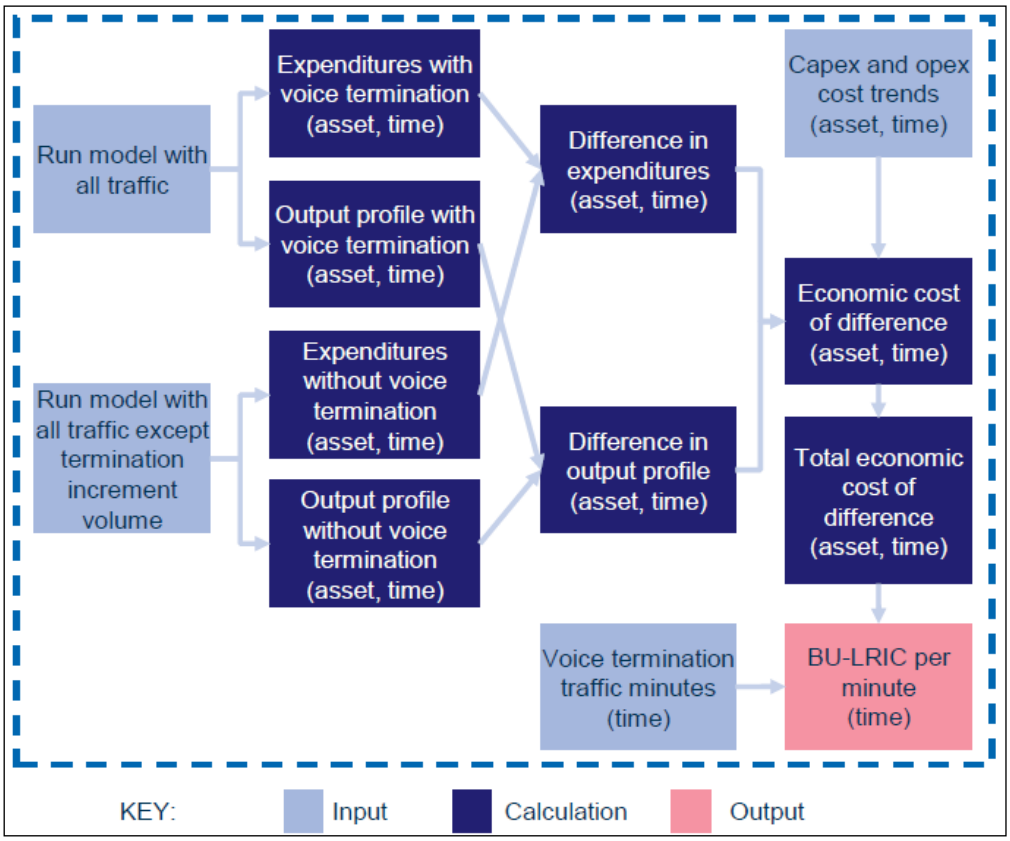
- Relevant increment;
- Asset depreciation method;
- Time horizon;
- Remuneration of cost of capital;
- Calibration of the model.

#### 2.3.4.1 Relevant increment

When imposing price control and cost accounting obligations on operators designated as having SMP in wholesale markets for voice call termination on each public telephone network, NRAs are required, under article 13 of Directive 2002/19/EC, to set termination tariffs on the basis of costs incurred by an efficient operator. In that sense, and in accordance with the EC Recommendation, the establishment of costs of an efficient operator should be based on current costs and the use of a bottom-up modelling approach using long-run incremental costs (LRIC) as the relevant cost methodology. In the developed model, the “pure” LRIC calculation is done in four general stages (Figure 9):

1. It calculates the costs for all network elements, excluding the incremental cost of wholesale termination traffic from other networks;
2. It calculates the costs for all network elements, including the incremental cost of wholesale termination traffic from other networks;
3. It calculates the calculates the difference in costs between the two scenarios, and annualises the difference using the economic depreciation method;
4. It divides the total annualised costs by the number of wholesale terminated minutes to derive the incremental cost per minute.

**Figure 9: Flowchart used to calculate "pure" LRIC costs**




Source: "Documentation accompanying the fixed BU-LRIC model", prepared by Analysys Mason

In the scope of the Methodological Consultation on this issue, one of the respondents did not agree with the proposed approach, as it mainly considered that:

- As costs are directly related to traffic and as most of them vary directly with associated traffic volumes, such costs should necessarily be allocated to all services in proportion with their consumption, thus including the fixed termination service;
- The failure to allocate these costs to the fixed termination service inexplicably penalizes the valuation of this service, and leads to a cost structure that is not in line with reality, by not including the whole direct costs incurred with its provision;
- In the cost structure of a fixed operator, the termination service is not only associated to costs which are directly traffic-related, namely costs relating to network components, but also to costs that, despite not being associated with traffic, are incurred in the provision of the service, thus being incremental to the fixed termination service of (e.g. costs with billing platforms, with invoicing and

collection from operators and with operator support services). These costs are incremental to the fixed termination service, and are therefore avoidable;

- All costs associated with the fixed termination service, regardless of whether they are directly or indirectly related to the traffic of the service concerned, should be taken into consideration. The criterion for cost eligibility should focus on the service and not on associated traffic;
- It is not realistic to assume, even for an efficient operator, that its network is always dimensioned for the levels of use registered in each moment, namely due to the fact that the development of infrastructures in the electronic communications sector is guided by a logic of investment by steps, thereby resulting, over time, on some level of unused capacity. This effect should be contemplated in the calculation of the relevant increment, and the cost associated with that unused capacity should be considered in the valuation of all available products and services, including fixed termination.

In the choice of the costing methodology to be implemented, ANACOM believes that the consistency with the EC Recommendation on this matter should be guaranteed, as well as with the approach implemented at the time of the development of the costing model to determine mobile termination costs.

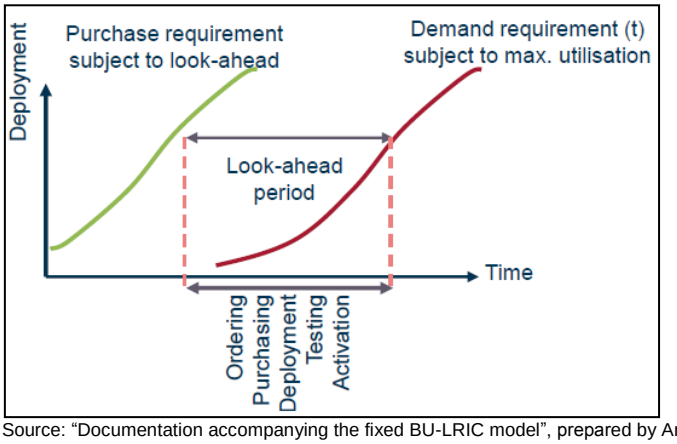
As such, ANACOM considers that the “pure” LRIC solution is the most appropriate costing methodology, given that it maintains the consistency with two mentioned references. Concretely, the implemented “pure” LRIC methodology considers all fixed termination traffic as relevant increment. Incremental costs considered by the model are, therefore, those that are avoided where the wholesale fixed termination service is not provided.

Moreover, and as argued by one of the operators, avoidable costs can also include other costs, such as invoicing systems related to the wholesale component. This will only require that the wholesale termination traffic volume is enough to lead to a broader dimensioning of one or more systems than the dimensioning considered without the termination service. In such case, the additional cost generated by the dimensioning of a higher capacity system will result in the establishment of the wholesale fixed termination LRIC cost.

With regard to the last point listed above, wherein it was referred that it is not realistic to assume, even for an efficient operator, that its network is always dimensioned for the levels of use registered in each moment, it is highlighted that the developed model tests

on an annual basis whether new equipment should be introduced to meet demand for expected traffic. It may be referred also that the model does not dimension the network of a hypothetical operator to a maximum level of use, rather it considers that there is a use threshold (below 100%) beyond which new equipment is purchased and installed. The purchase of this equipment typically occurs 1 to 12 months before it is activated, depending on delivery times and on the size of the network (Figure 10). Where the modelled network requires additional equipment, in a given year, the cost of purchase and installation is considered in the model, and a prior period of time for the purchase and installation of equipment is also provided for.

**Figure 10: Look-ahead period for asset purchase**

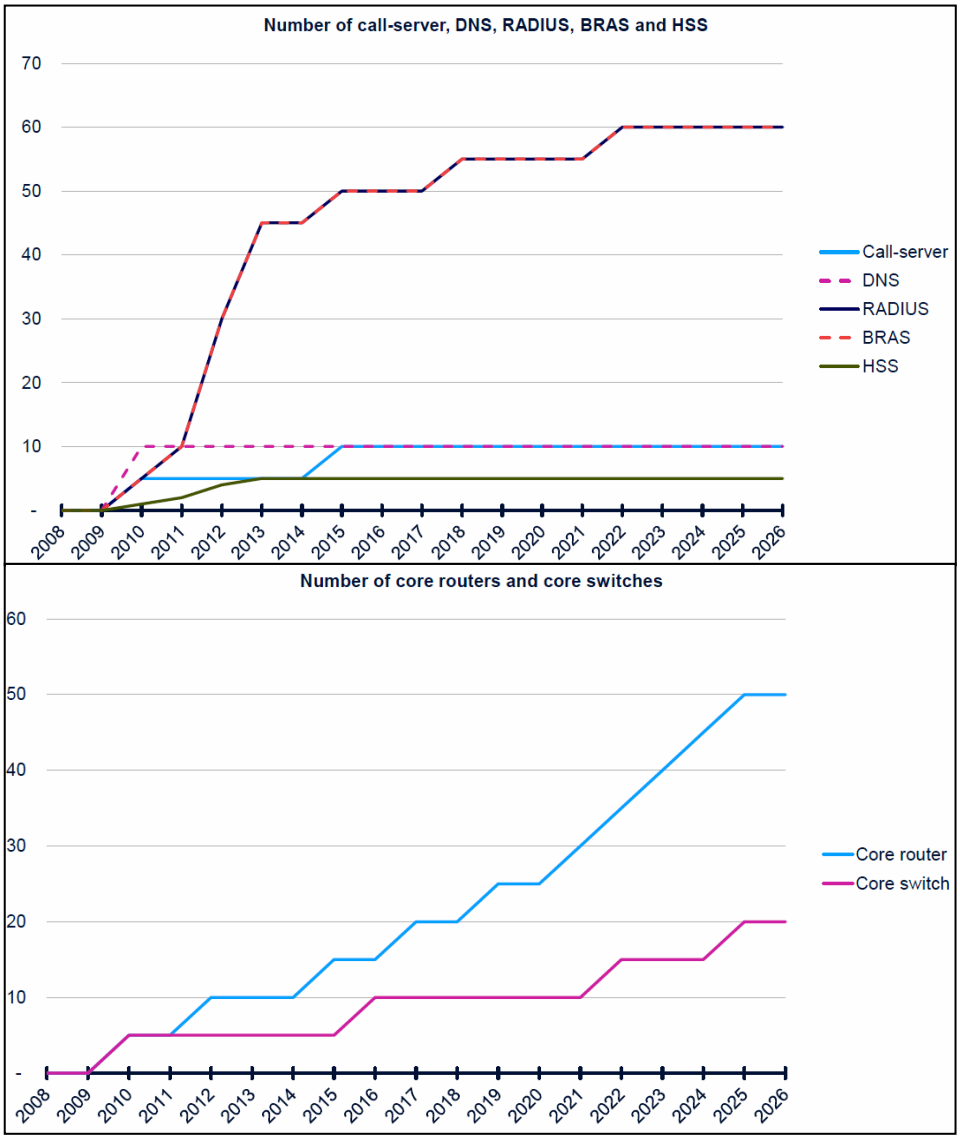



Source: "Documentation accompanying the fixed BU-LRIC model", prepared by Analysys Mason

Nevertheless, in case the traffic demand falls suddenly, for some reason, the equipment is not discarded, it is rather maintained in the network until it has reached the end of its lifetime. Naturally, if by the end of the asset's lifetime, the traffic demand is such as not to justify the replacement of the equipment, then it will not be replaced. As such, although the dimension of the network in terms of equipment is periodically optimized, the model considers that there is unused capacity along the lifetime of the operator.

Finally, it is also emphasized that traffic is the driver that defines the growth of equipment over time in the network of the modelled operator. For example, Figure 11 shows how the amount of some equipment (core routers, core switches, BRAS and RADIUS servers) changes with the increase in traffic.

**Figure 11: Change in the number of equipment over the years**




Source: "Documentation accompanying the fixed BU-LRIC model", prepared by Analysys Mason

Contributions received in the scope of the DD associated with this decision do not include any specific comments with regard to this aspect of the developed model.

In view of the above, ANACOM maintains its position that the model to be developed should abide by the EC Recommendation with regard to the increment to be used, that is, it must determine the avoidable costs of the wholesale call termination service supplied to third parties.

**Relevant increment**

In this context, ANACOM takes the view that the model to be developed should abide

by the EC Recommendation with regard to the increment to be used, that is, it must determine the avoidable costs of the wholesale call termination service supplied to third parties. As such, only termination-traffic-sensitive costs should be considered, any costs non-sensitive to termination traffic being removed from its calculation.

#### 2.3.4.2 Asset depreciation method

Asset depreciation is associated with a financial reserve set up to address the loss of value of immovable assets, which depreciate over time, in order to replace them at the end of their estimated lifetime.

Having this issue been analysed, ANACOM considers in principle that the choice for the asset depreciation method should rest on one of the following options:

- **Option 1** – depreciation based on Historical Cost Accounting – HCA;
- **Option 2** – depreciation based on Current Cost Accounting – CCA;
- **Option 3** – depreciation based on Tilted Annuities;
- **Option 4** – economic depreciation.

The EC Recommendation considers that the depreciation method to be adopted should reflect the economic value of assets, giving priority to the economic depreciation method as asset depreciation criterion to be used. Although the EC Recommendation allows for other depreciation methods, such as "*straight-line depreciation, annuities and tilted annuities*", these should only be adopted insofar as they come close to results which would be obtained where the economic depreciation method was adopted.

ANACOM considers that, for the purpose of the model to be developed, **Option 1** should be excluded as it would be incompatible with the modelling of a hypothetical operator, thus departing from the approach recommended by EC.

With regard to **Option 2**, ANACOM considers that it should also not be adopted, given that, despite considering the current cost of modern equivalent assets (MEA), it fails to take into account other factors such as the cost evolution of MEA, traffic evolution of the installed network and the lifetime of existing assets.

Although **Option 3** does not significantly differ from the economic depreciation criterion (**Option 4**), it does not allow for the recovery of costs in line with the traffic evolution of the installed network. Accordingly, ANACOM believes that **Option 4** is the asset depreciation method that best reflects the economic value of assets in the model to be developed, as

supported by the EC Recommendation and as determined in the scope of mobile termination.

In the scope of the public consultation on the methodological definition of the fixed termination costing model, most stakeholders agree with the position expressed by ANACOM, that the depreciation of assets of the hypothetical operator to be considered in the model to be developed should be based on economic depreciation.

Contributions received in the scope of the DD associated with this decision do not include any specific comments with regard to this aspect of the developed model.

In view of the above, ANACOM maintains its position that the model to be developed should abide by the EC Recommendation with regard to the increment to be used, that is, it must determine the avoidable costs of the wholesale call termination service supplied to third parties.

**Assets depreciation method**

ANACOM takes the view that the depreciation of assets of the hypothetical operator to be considered in the developed model should be based on economic depreciation (Option 4), as it is the method that best reflects the economic value of modelled assets, as called for in the EC Recommendation.

#### 2.3.4.3 Time horizon

The time horizon of the developed model is of a particular importance, as it must allow the recovery of efficient costs associated with the provision of the service of call termination on fixed networks, which is only possible through the use of long time series. One of the possibilities with regard to the definition of the time horizon to be considered would be the use of the operator's lifetime, the value of which is debatable.

Taking into account the lifetime of some assets, such as ducts and buildings, characterized by long lifetime periods, it is deemed that it is necessary to model the network of the hypothetical operator with a time horizon with at least the same duration, allowing at the very least that the longest-lived asset have a full lifetime period, thus rendering negligible any residual values of assets that may exist at the end of the modelled lifetime.

In this respect, it is emphasized that at the time of the Methodological Consultation on the methodological definition of the fixed termination costing model, responses received were

generally in favour of the option set out, except for one that showed some doubts as to the option taken, considering that for the time horizon taken into account in the proposal, estimates to be made would scarcely be credible, and in addition, at technological level, one should not expect things to remain the same as modelled for the current period. Such technological evolutions are in fact not incorporated in the model, nor could they be, given the degree of uncertainty with regard to options and evolutions that will occur during that period.

With regard to concerns raised about technological evolutions and forecasts difficulties as far as long periods of time are concerned, it is noted that this 45-year-LRIC-model does not aim to make technological forecasts for such a long time period. This would be a difficult and uncertain exercise due, among other aspects, to new technological developments, the introduction of new services and change of consumption behaviours.

The model developed assumes a market “stationary state” as from 2025, which ensures a continued and perpetual recovery of costs, subject to the price evolution of equivalent modern assets. This avoids that changes in long-term traffic forecasts affect costs recovered over the first years of the model.

A 45-year-modelling-period guarantees at least a full lifetime period for all assets and ensures also that any final residual value is insignificant and therefore may be ignored.

In fact, some assets can be considered to have a maximum 40-year-lifetime, however most assets in the costing model will have a significantly shorter lifetime period, as is the case of the network’s hardware and software (the typical lifetime of which is around 5 to 8 years).

ANACOM thus takes the view that a model that takes into consideration a 45-year period of time, estimating the development of the Portuguese market until 2025, that assumes a stable state as from that date and that adopts an economic depreciation method, is an acceptable solution that reduces the potential unpredictable effect of the market evolution after 2025.

Contributions received in the scope of DD, with regard to the time horizon, did not show any general opposition to the option taken, although some reservations were put forward, namely deeming that, for the modelled time horizon, estimates would scarcely be credible, given that, at technological level, one should not expect things to remain the same as modelled for the current period.

ANACOM considers that the modelling of a long time horizon does not differ from the practice of most NRAs which have carried out similar exercises, thus being intended to guarantee that the longest-lived asset of bigger duration has, at least, a full lifetime period, being minimised the relevance of any residual values of assets existing by the end of the period.

A different matter to the modelled time horizon is the definition of the equipment lifetime, which is defined taking into account the period during which it is expected to bring economic benefits to the company, before being replaced due to technological obsolescence or breakdown. ANACOM thus endeavoured to incorporate the available information, including data provided by national fixed operators.

Taking into account that the time horizon differs from the lifetime of most equipment, the developed model considers the need to guarantee replacement investments that may address this difference, guaranteeing the regular activity of the operator over the whole time horizon defined.

These considerations led ANACOM to take into consideration, for the purpose of the developed model, an extended 45-year-period.

In view of the above, ANACOM maintains its position that the time horizon to be considered for the purpose of the developed model should be 45 years, to include long-lived assets.

**Time horizon**

ANACOM thus takes the view that the time horizon to be considered for the purpose of the developed model should be 45 years, to include long-lived assets.

#### 2.3.4.4 Remuneration of the cost-of-capital

The Electronic Communications Law[16] (ECL) lays down that the imposition by the NRA of obligations on operators identified as having SMP, namely the obligation for cost-orientation of prices and for adoption of a cost accounting system, must take into

[16] Law No. 5/2004, of 10 February, as amended by Law No. 51/2011, of 13 September, and subsequently amended by Law No. 10/2013, of 28 January, by Law No. 42/2013, of 3 July, by Decree-Law No. 35/2014, of 7 March, by Law No. 82-B/2014, of 31 December and by Law No. 127/2015, of 3 September, available at http://www.anacom.pt/render.jsp?contentId=930940#.VxjeI08aFv0

consideration the investment made by the operator, allowing it to earn a reasonable rate of return on the capital employed, taking associated risks into account[17].

The concept of "cost-of-capital" is usually associated to the return that a given investment must provide, in the light of the business risk. The developed model must include an appropriate and reasonable remuneration of investments made by the efficient hypothetical operator, taking associated risks into account, deemed to stimulate investments required for an appropriate provision of services.

In this context, the model incorporates a cost-of-capital rate, determined on the basis of the Weighted Average Cost-of-Capital (WACC) methodology, which theoretically and technically is acknowledged to be apt to achieve objectives listed above.

In this respect, ANACOM has been studying since 2009 the subject of the cost-of-capital to be applied to fixed communications for regulatory purposes, therefore it is deemed coherent that the model in question adopts a similar approach, as far as the cost-of-capital is concerned, to decisions issued on MEO's cost-of-capital (formerly known as PT Comunicações).

In the course of the Methodological Consultation on this matter, notwithstanding the fact that responses presented were close to the approach proposed by ANACOM, stakeholders raised some issues that are summarised as follows:

- The indexation of the risk-free interest rate to Portuguese State bonds is not acceptable, and this value should reflect a value closer to the one provided by the market. The interest rate associated with the market risk should take into consideration the company's effective operational risks;
- As the model proposed by ANACOM has an extended time horizon, the cost-of-capital rate associated with each of the exercises should not remain constant, therefore it will not be enough for ANACOM to perform a pure and simple parallelism of parameters used for MEO's CAS cost-of-capital; on the contrary, the Regulatory Authority should make a substantiated and detailed evolution estimate of such parameters, notably through the use of macro-economic evolution assumptions;

[17] Paragraphs 1 and 2 of article 74 of Law No. 5/2004, of 10 February.

- With regard to the risk-free interest rate, the option for taking into consideration 10-year AAA-rated sovereign State bond issues seems to be appropriate;
- As regards the market risk premium, one of the responses seems to indicate a preference for a market risk premium value measured at worldwide level, suggesting a value between 3% to 3.5% in annualised terms;
- As far as the calculation of the systematic risk weight is concerned, a benchmarking exercise with similar operators was proposed, the necessary corrections of capital structures being performed;
- As regards the cost of debt capital, the use of a benchmark with peer European bodies is also suggested, seeking to reflect business conditions in the cost of debt capital, corrected for the various levels of financial leverage of collected observations. At the end, the model must be able to reflect the impact of the efficient hypothetical company's capital structure on the cost of its debt capital;
- In the scope of the efficient operator's capital structure, the adoption of a methodology for simulating different scenarios and assessing their effects on the cost of equity and debt capital was proposed.

ANACOM acknowledges that the appropriate cost-of-capital rate is not expected to remain constant over such an extended period of time. Nevertheless, it is considered that simulating changes in the cost-of-capital rate over a 45-year-period is not only a complex and highly speculative exercise, but above all useless in the context of the present model. The model is required to guarantee coherent and consistent results, implying as such that the WACC calculation takes into account the best available information.

The way how WACC is determined implies being aware with reasonable certainty of values of various parameters, some of which are exogenous to the modelled operator (for example: risk-free interest rate, tax rate, risk premium), therefore their long-term estimation would introduce in this model an additional level of complexity without necessarily providing more robustness to results produced, particularly taking the current macro-economic context into account.

Contributions received in the scope of the DD, with regard to the remuneration of the cost-of-capital, led ANACOM to review the value of the capital rate to be considered in the costing model (*vide* prior hearing report).

With respect to the WACC methodology calculation, it is worth noting the following:

- ANACOM calculated in due course MEO's cost-of-capital rate for 2014, which stands at 10.42%;
- That calculation was performed in accordance with a methodology discussed with the sector and published in 2014, integrating results of international benchmarks in various components and representing at present a reference for all market agents.

In that sense and bearing in mind the similarities/differences between fixed networks held by MEO and by the modelled operator, the cost-of-capital rate[18] applied to MEO was used for the purpose of the calculation of the cost-of-capital of the fixed communications business, being deemed that the value under consideration represents an appropriate estimate to be incorporated in the developed module.

It must also be referred that ANACOM expects that, in a future update of the costing model, insofar as there is greater confidence in relevant parameters used to calculate the cost-of-capital, such parameters may be reviewed in light of developments that meanwhile may take place. These reviews will mitigate the need for very long-term estimates, which, as referred, would necessarily be difficult and uncertain.

In view of the above and bearing in mind that there is a new cost-of-capital reference for MEO for regulatory purposes in 2014, ANACOM deems this reference to be the best available information and, simultaneously, a good proxy for the cost-of-capital rate of the hypothetical operator to be considered. As a result, it is informed that the model was updated so that the parameter concerning the cost-of-capital rate reflects the best currently available information.

**Remuneration of the cost-of-capital**

ANACOM takes the view that the developed model must take into consideration an appropriate remuneration of investments the hypothetical operator would be required to make in order to provide call termination on fixed network, taking into account the associated business risks.

As such, the calculation of the cost-of-capital for the purpose of the model to be developed was based on the adjustment of the methodology applied to MEO in the scope of the fixed communications business, bearing in mind the similarities/differences

[18] By order of 23 May 2014, ANACOM determined that the cost-of-capital rate to be applied by MEO for 2014 stands at 10.42%, in the context of results of the cost accounting system (CAS) for 2014, http://www.anacom.pt/render.jsp?contentId=1257892

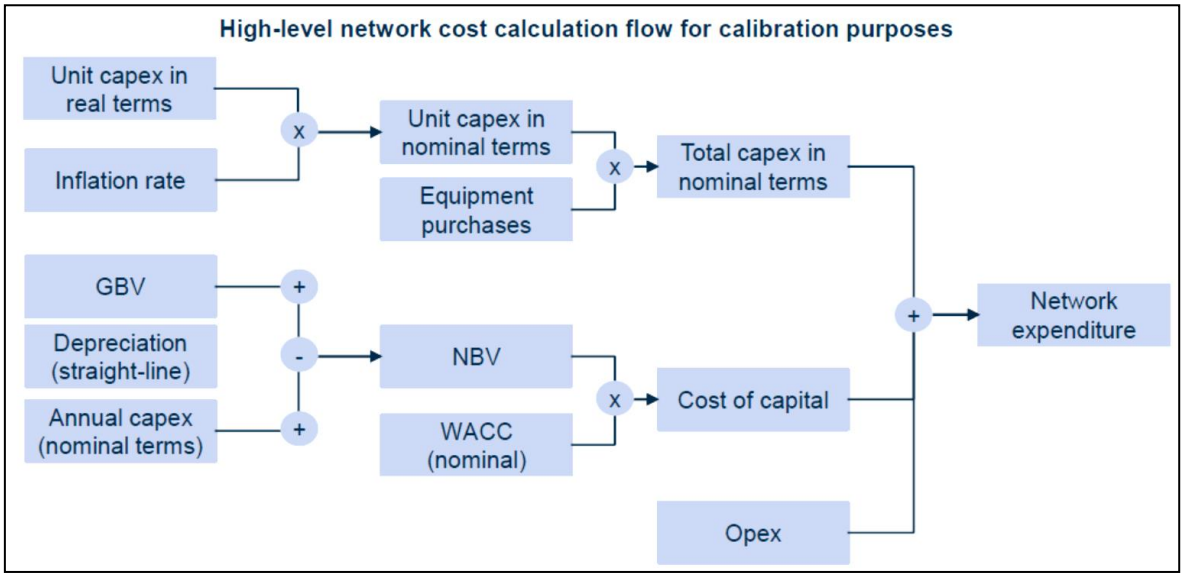
between fixed networks held by MEO and by the modelled operator. In this context, the model is updated in line with the parameter concerning the cost-of-capital rate that applies to MEO for regulatory purposes in 2014.

#### 2.3.4.5 Calibration of the model

The consultant carried out an economic calibration exercise, as described below, in order to compare results produced by the model with the underlying reality.

In brief, the calibration of the network consisted in the comparison of the model results with data provided by MEO at the data request stage. In order to undertake the calibration, network costs borne by the modelled operator in 2012 were calculated in nominal terms, the straight-line method having been used to determine depreciation shares. Figure 12 illustrates the methodology followed to calculate the costs incurred by the modelled operator.

**Figure 12: Methodology used in the calibration of the model**




Source: "Documentation accompanying the fixed BU-LRIC model", prepared by Analysys Mason

Based on data obtained, it was found that costs declared by MEO are about **[bci]** **[eci]** higher than those calculated by the model, which is deemed to be reasonable, taking into account that values reported by MEO also include the access network, with which a great part of total costs is associated**.** The fact that MEO's network has been deployed for several years is also relevant, with all the implicit restrictions, like for example, the use of legacy technologies that prevent MEO from holding a fully NGN all-IP network. Taking into consideration the differences between MEO's network and the modelled network, costs

incurred with both networks were compared, having the consultant based the design and dimensioning of the modelled network on widely accepted sector standard criteria that have already been used in similar exercises, having the consultant concluded that differences verified may be reasonably explained by context differences between MEO and the modelled operator.

Contributions received in the scope of the DD, with regard to calibration, include various observations on how it is processed in various areas (traffic considered, type of customers, technical parameters regarding specification and network dimensioning, and price evolution of equipment), as extensively referred to in the prior hearing report, which also sets out ANACOM's views on each of them, this Final Decision not being deemed to require any change or addition.

It is emphasized in any case that, as regards the fact that allegedly technical aspects of the model are not appropriate in view of the reality of the national territory, it must be noted that MEO's network configuration was taken into consideration, although it might not have been modelled. In this regard, it is stressed that although the number of modelled access nodes may have been highly influenced by the design of MEO's network in close relation with the demonstrated national coverage, the aggregation levels considered in the model were changed so as to reflect a higher efficiency level. As set out in the consultation document, the model adopted the modified scorched-node principle which, as in the case of the mobile termination model, seems to be the methodological approach that best balances the need to address efficiency concerns in the model and not to introduce too much complexity in its practical development.

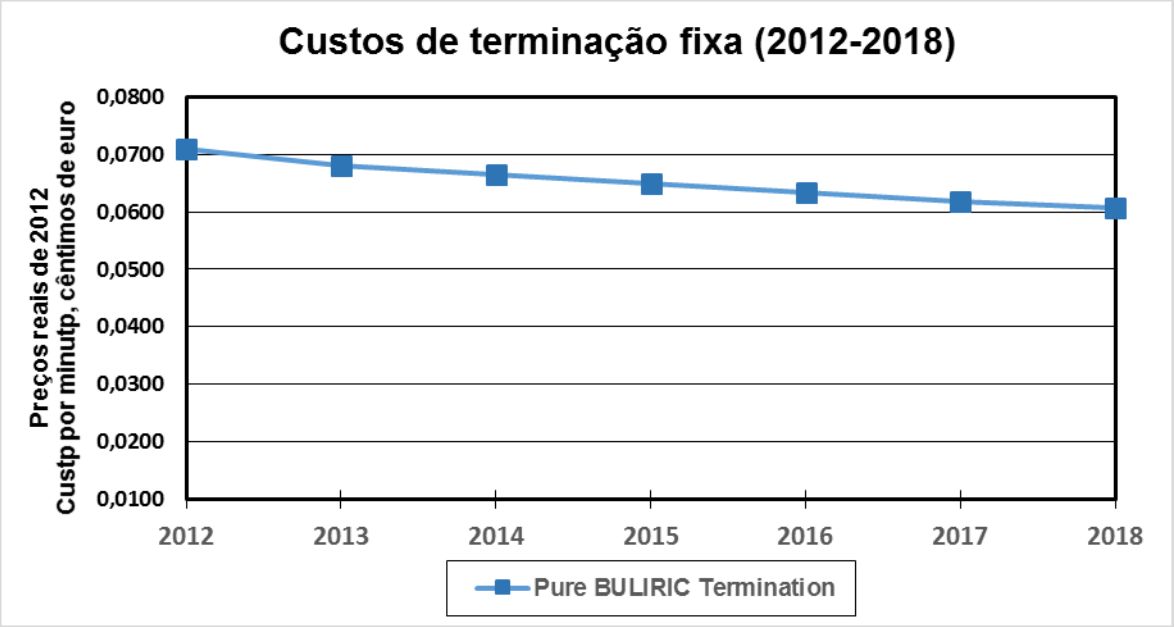
Moreover, it is important to note that the modelling exercise carried out focused on the core network and not on the access network, thus the number of modelled MDFs have no impact on the pure LRIC value, as the number of MDF does not vary with call termination traffic.

### 2.4 Results of the model

Bearing in mind the description of modelled options and mechanisms used in the practical implementation of those options, unit incremental costs (at values for 2012) of the wholesale fixed termination service, calculated according to the "pure" LRIC methodology, are presented. As may be seen from Figure 13, according to the costing model developed by ANACOM on the basis of the "pure" LRIC option, the cost of the wholesale fixed termination service, calculated according to the EC Recommendation, amounts, in 2016,

to around 0.0633 cents per minute (at prices for 2012), or to 0.0644 cents per minute considering an inflation close to 0.27% in 2013, -0.28% in 2014, 0.49% in 2015 and a foreseen 1.2%[19] inflation in 2016.

**Figure 13: Results produced by the model**




Source: Model of costing developed by Analysys Mason

Fixed termination costs (2012-2018)
Real 2012 prices
Costs per minute, Euro cents

As referred earlier, in addition to this document, stakeholders must take account of annexed documents prepared by the consultant as well as the public version of the developed costing model which, it is reminded, may present slightly different values from those produced by the model on which Decisions of this Authority will be based (and which were used in this document); nevertheless, the assumptions, calculation structure as well as incorporated algorithms are the same.

Contributions received in the scope of the DD associated with this decision included two specific comments directly related to the result obtained by the model, comparing it to results obtained in other countries and to the mobile termination value in force.

[19] According to the Government Budget for 2016, available at http://app.parlamento.pt/webutils/docs/doc.pdf?path=6148523063446f764c3246795a5868774d546f334e7a67774c336470626d6c7561574e7059585270646d467a4c31684a53556b76644756346447397a4c334277624445794c56684a53556c664d6a49755a47396a&fich=ppl12-XIII_22.doc&Inline=true on 20 April 2016.

With regard to the value presented and now slightly corrected, ANACOM considers that the value obtained for fixed termination was the result of a model implemented in a transparent manner, based on the "pure" LRIC approach that takes account of national specificities and uses information provided by players operating in the Portuguese market. Moreover, most characteristics of the model that was developed were also the subject of a specific public consultation, that ran from 29/11/2013 to 15/01/2014, as well as of a workshop, which aimed to collect contributions not only from fixed operators, but also from the rest of the sector and other stakeholders, having those contributions resulted in changes of the characteristics of the developed model.

### 2.5 Presentation of the model

The development of the "pure" LRIC costing model for fixed termination was based, among other data, on elements that could be deemed to be confidential, and for this reason ANACOM will not make such elements publicly available, in order to safeguard bodies concerned by these data. Nevertheless, a cost model is provided to stakeholders, which stems from the original model referred above, as regards assumptions considered and the structure of calculation of algorithms used, having elements deemed to be confidential been deleted and masked.

ANACOM thus opts to publish a model that differs from the confidential model only as regards the input parameters deemed to be confidential, which were modified relatively to original parameters in a random proportion between -15% and +15%, to protect their confidential nature. In any case, ANACOM believes that the assumptions, structure of the calculation model and algorithms used by the model, as well as remaining documents published, will allow the various stakeholders to adequately understand the modelled hypothetical operator.

Taking into account observations received during the public consultation (*vide* the DD Report), it is emphasized that ANACOM published a public version of the model, for reasons relating to the fact that part of the costing model, related to CAPEX and OPEX inputs, was elaborated, whenever applicable, on the basis of responses of operators to ANACOM's request for data. The anonymity of these inputs in the public version of the model is required to protect confidential operator data, obtained in the scope of a non-disclosure agreement. The public version of the model works exactly like the confidential version, whereby the user will be able to assess the impact of each variable on results by performing tests in the public version.

## 3 Decision

Taking into account the grounds set out above, and in pursuit of regulatory objectives, especially provisions set out in paragraphs 1a) and 2b) of article 5 of Law No 5/2004, of 10 February[20], ANACOM's Management Board, pursuant to articles 66 and 74 of the same Law, hereby determines to adopt the fixed termination costing model described herein and respective annexes and to take in account the respective results in the decision relating to the analysis of the wholesale market for call termination on public telephone networks provided at a fixed location.

http://www.anacom.pt/render.jsp?contentId=930940#.WBDSPBJFscM

## Appendix A: List of acronyms and abbreviations

| | |
|---|---|
| ATM | Asynchronous Transfer Mode |
| BAP | Broadband Access Platform |
| BRAS | Broadband remote access server |
| BU-LRIC | Bottom Up Long Run Incremental Costs |
| CAS | Cost Accounting System |
| CCA | Current Cost Accounting |
| DD | Draft Decision |
| DSLAM/MSAN | Digital Subscriber Line Access Multiplexer/Multi-Service Access Node |
| DTH | Direct-To-Home (satellite television service) |
| ECL | Electronic Communications Law |
| FL-LRIC/LRIC | Forward-looking long-run incremental costs |
| FTTH | Fibre-to-the-home |
| GPON | Gigabit Passive Optical Network |
| HCA | Historical Cost Accounting |
| IP | Interconnection Point |
| IP | Internet Protocol |
| IP NGN | IP Next Generation Network |
| IP/MPLS | Internet Protocol/Multi-Protocol Label Switching |
| IPTV | Television over Internet Protocol |
| LAN | Local Area Network |
| LRAIC | Long-Run Average Incremental Cost |
| MEA | Modern Equivalent Assets |
| NGA | Next-Generation Access Network |
| NGN | New Generation Network |
| NG-SDH | Next Generation SDH |
| NRA | National Regulatory Authority |
| OLT | Optical Line Terminal |
| OSP | Operators and Service Providers |
| OTT | Over The Top (OTT) |
| PV | Present value |
| RADIUS | Remote Authentication Dial In User Service |
| SDH | Synchronous Digital Hierarchy |

| | |
|---|---|
| SIM | Subscriber Identity Module |
| SMP | Significant Market Power |
| STM | Synchronous Transport Mode |
| TDD | Time Division Duplex |
| TDM | Time Division Multiplexing |
| UMTS | Universal Mobile Telecommunications System |
| VoD | Video on demand (VOD) |
| WACC | Weighted Average Cost of Capital |
| WDM | Wavelength-division multiplexing |
| xDSL | DSL technologies |

## Appendix B: List of other bodies/organizations

| | |
|---|---|
| ANACOM | Autoridade Nacional de Comunicações |
| Analysys Mason | Analysys Mason Limited |
| DECO | The Portuguese Association for Consumer Protection |
| EC | European Commission |
| ERG | European Regulators Group (currently BEREC - Body of European Regulators for Electronic Communications) |
| EU | European Union |