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Report for OPTA

Conceptual specification for the update of the fixed and mobile BULRIC models

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Final version after industry comment

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Contents

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1 Introduction

Onafhankelijke Post en Telecommunicatie Autoriteit ('OPTA') has commissioned Analysys Mason Limited ('Analysys Mason') to update the bottom-up long-run incremental cost (BULRIC) models of fixed and mobile networks in the Netherlands, for the purposes of pricing wholesale fixed termination and wholesale mobile termination. These two services fall under the designation of Markets 3 and 7 respectively, according to the European Commission (EC) Recommendation on relevant markets.

Analysys Mason and OPTA have agreed a process to update the BULRIC models, which will be used by OPTA to inform its market analysis for wholesale fixed and mobile termination after the current regulation ends in 2013. This process presents industry participants with the opportunity to contribute at various points during the project.

The original BULRIC models were published in April 2010,[1] following a year-long period of development. A conceptual specification (document reference 14895-163g) was finalised as part of this process. The published materials form the starting point for this upgrade.

In this section, we provide:

- the background to the overall process
- an explanation of the scope of this document
- the overall timeline of the project and opportunities for industry stakeholders to contribute
- application of the models to pricing of regulated services
- the structure of this conceptual specification.

1.1 Background to the process

OPTA is seeking to update a set of BULRIC models for both wholesale fixed and mobile termination services in the Netherlands (Markets 3 and 7 according to the EC relevant markets). OPTA also plans to undertake new market analyses of both markets in 2013, with the BULRIC models ready for the completion of these analyses. This will allow OPTA to complete an update to the termination rate regulation which is due to expire in 2013.

As part of the BULRIC model development and subsequent draft decisions, OPTA would like to take into account the Recommendation on termination rate costing published by the EC in May 2009.[2] As far as can be justified, OPTA also intends to continue to apply consistent principles to both the fixed and mobile BULRIC models.

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1 See http://www.opta.nl/nl/actueel/alle-publicaties/publicatie/?id=3180

2 European Commission C(2009) 3359 final COMMISSION RECOMMENDATION of 7.5.2009 on the Regulatory Treatment of Fixed and Mobile Termination Rates in the EU; also EFTA Surveillance Authority Recommendation of

1.2 Scope of conceptual discussion

Thirty-seven concepts were defined in the final conceptual approach document as part of the development of the original BULRIC models of fixed core and mobile networks in the Netherlands, released 20 April 2010.[3] This consultation paper should be read in conjunction with the original conceptual approach document. The issues to be considered are classified in terms of four dimensions: operator, technology, services and implementation, as shown below.

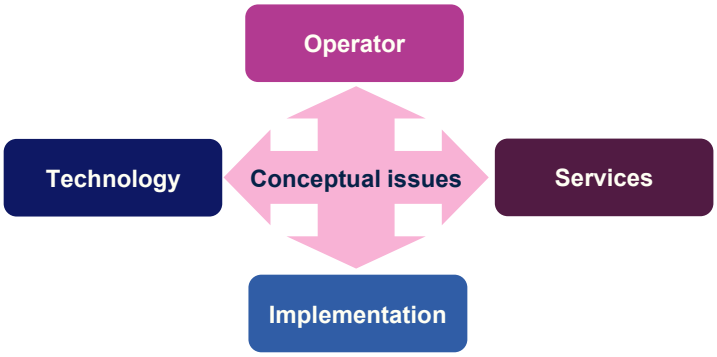

Figure 1.1: Framework for classifying conceptual issues [Source: Analysys Mason, 2012]

1.3 Project and consultation timetable

This specification presents the conceptual approach for the update of OPTA's BULRIC models for both wholesale fixed and mobile termination in the Netherlands. The issues described here for the model update were presented to industry parties at the first Industry Group meeting (IG1[4]), outlined in the overall timetable in Figure 1.2. This specification was finalised following industry consultation according to the timetable below, and was issued to the Industry Group as part of the draft model consultation, which was accompanied by a second meeting (IG2).

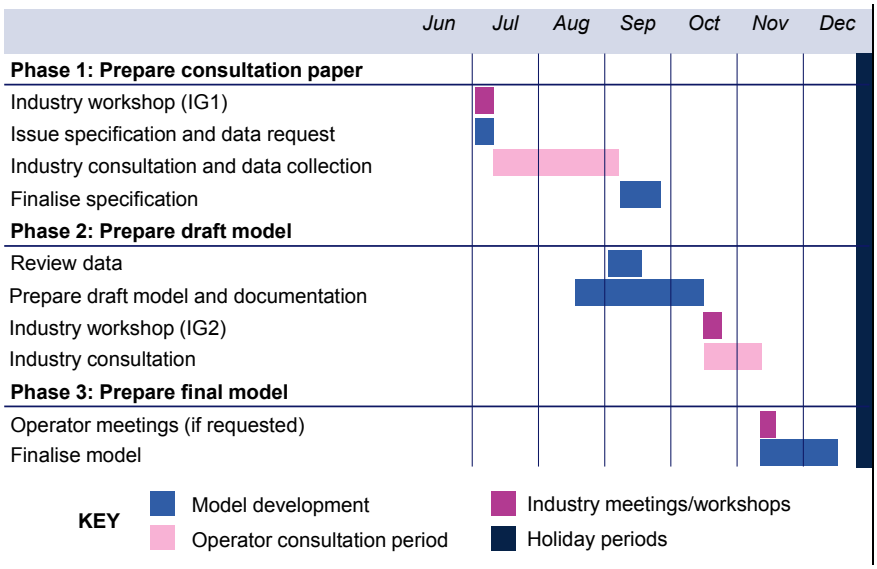

Figure 1.2: Project plan [Source: Analysys Mason, 2012]

13 April 2011 on the Regulatory Treatment of Fixed and Mobile Termination Rates in the EFTA States. See http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:124:0067:0074:EN:PDF.

3 See http://www.opta.nl/nl/download/bijlage/?id=539

4 See http://www.opta.nl/nl/actueel/alle-publicaties/publicatie/?id=3615

1.4 Application to pricing

OPTA is looking to set price caps for both fixed and mobile voice termination services after July 2013, when the current regulation expires. OPTA will undertake a full market analysis and plans to start the national consultation of the BULRIC models early in 2013, so the updated BULRIC models should be available before the start of 2013.

We note that, in June 2012 the European Commission[5] advised OPTA to set lower termination price caps in the Netherlands. This EC process constitutes a separate issue from the update of the BULRIC models.

1.5 The structure of this document

The remaining sections of this document summarise the concepts as finalised in the original project and discuss the aspects of the models that should be updated.

- Section 2 describes revisions we propose related to the operator dimension
- Section 3 discusses revisions we propose related to the technology dimension
- Section 4 sets out revisions we propose related to the service dimension
- Section 5 explores revisions we propose related to the implementation dimension.

The report includes one annex (Annex A) that expands the acronyms used in this document.

[5] See http://www.opta.nl/nl/actueel/alle-publicaties/publicatie/?id=3611

2 Operator issues

The following concepts are considered in this section.

Figure 2.1: Decisions on the operator-related conceptual issues taken for the original BULRIC models, and items requiring further examination in light of this update [Source: Analysys Mason, 2012]

No.	Conceptual issue	Recommendation for the original BULRIC model	Revisit?
1	Type of operator	Develop models of hypothetical existing operators	No
2	Network footprint of operator	National levels of coverage, with indoor coverage for the mobile networks	Yes
3	Market share	50% market share for the fixed operator and 33.3% market share for the mobile operator	Yes
4	Roll-out and market share profile	Hypothetical profile applied consistently to both the fixed and mobile models	No
5	Scale of operations	Service provider and MVNO volumes will be included in the market, and full-scale operations modelled	No

2.1 Type of operator

The final concept from the original specification for the type of operator, updated based on the implementation chosen for the original BULRIC model, was as follows:

Original concept 1: We shall develop a model based on a hypothetical existing operator.

The modelled operator is "hypothetical" because no actual operator has the same launch and market share characteristics, and it will have a hypothetical equal share of the relevant market, designated by 1/N. The operator modelled will therefore be:

An existing mobile operator rolling out a national 900MHz 2G network from 1 January 2004, launching 2G services on 1 January 2006, later supplementing its network with 1800MHz frequencies for extra 2G capacity. This network would also be overlaid with 2100MHz 3G voice and HSPA capacity and switch upgrades (reflecting technology available in the period 2004–09), to carry increased voice traffic, mobile data and mobile broadband traffic.

An existing fixed operator rolling out a national NGN IP core network and a copper access network from 1 January 2004, launching NGN services on 1 January 2006. The access network is assumed to use MDF/VDSL copper-based technology.

A hypothetical existing operator is defined with characteristics similar to, or derived from, the actual operators in the market, except for specific hypothetical aspects that are adjusted (e.g. date

of entry, mix of efficient technologies deployed). In particular, such an operator is not a new entrant. Therefore, it is not appropriate to model a low level of growth that might be anticipated from a real recent market entrant. Such an evolution is unlikely to set a reasonable cost benchmark for the existing, mature, efficient-scale operators. Instead, the operator is assumed to be rolling out a new network deployment for its existing customer base, which is then migrated onto this new network in a relatively limited period of time.

Where possible, this operator can be set up as a typical operator. In the case of the mobile market, where the three existing entrants were all 2G/3G network owners, a typical operator is easier to define. In the fixed market, there is no typical operator. As a result, a modelling choice was made as to an efficient mix of the technologies to be used by the operator.

We propose to maintain this concept because the over-arching efficiency goal and market characteristics have not changed.

► *Operator comments on concept 1*

One respondent understands the desire to maintain the original concept, given the fact that the overarching efficiency goal and market characteristics have not changed.

A second respondent maintains its position that rates should be based on actual operator costs rather than a theoretical model. However, the respondent *"acknowledges that an approach based on a hypothetical operator can in principle also approach the actual operator costs and therefore and under this condition this would be an acceptable alternative to using actual operator costs."*

► *Analysys Mason response*

Based on the comments above, the proposed concept will therefore be left unchanged.

Final concept 1: We shall develop a model based on a hypothetical existing operator.

The modelled operator is "hypothetical" because no actual operator has the same launch and market share characteristics, and it will have a hypothetical equal share of the relevant market, designated by 1/N. The operator modelled will therefore be:

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An existing fixed operator rolling out a national NGN IP core network and a copper access network from 1 January 2004, launching NGN services on 1 January 2006. The access network is assumed to use MDF/VDSL copper-based technology.

2.2 Network footprint of operator

The final concept from the original specification on the network footprint was as follows:

Original concept 2: National levels of geographical coverage will be reflected in the models comparable to that offered by current national fixed (or combined cable) and mobile operators in the Netherlands, including indoor mobile coverage.

We propose to maintain this concept.

However, we requested that the Dutch fixed and mobile operators provide updated information on their actual coverage profiles. The modelled national/outdoor/indoor coverage profiles will then be considered against the actual roll-out; in particular, we will ascertain whether actual operator coverage has consistently exceeded the coverage levels specified in the model to a material extent.

► *Operator comments on concept 2*

One respondent agreed with the original concept and agrees to maintain this concept.

A second respondent agrees that the model should include sufficient network equipment to allow mobile service in all the areas where service is currently available. However, it claims that the relationship between coverage and capacity is not straightforward: *"Apart from the very early days in the development of mobile networks when coverage statistics were used in promotional material, coverage has not been an end in itself. Rather coverage has been extended over time for the additional capacity and revenue generating capability that ensues. The complexities associated with providing capacity far outweigh the complexities associated with providing coverage and it is essential that the model is cognisant of this."*

In this respect, the respondent highlights the wording of the Recommendation on fixed and mobile termination, which defines coverage as follows: "Coverage can be best described as the capability or option to make a single call from any point in the network at a point in time, […]."

The respondent continues: *"The important difference between coverage as set out in the Recommendation and coverage as understood by network engineers in the real world is the extent to which future traffic growth should be reflected in the dimensioning of the coverage network. The dimensioning of the coverage network as per the Recommendation is for a single call network and should not take into account any expectation of future traffic growth. This is clearly different to a real world 'coverage' network which is built with the expectation of significant traffic volumes. It is crucial for this distinction to be reflected in the model to ensure that the costs of coverage are not over-stated and to ensure the incremental costs of capacity, including inter alia the incremental costs of the termination service, are not understated."* In the respondent's opinion, Analysys Mason and OPTA have not explicitly looked into such a 'single call network' to date. "*However, modelling such a hypothetical 'single call network' is an essential step to arrive at a demarcation between coverage-driven and capacity-driven costs that conforms with the definitions*

of the Recommendation. We are currently working with our radio network suppliers to provide Analysys Mason with the information they need for this purpose".

The respondent submits that it understands from the following comment in the draft document that Analysys Mason and OPTA are not following the coverage definition from the Recommendation. It notes that Analysys Mason and OPTA said *"However, we will request that the Dutch fixed and mobile operators provide updated information on their actual coverage profiles. The modelled national/outdoor/indoor coverage profiles will then be considered against the actual roll-out; in particular, we will ascertain whether actual operator coverage has consistently exceeded the coverage levels specified in the model to a material extent."*

Further, the respondent submits that *"By taking into account the actual operator coverage, rather than the coverage of a 'single call' network, Analysys Mason and OPTA will draw an incorrect demarcation line between coverage and capacity. Such a demarcation line will be strongly biased towards coverage, in the sense that it will consider much more costs as coverage-driven than justified. This will lead to the model underestimating the incremental costs of each service, including the termination service. This will also lead to an over-estimate of common costs, the allocation of which is arbitrary as explained in our response to concept 37."* As such, the respondent is *"strongly opposed to any interpretation of coverage for the purpose of this modelling exercise that goes beyond a single-call network"*.

A third respondent states that *"using actual coverage as a measure however fails to address representative levels of especially indoor coverage for the hypothetical operator over the envisaged regulation period:*

- *Using only actual coverage does not take into account necessary further 2G and 3G roll-out by operators;*
- *Using coverage that gradually builds up to the actual coverage of existing operators fails to address the situation of a hypothetical new entrant requiring a very high level of coverage from day one. A new operator should have a 3G network that provides extensive deep-indoor coverage."*

► *Analysys Mason response*

With respect to the second respondent, we first observe that the demarcation between assets deployed for coverage purposes and assets deployed for capacity purposes is not relevant under the Plus BULRIC approach, since this approach requires that all relevant costs (coverage costs, capacity costs and common costs) are included.

In the case of the Pure BULRIC approach, we would observe that recommendation 6 in the Commission Recommendation states that the LRIC model must establish "the difference between the total long-run cost of an operator providing its full range of services and the total long-run costs of this operator in the absence of the wholesale call termination service being provided to third parties. A distinction needs to be made between traffic-related costs and non-traffic-related

costs". Below, we consider these points, in conjunction with the single-call network definition, separately for the modelled 2G and 3G technologies:

- For the case of 3G, we note that the nature of the technology means that the coverage area of a NodeB reduces as it carries more traffic ('cell breathing'). Therefore, a 3G network capable of carrying only one call between two indoor subscribers (according to the above definition) can be deployed with fewer sites. However, the key characteristic required by the Recommendation is the behaviour of the network design with the removal of "only termination traffic", not of "all traffic bar the first minute". In order to calculate this, the second respondent would have to:

  – calculate the network costs of 3G coverage to support one indoor voice call
  – calculate the additional network costs to support all additional traffic except voice termination
  – calculate the further additional 3G network costs to support voice termination.

  Our approach to the 3G network design considers the two last cases as required by the Recommendation (as illustrated in Figure 2.2 below), and assumes slightly larger 3G cell radii in the absence of termination, due to lower traffic loading in the long term. Therefore, some of the 3G network "coverage" is considered entirely incremental to termination. We believe that our implementation will lead to the same outcome as that implied by the second respondent, i.e. as represented by the purple boxes below.

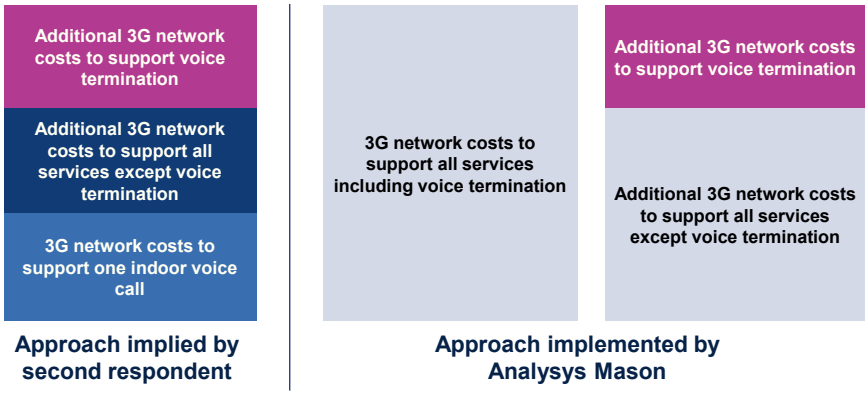


Figure 2.2: Comparison of the implementation undertaken by Analysys Mason to that implied by the second respondent [Source: Analysys Mason, 2012]

- For the case of 2G, the key point is again the difference in the network design with and without termination traffic. When we consider the network carrying all services except termination, the model already assumes a smaller minimum TRX deployment per sector (1 TRX per sector rather than 2) than when the network carries all modelled traffic.

Therefore, we believe that the approach implemented is considering the avoidable costs of termination in a manner that is consistent with the Recommendation. In particular, the network design adjustments assumed in the absence of termination (e.g. fewer minimum TRX, less 1800MHz spectrum, larger 3G cell radius) reflect that reducing the Erlang load on the network may be accompanied by a variety of possible technical adjustments to the network design.

With regard to the third respondent, we observe that the modelled operator already has a high-level of indoor coverage (>99% for 2G in the long term and 90% for 3G in the long term). The model will also obviously deploy additional equipment for capacity if required in order to carry the assumed demand. The key issue is the long-term level of 3G population coverage. This was previously set at 90%, but could be revised if operators have achieved a higher level of 3G coverage than this. However, the original model also assumed that the GSM network operated in parallel with the 3G network. If 3G network coverage is assumed to reach levels achieved by the 2G network, then this would imply that the 2G network should be shut down in the long-term, since it would be inefficient to maintain two parallel infrastructures for voice and data. Therefore, these two competing assumptions will need to be considered in the model revision.

This issue of the 3G coverage level does not require any revision to the concept, so the concept will be retained. We provide further clarification on the treatment of coverage within the concept, as set out below.

Final concept 2: National levels of geographical coverage will be reflected in the models comparable to that offered by current national fixed (or combined cable) and mobile operators in the Netherlands, including indoor mobile coverage. The definitions of coverage and capacity will be focused on solving the pure BULRIC calculation based on the effects of removing wholesale termination traffic from the network carrying all service demand, taking into account the requirement to provide the option or ability to make a call anywhere in the network.

2.3 Scale of operator

The final concepts from the original specification on operator scale were as follows:

Original concept 3: The modelled fixed operator will have a 50% share of the fixed market. The modelled mobile operator will have a 33.3% share of the mobile market.

Original concept 4: We shall model the hypothetical existing operator with a hypothetical roll-out and market share profile. This principle will be applied identically to the fixed and mobile costing:

- the operator will already be in existence, operating on 1 January 2004, with a legacy network and legacy access connections to a hypothetical 1/N share of the market
- it will roll out its national NGN traffic-sensitive network over two years and launch service on 1 January 2006
- basic legacy services (e.g. residential voice, residential data, GSM voice, SMS and GPRS data) will be moved onto the NGN network as quickly as possible
- complex legacy services (e.g. business ISDN, business connections) will be moved onto the NGN over the period of time in which service support, emulation and customer equipment (e.g. PABXs) can be prepared for the market place

- traffic from new services (e.g. HSDPA, IPTV) will increase on the NGN as these services are expected to develop over time.

Original concept 5: Service provider and MVNO volumes will be included in the market, however full-scale network operations will be modelled.

Original concept 4 is important in that it sets out the definition of the operators to be modelled. In particular, the BULRIC models consider only next-generation network infrastructures. The legacy network is not modelled, but is relevant insofar that it provides an existing customer base that can be rapidly switched to the NGN. Loading curves are used to define how legacy subscribers and traffic are migrated onto the NGN. The loading curves used are illustrated below.

In particular, the loading curves for fixed business services are relatively slow. This is to allow for the transition time for business customers to migrate to NGN services, as well as for the necessary service support and customer equipment (such as PABX) to be developed.

Figure 2.3: Loading curves used in the fixed BULRIC model [Source: OPTA model, 2012]

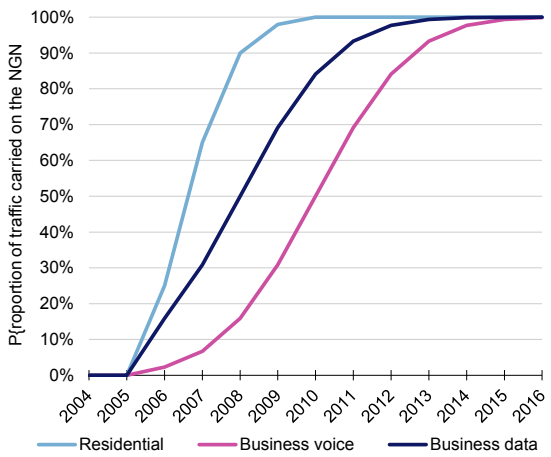
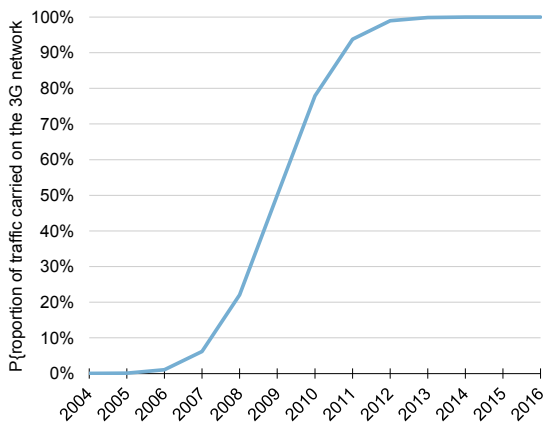


Figure 2.4: Loading curves used in the mobile BULRIC model [Source: OPTA model, 2012]



In the development of the original BULRIC models, comments from industry parties indicated that they considered further entry in the mobile market likely. However, it was observed that recent consolidations of Telfort and Orange had demonstrated that market parties expected there to be three voice and mobile data GSM+UMTS players in the long run, otherwise these parties would not have been acquired by existing mobile players. This situation has also resulted in spectrum being returned/sold by KPN. It was noted that it might be the case that obligations for more than three national GSM+UMTS networks could not be sustained in the long run.

It was noted that further spectrum auctions could occur in the future, and operators could plan to launch new networks and/or new services with the acquired spectrum. However, for the purposes of calculating the efficient costs of voice termination for the period 2010–13, it was considered reasonable to model the current number of national networks supporting GSM and UMTS voice

and mobile data demand in the Netherlands. Therefore, in original concept 3, it was assumed that N=3 for the mobile BULRIC model.

As part of the model update, we are revisiting this concept for the mobile model, based on recent market developments. At the start of 2012, the Ministerie van Economische Zaken, Landbouw en Innovatie ('the Ministry') announced[6] that a large number of mobile spectrum licences would be auctioned in late October 2012. In particular, these frequencies were:

- six licences in the frequency range 791–821MHz paired with 832–862MHz, with two licences reserved for new entrants
- seven licences in the frequency range 880–915MHz paired with 925–960MHz, with one licence reserved for a new entrant
- fourteen licences in the frequency range 1710–1780MHz paired with 1805–1875MHz
- two licences in the frequency range 1959.7–1969.7MHz paired with 2149.7–2159.7MHz
- one licence in the frequency range 1900–1904.9MHz paired with 2010–2019.7MHz
- ten licences in the frequency range 2565–2615MHz
- one licence for the frequency range 2615–2620MHz.

Almost all licences have been specified in 5MHz blocks. The existing operators must bid for spectrum holdings in the auction, since all of their 900MHz/1800MHz licences are expiring. Based on the auction rules related to new entrants, there will be three outcomes:

- one or more new radio network operators aim to enter the Dutch mobile market
- there are no new entrants, meaning that the reserved spectrum is unsold
- existing players fail to secure future spectrum allocations, either exiting the market by vacating spectrum or because of new entrants outbidding them.

In the original concept specification, N is based on the current number of national mobile networks supporting GSM and UMTS voice and mobile data demand in the Netherlands. As of July 2012, this is unchanged from the conclusion reached in the original modelling project (three national GSM+UMTS networks). The relevant period for the next period of termination regulation in the Dutch market is 2013–2016 and there is thus a need to consider the number of networks expected in the market during this time. If it is highly likely that N would increase, then this would need to be taken into account.

It is certainly possible that, in the spectrum auction, more than three companies acquire spectrum. This is particularly the case since one 900MHz licence is ring-fenced from the existing three network operators. However, even this outcome would not necessarily mean that more than three separate networks appear in the long term in the Netherlands.

6 See http://www.rijksoverheid.nl/bestanden/documenten-en-publicaties/besluiten/2012/01/06/besluit-bekendmaking-van-het-via-de-procedure-van-veiling-verdelen-van-vergunningen-voor-frequentieruimte-in-de-800-900-en-1800-mhz-band/stcrt-2012-395.pdf

For example, the opportunity for infrastructure sharing may arise in the future, pending approval by the Nederlandse Mededingingsautoriteit (NMa). This would allow companies to pool their spectrum for use in a joint infrastructure venture. It should also be observed that the recent merger that led to the consolidation of the Dutch mobile market from four to three networks suggests that four players may not be sustainable in the Netherlands. Therefore, the likelihood that N will exceed three for a significant part of the period 2013–2016 is, in our view, unlikely.

As a result, we propose to maintain the current 33.3% market share (i.e. N=3) for the next period of termination regulation, defined in concept 3. We also do not propose to the revise the market share assumed for the modelled fixed operator (50%) because market entry conditions in the fixed market also appear unchanged.

We also proposed to maintain concepts 4 and 5.

► *Operator comments on concept 3*

One respondent has no comments additional to its earlier remarks in the previous regulatory period. In its earlier remarks, the respondent pointed *"at the discrepancy between the public view of OPTA that the auction design should cater for a new entrant, while at the other hand OPTA expresses with regard to the termination model the view that there will not be room for a fourth entrant."*

A second respondent agreed with the assessment that there is little likelihood that N will exceed three for a significant part of the period 2013–2016, is low. The recent consolidation in the market and the fact that spectrum was returned by KPN still indicate that there will be three players in the long run. Although it is possible that more than three companies will acquire spectrum in the auction, the respondent submits that it is questionable whether this justifies making an adjustment to the market share used in the model (33.3%). The respondent commented that:

- *"First of all, a significant amount of spectrum in the currently used 900 and 1800MHz band will remain in use by the existing operators for a period of 21 months, which starts after the expiry date*

- *Also it is unclear whether new entrants will deploy serious voice termination services within the relevant period (2013–2016): as the market is evolving towards mobile data rather than voice, it is unclear whether new entrants will seriously enter the voice market at all;*

- *Finally it remains unclear whether new entrants will actually build (a) new network(s): we agree with AM that companies have an incentive to pool their spectrum for use in a joint infrastructure venture."* The respondent *"sees has no reason to believe that the Nederlandse Mededingingsautoriteit (NMa) would withhold its approval in case approval would be required. Also the Dutch Minister expects that especially for voice services, new entrants will make use of existing network infrastructures"*.

The respondent adds that *"even if new parties will achieve spectrum and also enter the market, deploying voice services, and even if they will also build their own networks, this would obviously require a significant amount of time and should not be taken into account in the current model. With respect to the modelled fixed operator, AM proposes to maintain the current (50%) market share as well."* The respondent agrees that market entry conditions in the fixed market appear unchanged.

With regard to the mobile model, a third respondent emphasised that *"the timing of the process for updating the mobile model is critical in relation to the auction of large parts of the relevant mobile spectrum that the Ministry of Economic Affairs has planned for Q4 2012. The strict auction rules prevent potential bidders in the auction to express themselves on even their intention (or not) to participate in the auction, let alone all views they may have on issues that could materially impact the value of the auctioned spectrum*". Therefore respondents are *"restricted in presenting any information and view on a forward looking basis for the mobile market and the mobile model. Even though we understand the pressure for OPTA in relation to the timing of its draft decisions, we have to refrain from commenting on some of the issues that are part of the process of updating the mobile model up and until the auction has been finalised. As already included in the Conceptual specification document, Analysys Mason recognises this issue in relation to the valuation of spectrum in the model, which can only be included after the auction has taken place, but we believe this applies also to a material response to some other elements of the model. We currently have to refrain from commenting on the expected numbers that are likely to be active for voice services and on all expectations to the development of costs and volumes. We believe Analysys Mason will have the expertise to use their independent view on these factors as preliminary input into the models, but we stress the need to verify these preliminary views against the outcome of the auction afterwards. We reserve our position to comment to these issues at that stage"*.

With regard to the fixed model, the third respondent observes that *"it is intended to retain the concept of a 50% market share for the modelled hypothetical operator."* The respondent understands this concept for the access network part, but nonetheless concludes that the access networks are hardly a relevant cost factor in the fixed model. As for the NGN costs that are relevant to the costs in the model for the Dutch market, with independent service providers based on ULL or WBA wholesale services, the respondent submits that this approach seems questionable. The use of a 50% market share in the model would exclude the existing costs and services of these alternative providers for costs they incur themselves (such as DSLAMs, transmission, switches) for their services, including for call termination.

A fourth respondent states that *"in the fixed market, the likelihood of facilities based entry seems very small and the number of 2 operators looks justifiable. However, this is not the case in the mobile market so that the proposed assumption of 3 operators (or rather mobile networks) is highly likely to understate the number of mobile networks during the regulatory period. The clear objective set out by Dutch Government and Parliament is to forcefully 'facilitate' low cost entry into the Dutch mobile market with the long term objective of having 4 or even 5 and certainly not 3 separate mobile operators with their own networks. There are many developed mobile markets*

internationally with 4 or more players. There is no reasonable basis for the assumption of AM that total network costs of all (4 or more) operators combined will not exceed the costs of the current 3 mobile networks. Further, the cost advantages of network sharing would be quite limited due to the following factors:

- *The current NMa policy only allows sharing of passive infrastructure, all active equipment is to be separate. Antenna sharing potential is limited as spectrum owned and used by new entrants versus existing MNOs for different technologies is likely to differ significantly;*
- *Site rental, which constitutes the majority share of Radio Access Network costs, is likely to go up significantly when landlords take into account that the site is shared by more parties and/or more antennae will be installed.*
- *Costs for power and backhaul will anyway hardly see any sharing advantages.*

Therefore, the argument to assume only (costs of) 3 mobile networks in the Dutch market appears significantly flawed. Given the strong objective of the Dutch Government and Parliament to enforce low cost new entry which will (minimally enforced by roll-out obligations) materialize over exactly the regulatory period, AM should assume the most likely future structure of the industry – at a minimum, this will include 4 facilities based operators."

► *Analysys Mason response*

Regarding the third respondent, we observe that the auction is designed to cater for a new entrant in the *mobile* market. However, this does not necessarily mean that there will be a fourth operator in the *mobile voice* market, which is the focus of the mobile BULRIC model, since the operator could be a data-only operator. Furthermore, since the auction has not yet occurred, it is not yet apparent or certain that a new entrant will appear and persist in the Dutch mobile market (the Netherlands has previously had up to five mobile operators, but these have since consolidated to three). A new operator would also take several years to establish itself. Therefore, retaining the existing assumption of a three-player mobile voice market in the long term appears to be the most prudent assumption to make for the forthcoming window of regulation to 2016. This part of the concept will therefore be maintained.

Regarding the second respondent, the conceptual definition of N is considered to be the actual number of large network operators having near-nationwide coverage. The BULRIC model then considers the volumes of traffic appearing at the first point of traffic concentration on one of these two national infrastructures. We consider that there are two providers with national coverage: KPN and the combined cable operators. Additional players in this market are mainly either alternative fibre access providers (e.g. Tele2 and Reggefiber), or local loop unbundlers.

Fibre access providers do not match the footprint of KPN or cable access, and are deploying a technology which aims to supersede copper access by being able to offer access to significantly higher bandwidth using today's modern optical technology. If a national fibre access network was deployed in the long term, then disconnection of the copper access network would be expected.

We do not consider that unbundlers can be considered as national infrastructure access operators; it is simply that they prefer to rely on unbundled access to copper and/or cable lines.

It would be unrealistic to assume three or more national operators since there are not this many players with full national and regional transmission networks, or full national exchange building deployments. In particular, the fixed costs (economies of scale) for a national three-level fixed core network are sufficiently great that a large number of players will not set an efficient cost price for voice termination. Consequently, it is considered reasonable that two national networks should provide the efficient cost for fixed voice termination in the long run.

Regarding the first response, we observe that the auction is designed to cater for a new entrant in the *mobile* market. However, this does not necessarily mean that there will be a fourth operator in the *mobile voice* market, which is the focus of the mobile BULRIC model, since the operator could be a data-only operator. Furthermore, since the auction has not yet occurred, it is not yet apparent or certain that a new entrant will appear and persist in the Dutch mobile market (the Netherlands has previously had up to five mobile operators, but these have since consolidated to three). A new operator would also take several years to establish itself. Therefore, retaining the existing assumption of a three-player mobile voice market in the long term appears to be a reasonable assumption to make for the forthcoming window of regulation to 2016.

Therefore, we do not consider it appropriate to change the value of N for the purposes of the fixed BULRIC model. Concept 3 will therefore be maintained.

Final concept 3: The modelled fixed operator will have a 50% share of the fixed market. The modelled mobile operator will have a 33.3% share of the mobile market.

► *Operator comments on concepts 4 and 5*

One respondent supports the idea of maintaining these concepts.

A second respondent observes that *"if the 50% market share is maintained in concept 3, then the costs of the hypothetical operator should not be checked against the actual costs incurred by smaller operators."* The respondent has earlier stated that: *"a modelled 50% national fixed operator should be able to offer services to all (consumer and business) customers, with all specific requirements for various market segments. The differentiation in platforms and services elements, necessary to serve all these segments, should be included in the model. The approach that OPTA and Analysys Mason have used in the recent FTA 3b decision – which seems to be based on more or less averaging VoIP license costs of many much smaller operators and much less differentiated than the modelled operator should be – therefore unrealistically underestimates the realistic hypothetical costs."*

A third respondent maintains its remarks with regard to reiterates the comments it made regarding concepts 4 and 5 in the consultation of the model concepts in the previous project. In particular, *"the loading curves are extremely steep, and do not at all take into account the migration issues that are observed in reality. As Analysys Mason and OPTA acknowledge very correctly in the*

context of LTE, migration to new technologies is usually slowed down considerably as a result of the fact that not only handsets and other end-user devices need to support the new technology, but also that end-users need to actually replace their devices. In reality end-users will only replace their devices by next generation devices after a considerable period of time. It takes usually many years before the majority of users are migrated to the new technology. The actual switch-off, the moment in time that the old network technology can be switched-off completely takes much more time, if such a switch-off is possible in the first place. The assumption from Analysys Mason that within one year the majority of consumers will be migrated to a new technology (and in two years even up to 90 percent of consumers) is clearly at odds with the timelines observed in reality."

A fourth respondent states that, *"firstly, AM proposes to model a hypothetical existing operator with a legacy network. This seems to constitute a breach with the previous approach, for no apparent reason, where the hypothetical operator used the first years of its existence to roll-out a network and acquire customers. The latter would seem a more valid approach as operators have had to build networks in advance of the traffic levels required to recover costs with the need for later revenues to help recover earlier losses. The new approach does not allow for recovery of ramp up costs and therefore ignores a significant and unavoidable cost factor of entering into mobile business."* The respondent therefore *"disagrees with this approach that seems biased towards bringing MTA rates down rather than enabling a price level sufficient to recover an operator's unavoidable costs of entering into business. Secondly, AM proposes that the hypothetical operator will roll-out an NGN network within 2 years and migrate its basic legacy services onto it between 2006 and 2008. This is unrealistic. Whereas actual mobile operators have started building NGN elements into their networks, many of these elements are still to be put into any significant operation in 2012. As it is unclear what will be the precise pace of NGN roll-out and adoption into operational use, the impact of costs of mobile termination is speculative and impossible to accurately quantify. For this reason NGN should be excluded from at least the mobile model until its deployment, use and cost base is supported by known actual costs and significant mobile traffic volumes. The same reasoning holds for planned services: their developments are too speculative to be able to result in any robust cost allocation estimates."* The respondent agrees with concept 5.

► *Analysys Mason response*

Analysys Mason and OPTA will consider the first respondent's view when considering the operator data submitted regarding the fixed network. The two main questions related to the operator data submitted should be: (i) whether the costs could be used to represent a platform with appropriate scale and scope and (ii) whether the costs represent an efficient system.

With respect to the second respondent, we note that this issue relates to implementation rather than the concept, so the concept will be left unchanged. However, we observe that the model uses a faster load-up curve for residential voice, and a much slower curve for business voice, acknowledging the fact that legacy PBX issues complicate such a transition. We note that our curve for residential voice is consistent with examples of migration observed in the Dutch market (e.g. cable operators already use a 100% NGN platform to support their own residential voice, and

KPN's residential VoIP service saw significant take-up during the construction of the original BULRIC model).

With regard to the third respondent, we note that this approach was justified in the original concept paper, with a consistent treatment of both fixed and mobile networks considered of particular importance. We did not consider that implementations where the modelled operator either matched a historical roll-out or used historical operator inputs would lead to a consistent treatment of fixed and mobile network costs in an efficient, modern, forward-looking context. The actual evolution of copper, cable and mobile networks is related to events and expectations from several decades ago. These options could lead to costs that are heavily dependent on historical developments of different operators, rather than the costs which today's modern, forward-looking operators should achieve through the operation of efficient networks. Therefore, it was concluded that the chosen approach was competitively neutral and could be applied consistently to both fixed and mobile BULRIC models.

We would also note that the "NGN" technologies implemented in the mobile model had, even at the time of model construction, been established in the market for some years. The modelled services, including the high-speed data services, are also well established. The Commission Recommendation also states that "The bottom-up model for mobile networks should be based on a combination of 2G and 3G employed in the access part of the network, reflecting the anticipated situation, while the core part could be assumed to be NGN-based." These core architectures are now widespread and established in mobile operations throughout Western Europe.

Finally, the network and services that are currently emergent are those related to LTE networks, and they are not currently within the scope of the model.

Final concept 4: We shall model the hypothetical existing operator with a hypothetical roll-out and market share profile. This principle will be applied identically to the fixed and mobile costing:

- the operator will already be in existence, operating on 1 January 2004, with a legacy network and legacy access connections to a hypothetical 1/N share of the market
- it will roll out its national NGN traffic-sensitive network over two years and launch service on 1 January 2006
- basic legacy services (e.g. residential voice, residential data, GSM voice, SMS and GPRS data) will be moved onto the NGN network as quickly as possible
- complex legacy services (e.g. business ISDN, business connections) will be moved onto the NGN over the period of time in which service support, emulation and customer equipment (e.g. PABXs) can be prepared for the marketplace
- traffic from new services (e.g. HSDPA, IPTV) will increase on the NGN as these services are expected to develop over time.

Final concept 5: Service provider and MVNO volumes will be included in the market, however full-scale network operations will be modelled.

3 Technology issues

The following concepts are considered in this section.

Figure 3.1: Decisions on the technology-related conceptual issues taken for the original BULRIC models, and items requiring further examination in light of this update [Source: Analysys Mason, 2012]

No.	Conceptual issue	Recommendation for the original BULRIC model	Revisit?
6	Radio network	Use GSM deployed in 900MHz and 1800MHz bands, and UMTS deployed as a 2100MHz overlay	Yes
7	GSM radio spectrum	Model an operator with 33.3% of GSM/DCS spectrum	Yes
8	UMTS radio spectrum	Model an operator with 2×10MHz of UMTS spectrum	No
9	Spectrum payments	Assume the 15-year spectrum licences are valued at EUR0.70 per MHz per pop for 900MHz, EUR0.30 per MHz per pop for 1800MHz and EUR0.45 per MHz per pop for 2100MHz	Yes
10	Mobile switching network	Deploy combined 2G+3G MSCs from launch, followed by MSS+MGW layered equipment	No
11	Mobile transmission network	Model a national leased dark fibre network and self-provided transmission equipment running STMn in the 2G/3G core network, with Gbit/s after 2011	No
12	Fixed access network	Model a copper-based fixed access network using VDSL at the MDF	No
13	Fixed switching network	An IP BAP NGN will be modelled, with associated platforms and support for a reasonable level of redundancy and service qualities	No
14	Fixed transmission network	Model IP and IP/MPLS over Ethernet and WDM in the fixed next-generation core network	No
15	Network nodes	Apply the modified scorched-node principle	No

3.1 Modern network architecture

This section describes our proposed revisions to the modelled network architectures in both the mobile and fixed BULRIC models. We requested updated unit capital expenditure information for the key assets in their respective networks i.e.:

- BTS, TRX, NodeB, BSC, RNC, MSC and MGW in the mobile model
- VoIP-related equipment, DSLAMs, routers and buildings in the fixed model.

This will allow the capital cost trends to be updated in the *Cost_trends* worksheets in the Fixed and Mobile workbooks.

We invited the IG to provide updated information as to the capacities and utilisation levels of the assets that are considered in both the fixed and mobile BULRIC models.

3.1.1 Mobile model

Radio network

The final concept from the original specification for the modelled radio network was as follows:

Original concept 6: The mobile model will use both 2G and 3G radio technology in the long term, with GSM deployed in 900MHz and 1800MHz bands, and 3G deployed as a 2100MHz overlay.

In the original conceptual specification, only 2G technologies (using 900MHz and 1800MHz frequencies) and 3G technologies (using 2100MHz frequencies) were included in the mobile model network design. This was on the basis that both technologies are proven and available, and also consistent with the EC Recommendation.

We believe there are two issues to consider as part of this update, which we discuss below:

- whether LTE technologies should continue to not be included in the BULRIC model
- whether alternative frequencies should be considered for 2G and 3G technologies.

► *Treatment of LTE technologies*

Previously, it was concluded that although fourth-generation mobile technologies such as LTE may be deployed in the long term in the Netherlands, these networks were expected to be focused on delivering higher-rate mobile data services. Given the large capacities available in a modern network using 900MHz, 1800MHz and 2100MHz frequencies, a fourth-generation overlay was considered unlikely to be used to deliver large volumes of wholesale mobile voice termination in the short-to-medium term.

We observe that five operators acquired 2600MHz frequencies in the auction in 2010 (KPN, T-Mobile, Vodafone, Tele2 and the cable operator Ziggo/UPC). The first coverage obligation deadlines for LTE deployments expired in May 2012 and appear to have been satisfied by all five operators, although coverage and usage appear to be still very low[7]. Moreover, given the upcoming auction of lower frequency spectrum, it is unlikely that there is any significant growth in LTE coverage until operators know what spectrum holdings they have following this auction.

There are economies of scope through deploying an LTE overlay with the 2G/3G networks, due to asset sharing. For example, LTE base stations can be co-located at existing radio network sites and can also share the use of the core transmission networks. However, based on our experience in other jurisdictions, the inclusion of LTE technologies in a mobile cost model has little impact on

[7] According to Vodafone's website, their LTE coverage is currently limited to the region of Eindhoven. According to T-Mobile's website, their LTE coverage is currently limited to 5 small areas in the Netherlands, including the Hague and Rotterdam. According to KPN's website, their LTE coverage is currently limited to parts of the Hague and Utrecht. This information was correct as of the end of June 2012.

the pure BULRIC of wholesale mobile termination and only a relatively small downwards impact on the BULRAIC of wholesale mobile termination, until such time as a significant proportion of voice termination might be carried as voice-over-LTE.

Therefore, given the current mobile data traffic usage on LTE networks in the Netherlands, the current uncertainties of eventual usage and roll-out, and the fact that it would add complexity to the BULRIC model for little impact, we will therefore continue to exclude LTE.

Original concept 6 shall therefore not be revised with respect to LTE technologies.

► *Alternative frequencies for 2G and 3G technologies*

In the original conceptual specification, the 2G network design was assumed to use 900MHz and 1800MHz frequencies, whilst the 3G network design was assumed to use 2100MHz frequencies. We requested data from operators to ascertain how they envision using their spectrum holdings for 2G and 3G technologies in the Netherlands in the future.

As a result of the auction in late 2012, 2G/3G operators may have access to frequencies in the 800MHz, 900MHz, 1800MHz, 2100MHz and 2600MHz bands. Of these five bands, we do not believe that the 800MHz and 2600MHz frequencies are needed for an efficient use of 2G and 3G technologies (these are mainly intended for LTE). We still consider that the only frequencies relevant to 2G technologies are the 900MHz and 1800MHz frequencies.

With respect to 3G technologies, the original BULRIC model assumed that the modelled mobile achieved 85% 3G population indoor coverage by 2012, and 90% in the long term, using only 2100MHz frequencies. The equipment specific to the 2G and 3G networks was shut down (and all costs recovered) by 2019.

Current levels of actual 3G coverage with 2100MHz frequencies in the Netherlands are high. Therefore, incremental coverage using 900MHz frequencies in the future (if any) would be small. It would also require an assumed reduction in the spectrum assumed for 2G 900MHz use, to allow frequencies to be used for 3G 900MHz. Although it could be the case that 3G 900MHz coverage is deployed in the Netherlands after the 2012 auction, it is an outcome within the control of actual operators and not obligated by any frequency package allocation. Therefore, our starting position will be to retain our existing assumption of using only 2100MHz frequencies for 3G deployments.

Original concept 6 shall therefore not be revised with respect to 2G and 3G technologies.

The original BULRIC model contains HSDPA technology up to 7.2Mbit/s. If it is found that 14.4Mbit/s or higher speeds have been deployed by existing operators to carry a higher data traffic load, then we will update the network design to reflect this development. We will also refine the HSPA network design so that it can upgrade automatically as traffic increases, rather than being just a specified network design input.

► *Operator comments on concept 6*

One respondent believes that 4G can be left out, unless 4G would become reality during the timeframe of regulation, which does not seem to be likely. It submits that: *"As far as we know, no significant proportion of voice termination might be carried as voice-over-LTE. Given the current very low mobile data traffic usage on LTE networks in the Netherlands, the current uncertainties of eventual usage and roll-out, and the fact that it would add complexity to the BULRIC model for little impact, we support the proposal not to revise original concept 6 with respect to LTE technologies.*" The respondent sees no reason to believe that original concept 6 should be revised with respect to 2G and 3G technologies.

Another respondent agrees with Analysys Mason and OPTA that *"voice over LTE is not likely to take off in the upcoming regulatory period."* If the choice between the two modelling options (with or without LTE) has no material impact on the outcome, then the respondent is *"of the opinion it is pragmatic to leave LTE at this stage out of the model. It is important to note, that in case Analysys Mason and OPTA would choose to model LTE, they should take into account that LTE technology would need to be operated parallel to legacy technology for a very considerable period of time. It is questionable whether a complete switch-off of the older technologies can be achieved, and if it is possible this will take many years due to legacy issues and contractual obligations."*

Another respondent *"agrees with AM's conclusions on excluding LTE and/or 3G in the 900 MHz, as whether, when and how this would be applied by a market average operator is uncertain."* The respondent *"disagrees with AM's proposal to increase the maximum achieved speed for HSDPA to 14.4 Mb/s given that actual data loads are likely to be carried at a much lower average speed. Whereas speeds of 14.4 Mb/s may be observed occasionally in mobile networks, its capacity sharing characteristic will prohibit data loads from actually be transferred at this speed."* The respondent *"agrees that 14.4 Mb/s HSPA speeds can nowadays be observed in Dutch mobile networks and should in principle be taken into account in the cost modelling."*

► *Analysys Mason response*

Given operator feedback, the proposed concept will be finalised and implemented without further comment.

Final concept 6: The mobile model will use both 2G and 3G radio technology in the long term, with GSM deployed in 900MHz and 1800MHz bands, and 3G deployed as a 2100MHz overlay.

Radio spectrum

The final concepts from the original specification for the modelled radio spectrum were as follows:

Original concept 7: We shall model an operator with 33.3% of 67.6MHz of GSM spectrum. We shall model an operator with 33.3% of 114MHz of DCS spectrum.

Original concept 8: We shall model an operator with 2×10MHz of UMTS spectrum.

We propose to maintain original concept 8.

In the original conceptual specification, it was observed that the current 900MHz spectrum pool available to the three operators was 2×33.8MHz, with 2×57MHz of 1800MHz spectrum available to the three operators (excluding Telfort's returned spectrum). The operator in the original BULRIC model was assumed to be assigned 33.3% of the spectrum in these bands, as well as 2×10MHz of 2100MHz spectrum.

Based on the auction announced by the Dutch Ministry, there is 2×35MHz of 900MHz spectrum available for auction, and 2×70MHz of 1800MHz spectrum.

It is not possible to predict the outcome of the auction, but we believe that the new minimum spectrum block size of 2×5MHz should be taken into account. We propose to reflect this in the BULRIC model by assuming the modelled operator has 1/N of spectrum available, rounded down to a whole number of 2×5MHz blocks.

Assuming N=3 as described in Section 2.3, then we shall assume that the modelled operator has 33.3% of 2×35MHz of 900MHz spectrum, and 33.3% of 2×70MHz of 1800MHz spectrum. After rounding, the modelled operator is then assumed to have 2×10MHz of 900MHz spectrum and 2×20MHz of 1800MHz spectrum.

Original concept 7 shall be revised. We shall model an operator with 2×10MHz of GSM spectrum and 2×20MHz of DCS spectrum.

► *Operator comments on concept 7*

One respondent asserts that it is not currently in a position to comment on the proposal that the new minimum spectrum block size of 2×5MHz should be taken into account nor on the proposal to reflect this in the BULRIC model by assuming the modelled operator has 1/N of spectrum available, rounded down to a whole number of 2×5MHz blocks.

Another respondent regards this revision of concept 7 as a minor change and has no comments at this stage, but reserves the right to comment further during the model consultation.

Another respondent notes that *"AM's argument boils down to AM proposing to round down the amount of spectrum used for the hypothetical operator rather than not rounding it at all as was done in the previous BULRIC model. The main justification for AM's proposal seems to be that spectrum will be sold in 5 MHz blocks. This argument does not make sense as the hypothetical operator in essence represents a "market average profile" operator holding (in case of 3 assumed*

mobile operators) exactly 1/3 of the market and network assets. Then the hypothetical operator should also hold exactly 1/3 of the spectrum available in the market."

► *Analysys Mason response*

In order to be as consistent as possible with the 1/N approach, Analysys Mason has revised both concepts during the finalisation. The modelled operator will have 1/N of the 900MHz, 1800MHz and 2100MHz spectrum available, rounded down to the nearest multiple of the assumed channel bandwidth (0.2MHz, 0.2MHz and 5MHz respectively). This is particularly relevant to 2100MHz spectrum, since UMTS can only use spectrum in multiples of 5MHz (the minimum carrier size).

A key aspect related to the UMTS spectrum is that the BULRIC model will assume that only the first 2×5MHz carrier is required for voice services, with the remaining carriers dedicated to HSPA services. Therefore, only the spectrum costs of the first carrier are related to voice services.

Final concept 7: We shall model an operator with 2×11.6MHz of GSM spectrum. We shall model an operator with 2×23.2MHz of DCS spectrum.

Final concept 8: We shall model an operator with 2×20MHz of UMTS spectrum.

► *Operator comments on concept 8*

One respondent emphasises that joint and common costs such as the cost of the spectrum used by the network should be excluded. In Italy, Spain and the United Kingdom the costs of radio spectrum are not part of the pure LRIC model.

One respondent has no comments on concept 8 at this stage, but reserves the right to comment further during the model consultation.

Another respondent states that *"the approach used for UMTS spectrum should assume the available spectrum is allocated evenly across the assumed number of operators."*

► *Analysys Mason response*

As noted in the original BULRIC model, it is likely that 3G networks in the Netherlands currently carry significant volumes of mobile broadband (HSPA) traffic in their first and (more likely) second carriers. Additional carriers (i.e. third and fourth paired carriers) appear relevant in the model only for supporting higher volumes of mobile data traffic and not for supporting the mobile voice termination which is the primary purpose of the model. We believe this to still be the case, and therefore will retain this concept.

Final concept 8: We shall model an operator with 2×10MHz of UMTS spectrum.

Spectrum payments

The final concept from the original specification for the spectrum payments was as follows:

Original concept 9: Spectrum valuations for 15-year licences have been revised as follows:
- EUR0.70 per MHz per pop for 900MHz spectrum
- EUR0.30 per MHz per pop for 1800MHz spectrum
- EUR0.45 per MHz per pop for 2100MHz UMTS spectrum.

The spectrum payments for the 900MHz, 1800MHz and 2100MHz frequencies are currently specified in terms of EUR per MHz per capita for the full licence period, derived based on consideration of spectrum payments from historical Dutch auctions, Dutch spectrum renewal fees and additional data points from auctions in Sweden and the USA.

Spectrum from these three bands is being auctioned in October 2012.[8] When the auction outcome is known, then the value for any spectrum bought in these bands could be compared to that applied in the BULRIC model to see if there are any significant differences, which could justify a revision in the input values of EUR per MHz per capita.

We note that the values used in the original BULRIC model assumed a licence duration of 15 years, whereas the auction will be for licences of 17 years in duration. This may be another justification for revising the current values in the model after the auction.

The GSM licences of the existing operators are being extended for a period of 21 months in order to provide time for existing operators to adjust to new spectrum holdings.[9] The costs of these extensions are to be determined in a separate process based on the outcome of the auction. This extension fee will not be included within the BULRIC model, since the model will utilise an asset cost based on single period licences purchased up-front.

Original concept 9 shall be revised: The assumed values of EUR per MHz per pop shall be revisited once the outcome of the 2012 auction is known.

► *Operator comments on concept 9*

One respondent supports this proposal, because it ensures that the current market values are used ("*as opposed to the high license fees which were realistic only in the heyday of telecoms*").

Another respondent has no comments, as this concept will be revised after the auction.

A third respondent states that *"AM's proposal to use actual prices from the upcoming spectrum auction for the 900MHz and 1800MHz is flawed and demonstrates insufficient understanding of*

8 See https://zoek.officielebekendmakingen.nl/stcrt-2012-392.html

9 See http://www.rijksoverheid.nl/documenten-en-publicaties/kamerstukken/2012/04/04/brief-aan-de-tweede-kamer-over-veiling-mobiele-communicatie-en-transitie.html

the type of the CCA auction and the prices that will be determined in the auction. A CCA auction is a multiple band auction, yielding only a limited number of winning packages, i.e. combinations of different quantities of spectrum with different prices, as an outcome. It is impossible to use the auction to derive a sufficiently accurate estimate of the spectrum price per band as required for the cost model. In addition, using prices per band as emerging from the 'clock round' in the CCA is not possible as these prices are 'first prices' and may not represent actual payments or even actual valuations which are prerequisite as inputs for the BULRIC model." The respondent also observes that *"costs of 900/1800 spectrum are likely to rise versus the previous model given the setup of the upcoming spectrum auction."*

► *Analysys Mason response*

The concept will be maintained. However, the third respondent's comments will be considered in the context of the auction results, and at that point the approach to revising these values (if at all) will be determined.

Final concept 9: The assumed values of EUR per MHz per pop shall be revisited once the outcome of the 2012 auction is known.

Switching network

The final concept from the original specification for the mobile switching network was as follows:

Original concept 10: We shall model the evolution of the core architecture from 2004 onwards: combined 2G+3G MSCs from launch, followed by MSS+MGW layered equipment.

We propose to maintain this concept.

► *Operator comments on concept 10*

Two respondents provide no specific comments on this concept in their response.

A third respondent states that *"the proposed approach of assuming the hypothetical operator rolling out an NGN network within 2 years (migrating its basic legacy services onto it between 2006 and 2008) is unrealistic. Whereas actual mobile operators have started building NGN elements into their networks, many of these elements are still to be put into any significant operation in 2012. As it is unclear what will be the precise pace of NGN roll-out and adoption into operational use, the impact of costs of mobile termination is speculative and impossible to accurately quantify. For this reason NGN should be excluded from at least the mobile model until its deployment, use and cost base is supported by known actual costs and significant mobile traffic volumes. The same reasoning holds for planned services: their developments are too speculative to be able to result in any robust cost allocation estimates."*

► *Analysys Mason response*

With respect to the third respondent, it was clear at the time of model construction that mobile operators were already moving to a layered architecture and this was therefore reflected in the model. This will be even more applicable today. The Commission Recommendation also states that "The bottom-up model for mobile networks should be based on a combination of 2G and 3G employed in the access part of the network, reflecting the anticipated situation, while the core part could be assumed to be NGN-based." These core architectures are now widespread and established in mobile operations throughout Western Europe. We therefore believe that the concept remains appropriate and consistent with the Recommendation, and it will therefore not be changed.

Final concept 10: We shall model the evolution of the core architecture from 2004 onwards: combined 2G+3G MSCs from launch, followed by MSS+MGW layered equipment.

Transmission network

The final concept from the original specification for the mobile transmission network was as follows:

Original concept 11: We shall model a national leased dark fibre network and self-provided transmission equipment running STM-n links in the 2G/3G core network and Gbit/s links from 2011 onwards.

We propose to maintain this concept.

► *Operator comments on concept 11*

Two respondents provide no specific comments on this concept in their response.

Another respondent agrees in principle with this approach but notes that it may have further comments once it has had the opportunity to review the actual implementation in the model. It submits that the modelled costs should at least approximate actual costs of a contemporary mobile operator.

► *Analysys Mason response*

Based on operator feedback, this concept will be maintained.

Final concept 11: We shall model a national leased dark fibre network and self-provided transmission equipment running STM-n links in the 2G/3G core network and Gbit/s links from 2011 onwards.

3.1.2 Fixed model

Access network

The final concept from the original specification for the fixed access network assumed to be served by the modelled core network was as follows:

Original concept 12: We shall model a copper-based fixed access network using VDSL at the MDF.

We propose to maintain this concept.

► *Operator comments on concept 12*

One respondent provides no specific comments on this concept in its response.

Another respondent is of the opinion that *"this concept does not reflect the current network deployments in the Netherlands by incumbent KPN, let alone the network deployments of an efficient operator. VDSL CO is already largely taken in by the developments in the Netherlands. Speeds of VDSL CO are already at this point in time in most cases not sufficient to meet customer demand for triple play services."* However, as far as the respondent understands, the impact on the fixed termination rates of this concept is not material. To the extent that the impact of this concept is not material for the outcomes of the model, the respondent will not oppose this modelling choice.

Another respondent agrees in principle to this approach.

► *Analysys Mason response*

Based on the above feedback received from industry, the concept will be maintained.

Final concept 12: We shall model a copper-based fixed access network using VDSL[10] at the MDF.

Switching network

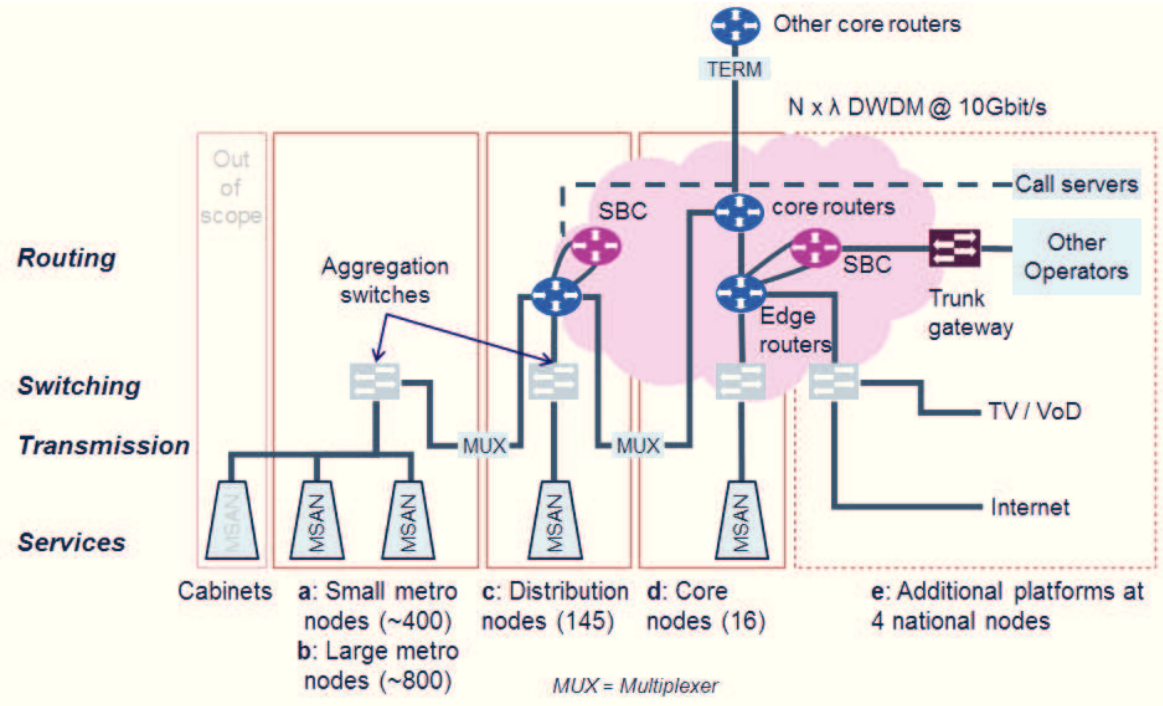
The final concept from the original specification for the fixed switching network was as follows:

Original concept 13: An IP BAP NGN will be modelled, with associated platforms and support for a reasonable level of redundancy and service qualities.

[10] We would note that, in the finalisation of the original fixed BULRIC model, the level of video-on-demand traffic was applied to reflect that a copper access MSAN-based network would be unable to provide VDSL signals to all homes in the area (due to copper line length).

As set out in original concept 13, an IP/Ethernet broadband access platform next-generation network (IP BAP NGN) was deployed in the fixed BULRIC model. This was consistent with the EC Recommendation. The IP BAP NGN aggregates all varieties of service lines, including legacy interfaces, from IP-enabled line cards aggregated at a Gigabit Ethernet core. The main features of the IP BAP NGN are illustrated below in Figure 3.2.

Figure 3.2: Illustration of the IP BAP NGN [Source: Analysys Mason, 2012]



In particular, the core network infrastructure is a four-level hierarchy of cabinets, metro nodes, distribution nodes and core nodes. From an accommodation perspective, all national nodes are co-located with a core node, all core nodes are co-located with a distribution node and all distribution nodes are co-located with a metro node. Gigabit Ethernet over fibre is used to provide transmission between the core network nodes. Coarse wave division multiplexing (CWDM) is used for transmission between distribution nodes and core nodes, whilst dense wave division multiplexing (DWDM) is used for transmission between core nodes.

In terms of the electronics, the equipment in the field-deployed cabinets is out of the model scope, since the first point of traffic concentration (defined in Section 5.1) is assumed to lie within the multi-service access nodes (MSANs) deployed in the metro nodes (**a** and **b**), where switching equipment aggregates traffic. Routers are deployed in both distribution nodes and core nodes to (**d**) route traffic either regionally or nationally. Voice interconnection is assumed to occur at the four national nodes (**e**) and uses TDM trunk gateways.

We do not propose to revise this network hierarchy in the fixed BULRIC model.

However, we will revisit the network design calculations for the hardware and software components of the VoIP platform and its related servers. This will take into account the prevailing VoIP platform architectures of the major Dutch fixed operators and their associated costs, cost-drivers and (if possible) scope of functionalities. This will be based on data requested from the operators and a comparison with data received in the development of the original BULRIC model.

This part of the network design has implications for all the costing calculations in the Service costing module, as described in more detail in Section 5.1.

► *Operator comments on concept 13*

One respondent agrees with the proposal not to revise this network hierarchy in the fixed BULRIC model: *"We cannot judge the need for a revision of the network design calculations for the hardware and software components of the VoIP-platform and its related servers. Given the apparent need to do so, we stress the importance of carefully checking and benchmarking the submitted data from the operators, especially since the remarkable adjustments which were made with respect to VoIP-software costs in the previous MTA/FTA3 decision."*

Another respondent has no comments on this concept at this stage but reserves the right to comment further during the model consultation.

Another respondent agrees in principle to this approach.

► *Analysys Mason response*

Based on operator feedback, the concept will be maintained.

Final concept 13: An IP BAP NGN will be modelled, with associated platforms and support for a reasonable level of redundancy and service qualities.

Transmission network

The final concept from the original specification for the fixed switching network was as follows:

Original concept 14: IP and IP/MPLS over Ethernet and WDM will be modelled in the fixed next-generation core network.

We propose to maintain this concept.

► *Operator comments on concept 14*

Two respondents provide no specific comments to this concept in their response. Another respondent in principle agrees to this approach.

► *Analysys Mason response*

Based on operator feedback, the concept will be maintained.

Final concept 14: IP and IP/MPLS over Ethernet and WDM will be modelled in the fixed next-generation core network.

3.2 Network nodes

The final concept from the original specification for the scorched-node principle was as follows:

Original concept 15: The modified scorched-node principle shall be applied to generate a realistic modern network using modern traffic-sensitive assets at current node locations.

As described in the original specification, the principle of scorching is related to network efficiency and is therefore an important costing issue. Both fixed and mobile networks can be considered as a series of nodes (with different functions) and links between them. In developing deployment algorithms for these nodes, it is necessary to consider whether the algorithm accurately reflects the actual number of nodes deployed. Allowing the model to deviate from the operators' actual number of nodes may be allowed in the instance where the operators' network is not viewed as efficient or modern in design. When modelling an efficient network using a bottom-up approach, there are several options available:

- Actual node, where the exact deployment of real operators is used without any adjustment to the number, location or performance of network nodes.
- Scorched node, which assumes that the historical locations of the actual network node buildings are fixed, and that the operator can choose the best technology to configure the network at and in-between these nodes to meet the optimised demand of an efficient operator.
- Modified scorched node, where the scorched-node approach is modified to replicate a more efficient network topology than is currently in place. Consequently, this approach takes the existing topology and eliminates inefficiencies related to historical locations.
- Scorched earth, which determines the efficient cost of a network that provides the same services as actual networks, without placing any constraints on its network configuration, such as the location of the network nodes. This approach models what an entrant would build if no network existed, based on a known location of customers and forecasts of demand for services. This approach would give the lowest estimate of cost.

We propose to maintain the original concept, meaning that we will continue to use the modified scorched-node principle. This will entail collecting up-to-date node information from the operators.

► *Operator comments on concept 15*

One respondent *"favours the scorched-earth approach, because it removes all inefficiencies. It believes this is in line with the EC Recommendation and inherent to the need to model a new entrant efficient operator."*

A second respondent has no comments at this stage with regard to concept 15, other than the comment already made in the previous round, namely that *"an efficient operator would at least already have adopted the reduction in network nodes KPN announced in its all-IP programme, but eventually did not execute this."*

A third respondent supports the proposed modified scorched-node concept in as far as it complies more with the actual costs approach than a pure scorched-node approach.

► *Analysys Mason response*

With respect to the first respondent, we consider the scorched-earth approach to set a very high benchmark of efficiency, which may overlook real-world constraints that should reasonably be captured by scorched-node modelling.

With respect to the second respondent, we observe that KPN's all-IP design had a comparable number of main network nodes to our modelled Distribution, Core and National nodes. The complete all-IP design, as originally envisaged, would have replaced the layer of more than 1300 MDF locations with active equipment in more than 25 000 street cabinets: these cabinets would also be relevant to the core network since they aggregate traffic. There was, and still remains, uncertainty as to how the all-IP design will be implemented in the future. Therefore, it is not currently understood whether it is more efficient to have hundreds or MDF buildings or thousands of street cabinet locations in the core network. Scorched-node modification would be applicable in either case. We also note that FTTH services provided in the Netherlands are likely to have less than 1300 active nodes (e.g. 200 metro points of presence) and that in this future network architecture, there would be a smaller traffic-sensitive network.

However, as we are modelling a VDSL-based network, this means that the roll-out of fixed network buildings as MSAN locations remains relevant to the cost model. Therefore, we believe that our modified scorched-node approach remains a reasonable approach to take.

Final concept 15: The modified scorched-node principle shall be applied to generate a realistic modern network using modern traffic-sensitive assets at current node locations.

4 Service issues

The following concepts are considered in this section.

Figure 4.1: Decisions on the service-related conceptual issues taken for the original BULRIC models, and items requiring further examination in light of this update [Source: Analysys Mason, 2012]

No.	Conceptual issue	Recommendation for the original BULRIC model	Revisit?
16	Service set	Provide all the commonly available Dutch voice and non-voice services. The associated economies of scope will be shared across all services	No
17	Fixed voice services	All voice traffic will be modelled, independent of specific technologies (such as ISDN) that can be used	No
18	Fixed non-voice services	Fixed transmission services, interconnection establishment, co-location and xDSL data backhaul will be modelled as different services	No
19	Fixed NGN services	All fixed services are defined as technology-independent and thus can be conveyed via an NGN	No
20	Mobile services	Aggregate mobile traffic across all subscriber types	No
21	Traffic volumes	Apply a market-average profile to the modelled 1/N operator	Yes
22	Points of interconnect	Fixed and mobile interconnection will both be modelled at four points	No
23	Interconnection and co-location	A separate module will be constructed to calculate the costs of services applicable to voice interconnection. These costs will not be allocated to voice minutes	No
24	Wholesale or retail costs	Only wholesale network costs will be included in the cost models. Retail costs will be excluded	No

4.1 Service sets

The final concepts from the original specification as to the modelled service sets were as follows:

Original concept 16: The modelled operator should provide all the commonly available (current and planned) Dutch non-voice services (broadband access, messaging, leased lines, TV) alongside voice services (originating and terminating voice, VoIP, transit traffic). The associated economies of scope will be shared across all services, although care will be taken where uncertain growth forecasts significantly influence the economic cost of voice (and therefore forecast sensitivities will be explored).

Original concept 17: All voice traffic will be modelled, independent of specific technologies (such as ISDN) that can be used.

Original concept 18: Leased lines and other fixed transmission services, interconnection establishment and co-location will be separately identified. xDSL data backhaul will be modelled as a different service, with transmission across the core to the access seeker's own point of presence.

Original concept 19: All services described above are defined as generic services that can be delivered independent of technology – in this case with a NGN.

Original concept 20: Mobile traffic will be aggregated for all subscriber classes, and a full-scale mobile operator will be modelled to accommodate its share of the traffic.

For the service sets in both the fixed and mobile BULRIC models, we propose to maintain this concept. We welcome feedback from the IG as to whether, in their view, any revisions are required.

► *Operator comments on concepts 16-20*

One respondent support the proposal to maintain concepts 16-19, and has no comments on concept 20. Another respondent has no comments on any of these five concepts.

Another respondent observes that *"including significant elements in the model which are still to be realized in practice is highly speculative and should therefore be omitted. This also holds for planned services that mostly do not, as yet, exist, such as mobile VoIP. Only existing services with significant volume of which the development can be accurately predicted should be taken into account."* The respondent therefore disagrees with Analysys Mason's approach of also including planned services.

► *Analysys Mason response*

We do not envisage any reason for changing or extending the established service set in the model as part of this update.

We believe there are five types of mobile traffic:

1. Voice interconnected as CS, but carried by the operator using GSM or UMTS voice circuits
2. Voice interconnected as IP, but carried by the operator using GSM or UMTS voice circuits
3. Voice interconnected as CS, but carried by the operator via its own VoIP in the air interface
4. Voice interconnected as IP, and carried by the operator via its own VoIP in the air interface
5. over-the-top (OTT) voice that is carried by third party clients using data bearers, which is not interconnected via voice gateways since it is carried as data bits.

We do not consider that the levels of OTT voice traffic is directly relevant to the mobile BULRIC implementation, even if such volumes were to increase rapidly. Carried as data traffic, operators

have the opportunity to recovery the full cost of that data traffic via retail data charges, and allowance within voice interconnection rates is unnecessary.

We do not intend to mobile VoIP traffic in the air interface (types 3 and 4), as this is generally an emerging technology (e.g. voice-over-LTE) and mobile operators may not significantly be developing this type of service. Any traffic interconnected as CS/IP traffic will be assumed to be carried as GSM or UMTS voice circuits (type 1 and 2).

If type 3, 4, or 5 voice traffic increases (or is forecast in the current regulatory period) to be growing so fast that type 1 and 2 traffic is in decline (i.e. that the cost of type 1/2 traffic may be increasing), then we would need to reconsider the efficient technology used to carry voice traffic and factor back in the type 3 and type 4 traffic to calculate an efficient cost of voice termination (we note that type 5 traffic would not be factored in because the costs are recovered from data charges).

For the purposes of this update we intend to model a market based on actual voice interconnected traffic (CS or IP as relevant), and to ignore VoIP in the air interface, and leave OTT voice traffic within the megabyte data load.

Final concept 16: The modelled operator should provide all the commonly available (current and planned) Dutch non-voice services (broadband access, messaging, leased lines, TV) alongside voice services (originating and terminating voice, VoIP, transit traffic). The associated economies of scope will be shared across all services, although care will be taken where uncertain growth forecasts significantly influence the economic cost of voice (and therefore forecast sensitivities will be explored).

Final concept 17: All voice traffic will be modelled, independent of specific technologies (such as ISDN) that can be used.

Final concept 18: Leased lines and other fixed transmission services, interconnection establishment and co-location will be separately identified. xDSL data backhaul will be modelled as a different service, with transmission across the core to the access seeker's own point of presence.

Final concept 19: All services described above are defined as generic services that can be delivered independent of technology – in this case with an NGN.

Final concept 20: Mobile traffic will be aggregated for all subscriber classes, and a full-scale mobile operator will be modelled to accommodate its share of the traffic.

4.2 Traffic volumes

The final concept from the original specification as to the consideration of traffic volumes was as follows:

Original concept 21: We shall develop a market forecast and apply a market-average profile for the modelled 1/N operator; the discussion of N is covered under concept 3.

Although the value of N for the mobile BULRIC model may be revised, as described in Section 2.3, this does not affect the wording of original concept 21. We propose to maintain this concept.

In relation to the modelled traffic volumes, we will request operator service volumes for the full calendar years 2009, 2010, 2011 and first-half 2012 if available, so that they can be used to update the Market workbook. We will also check with the latest versions of the third-party sources used in the Market workbook, such as those from within OPTA, Analysys Mason's Research Division and the Merrill Lynch broadband matrix.

We shall also review the forecasts of voice and data traffic in the model and update them where necessary.

► *Operator comments on concept 21*

One respondent agrees to maintain this concept. Another respondent has no comments on concept 21 at this stage, and will provide input once the actual updated market forecast becomes available.

A third respondent agrees in principle to this approach. However, it also observes that *"future growth in mobile data is likely to be much slower than previously forecast. For example, the amount of billable traffic on mobile network is likely to be reduced by WiFi offloading, necessarily increasing prices for mobile data and reduced usage of mobile dongles (due to rapidly increasing speeds on fixed networks and associated WiFi networks)."*

► *Analysys Mason response*

Based on operator feedback, this concept will be finalised and implemented without further comment. The mobile data forecast is one that will be revisited as part of the upgrade, and the dynamic considered by the third respondent will be considered.

Final concept 21: We shall develop a market forecast and apply a market-average profile for the modelled 1/N operator; the discussion of N is covered under concept 3.

4.3 Interconnection establishment and co-location

The final concepts from the original specification as to the treatment of interconnection establishment services were as follows:

Original concept 22: Fixed interconnection will be modelled at four points. Mobile interconnection will be modelled at four points.

Original concept 23: A separate module will be constructed to calculate the costs associated with regional interconnection establishment and related co-location services. For fixed NGA/NGN, the NGA/NGN equivalents of existing co-location and interconnection services will be modelled. The costs of co-location and interconnection services will be constructed by a build-up of individual cost components. The costs of co-location and establishing interconnection at the (regional) switches of a mobile network will also be calculated. Co-location services will be limited to those applicable to establishing voice interconnection at an operator's premises.

Operator information submitted as part of the data request process will be taken into account. Costs which are driven by the activities of interconnection, number of port connections and co-location space, etc., will be allocated to the *interconnection establishment services*, and not allocated to minutes.

We propose to maintain these concepts. However, we will request up-to-date cost data related to these services. If data is available, then it will be used to refine the inputs in the Interconnection module.

► *Operator comments on concepts 22 and 23*

One respondent agrees to maintain both concepts. Another respondent has no comments on concepts 22 and 23 at this stage, but reserves the right to comment further during the model consultation.

Another respondent has no additional comment in relation to these concepts: *"Since the decision of OPTA of 2010 we have not received new requests for direct interconnection to our mobile network and therefore we have not gained additional information on e.g. project costs"*.

Another respondent affirms that: *"the number of points of interconnect should be driven by efficiency considerations. Operators must be able to interconnect at such levels that approximate optimum overall efficiency, whilst maintaining a sufficient degree of redundancy. This means that for a fixed network, operators should, depending on their scale, be able to interconnect at different levels in the network. Small operators should be able to interconnect at a small number of interconnection points (e.g. the 'national' level) while large operators should be able to interconnect at a larger number of interconnect points deeper into the modelled operator's network (e.g. the 'regional' level). This achieves optimum efficiency as it allows operators to determine the shortest, most efficient, and therefore least costly, geographical route for their traffic. This situation is different in mobile networks where the location of users in one network is unknown to the originating operator. The most efficient way of handling traffic with mobile networks is to use a limited number of interconnect points regardless of scale."* The respondent therefore *"agrees with the proposed approach to model 4 interconnect points for mobile*

networks" but *"disagrees with the proposed approach for fixed networks to limit the number of interconnect points for fixed networks to only 4 creates inefficiency and therefore causes unnecessarily high costs for both the modelled operator and interconnected larger operators."*

With regard to concept 23, the same respondent observes that *"AM proposes to model the costs for interconnection, i.e. the costs that include the interconnect switch ports, billing and interconnect department separately to voice services. Interconnecting operators would pay for these services separately through the regulated costs for switch ports. Under a proper cost orientation regime, such an approach could be valid as long as certainty is provided to operators that are subject to this regime that all relevant costs made for mobile termination and interconnection will be able to be recovered."*

► *Analysys Mason response*

With regard to the comment on concept 22, we would observe that during the original model construction, five parties submitted that a maximum of four to five PoIs would be resilient and efficient and therefore should be modelled. The modelling approach does not prevent operators from negotiating access at many more locations in practice, but for the purposes of establishing efficient network costs, we shall maintain the assumption of four efficient PoIs.

With regard to the comment on concept 23, we observe that in the case where termination is priced using Pure BULRIC, then there will be costs that are "unrecovered" from this service compared with the Plus BULRAIC approach. These "unrecovered" costs could be considered to be recoverable across other traffic services. However, we would not consider them recoverable from non-termination services that are not traffic-related as this would not reflect cost-causality particularly well. However, OPTA may decide that adjacent markets function better with a specific treatment of such "unrecovered" costs.

Final concept 22: Fixed interconnection will be modelled at four points. Mobile interconnection will be modelled at four points.

Final concept 23: A separate module will be constructed to calculate the costs associated with regional interconnection establishment and related co-location services. For fixed NGA/NGN, the NGA/NGN equivalents of existing co-location and interconnection services will be modelled. The costs of co-location and interconnection services will be constructed by a build-up of individual cost components. The costs of co-location and establishing interconnection at the (regional) switches of a mobile network will also be calculated. Co-location services will be limited to those applicable to establishing voice interconnection at an operator's premises.

Operator information submitted as part of the data request process will be taken into account. Costs which are driven by the activities of interconnection, number of port connections and co-location space, etc., will be allocated to the *interconnection establishment services*, and not allocated to minutes.

4.4 Wholesale or retail costs

The final concept from the original specification as to the treatment of wholesale and retail costs was as follows:

Original concept 24: Only wholesale network costs will be included in the cost models. Retail costs will be excluded.

A 50% network share of business overheads will be included in the *Plus BULRAIC* models. The "wholesale interconnection business unit" will also be included as part of the overall overheads, but will be allocated to the service of *establishing and maintaining interconnection* rather than per-minute traffic charges.

In the *Pure BULRIC* models, general business overheads will be assumed to be invariant with the wholesale termination increment. A proportion (e.g. the half related to incoming interconnection) of the wholesale interconnection business unit would be avoided in the absence of wholesale termination volumes, and thus some interconnection establishment costs would be incremental to wholesale termination.

We propose to maintain this concept.

► *Operator comments on concept 24*

One respondent refers to its opening statement in favour of the pure BULRIC approach, which does not allow the modelling of business overheads.

A second respondent does not agree with the assumption that the level of general business overheads is invariant to the wholesale termination increment: *"The supply of wholesale termination services is a significant activity that requires substantial resources from all functional areas. It is evident that the size of support functions would be smaller if the termination service would no longer be offered. The Board, Finance, Technology, Legal and Regulatory and Human Resources are all functions that spend significant time on termination services. Further, it can be implied from the pure-BULRIC model that it is appropriate for some of the general business overheads to be deemed incremental to the termination service. This is because the pure-BULRIC model correctly recognises that the removal of the termination service would result in the removal of some network equipment (although we will need to assess the revised model to determine whether the magnitude of the reduction is appropriate). The model also recognises that less network equipment results in less operating costs. However, the model does not seek to understand where those operational cost savings come from. It is clear that a major source of the operational cost savings would be from having less staff working in network functions. The knock-on effect of having less staff in network functions is that there would be a reduction in staff in support functions such as Human Resources. The incremental business overhead costs should be determined by allocating the business overhead costs to termination services on a pro rata basis albeit recognising that a portion of general business overheads are fixed"*.

A third respondent *"strongly disagrees with the exclusion of customer related costs, as the costs of marketing and selling services and providing customer case (etc.) are clearly causally related to the provision of mobile termination services and therefore should be included – without customers, an operator would not earn termination revenues. AM also proposes to include a proportion of 50% of 'business overhead' into the BULRAIC model."* The respondent *"disagrees with this concept for two reasons: Firstly as argued above, as retail costs are intrinsic to providing the mobile termination service and must be included, also a proportional share of business overheads should be included. This implies that the business overheads included in the model should be near to 100% rather than 50%. For pre-pay customers, there are clearly not separate subscription charges so that business overheads must be recovered in per minute charges and they should be efficiently spread across both termination and outgoing services. While contract customers do pay monthly charges, these are fundamentally payments for bundles of services included in the contract. Again, business overheads should be efficiently spread across termination and outgoing services. Secondly, even in the case where only the network, some IT and the interconnection facilities and organization would be included, these combined costs would constitute a significantly larger share of non-overhead costs than the 50% that AM assumes. In order to arrive at an accurate allocation, it is essential that AM request relevant data from the operators and consult on the appropriate allocation methodology."* The respondent also *"disagrees with AM's proposal to consider business overheads invariant to presence or absence of the termination increment. The costs of business overheads do and will vary to some extent with the substantial volume of minutes and revenues associated with this increment."*

► *Analysys Mason response*

With respect to the second and third respondent on the treatment of business overheads:

- The modelled business overheads are intended to cover only the activity component that is common to network and retail functions in the long run – as such, there are variable overheads costs such as HR which are included in the opex mark-ups associated with each of the network elements

- It would be inappropriate for the costs (e.g. legal support) relating to challenging OPTA's market review decisions and pricing decisions to be included in the costs allocated to termination services

- The costs associated with establishing and maintaining interconnection are already covered in the separate interconnection activity cost model

- Although elements of business such as The Board, Finance, Technology, Legal/Regulatory and Human Resources are all functions that spend some time on termination services, that does not necessarily mean that the common component of these costs would reduce in size in the absence of termination.

With respect to the third respondent's comment on the inclusion of customer-related costs, we do not agree with this assertion. We observe that high subscriber-related retail costs may arise in a

saturated market such as the Netherlands since operators compete for subscribers (with the competing operators including both mobile and fixed operators). However, there is no reason for inter-operator wholesale termination charges to include an allowance for operators to pay each other for these retail support activities for both of the customers of competing operators who are involved in an inter-operator voice call termination event.

Final concept 24: Only wholesale network costs will be included in the cost models. Retail costs will be excluded.

A 50% network share of business overheads will be included in the *Plus BULRAIC* models. The "wholesale interconnection business unit" will also be included as part of the overall overheads, but will be allocated to the service of *establishing and maintaining interconnection* rather than per-minute traffic charges.

In the *Pure BULRIC* models, general business overheads will be assumed to be invariant with the wholesale termination increment. A proportion (e.g. the half related to incoming interconnection) of the wholesale interconnection business unit would be avoided in the absence of wholesale termination volumes, and thus some interconnection establishment costs would be incremental to wholesale termination.

5 Implementation issues

The following concepts are considered in this section.

Figure 5.1: Decisions on the implementation-related conceptual issues taken for the original BULRIC models, and items requiring further examination in light of this update [Source: Analysys Mason, 2012]

No.	Conceptual issue	Recommendation for the original BULRIC model	Revisit?
25	Increment approaches	Calculate Pure BULRIC, Plus BULRAIC and Plus Subscriber BULRAIC	Yes
26	Demarcation between traffic- and access-related costs	Assumed to be the first point of traffic concentration in the network such that resources are driven by traffic load	No
27	Depreciation method	Use economic depreciation	No
28	Modelling timeframe	Employ a 50-year modelling timeframe	No
29	Cost of equity	Use the capital asset pricing model	Yes
30	Risk-free and inflation rates	Apply a nominal risk-free rate of 3.8% and an inflation rate of 2.0%	Yes
31	Equity risk premium	Apply an equity risk premium of 6.1%	Yes
32–34	Asset beta	Apply a β_{asset} value for the modelled mobile operator of 0.66, and 0.40 for the fixed operator	Yes
35	Gearing	The average gearing shall be 32% for the mobile WACC and 51% for the fixed WACC	Yes
36	Debt risk premium	Adopt a debt risk premium of 1.84% for the fixed operator, and 1.78% for the mobile operator	Yes
37	Mark-up mechanism	Use EPMU for the Plus BULRAIC and Plus Subscriber BULRAIC models. No mark-up is required in the Pure BULRIC case. Include facility for non-EPMU	No

5.1 Choice of increment

This section in the original conceptual specification considered increment approaches and the demarcation point in the modelled networks between traffic-related and access-related costs.

Increment approaches

The final concept from the original specification on choice of increments was as follows:

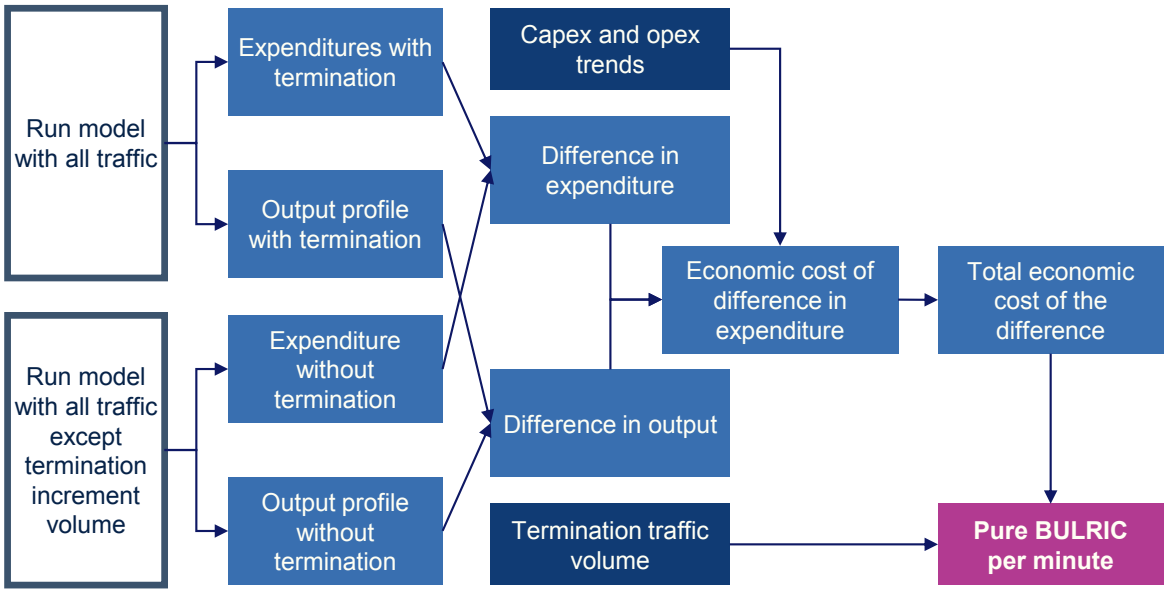
Original concept 25: In order to allow OPTA to understand the cost implications of each costing approach (consistency with the EC Recommendation, comparability with earlier costing approaches, and competitive neutrality towards mobile versus fixed operations), the model will calculate *Pure BULRIC*, *Plus BULRAIC* and *Plus Subscriber BULRAIC* results.

With regard to the choice of increment, we do not propose any revisions to the wording of original concept 25. However, we do propose to revisit the implementation of the Pure BULRIC and Plus BULRAIC costing calculations. Specifically, we intend to review the network design calculations and costs in both BULRIC models:

- In the fixed model, we shall consider the hardware and software components of the VoIP platform and its related servers. This will take into account the prevailing VoIP platform architectures of the major Dutch fixed operators.
- In the mobile model, we shall consider the sensitivity of modelled mobile network assets to the wholesale termination traffic increment, based on any new information available from the operators.

In the case of the fixed model, the network design and costs of the VoIP platform, and the resulting cost allocations of these costs to fixed termination, is relevant to the Plus BULRAIC calculation in the fixed model. However, the VoIP platform is of greater significance to the Pure BULRIC calculation, where its behaviour both with and without terminated voice traffic can have a large impact on the Pure BULRIC result. For reference, the Pure BULRIC calculation structure is shown in Figure 5.2.

Figure 5.2: Overview of Pure BULRIC calculation in the original fixed/mobile models [Source: Analysys Mason, 2012]



For both the BULRIC models, we requested the operators to provide input as to how the network design calculations should respond to the removal of terminated traffic.

► *Operator comments on concept 25*

One respondent prefers consistency with the EC Recommendation over comparability with earlier costing approaches. Therefore, the respondent believes the model should calculate pure BULRIC

only. *"With respect to the proposed revision of the network design calculations and costs in both BULRIC models in the fixed model, we again stress the importance of accurately considering the hardware and software components of the VoIP platform and its related servers. The data presented by the major Dutch fixed operators should be thoroughly checked and benchmarked. With respect to the mobile model, we have the same comment with respect to the information, which will be supplied by the operators".*

A second respondent provided extensive input to the costs of the fixed VoIP platform very recently (2011), and refers to this overview in light of this reconsideration. As stressed before, the respondent *"is of the opinion OPTA and Analysys Mason are not consistent with the demarcation point between coverage and capacity prescribed by the Recommendation. A substantial part of the observed coverage is actually a by-product from capacity requirements. In reality networks are initially designed with future volumes in mind. It is therefore deceiving to consider such initial networks as just reflecting a coverage requirement. As networks in reality are built to accommodate future growth, the initial design already implies a substantial amount of capacity-driven costs. Although these investments are incurred from the start of the network deployment, the actual costs should be allocated to services in periods that this capacity will be actually needed. It is important to note that in the situation without termination, both the initial network design would be considerably different (as it should reflect less future growth) as well as the eventual network design would be substantially different, reflecting the fact that the network would carry substantially less voice traffic (25%). This should be an important consideration in the assessment of the sensitivity of network elements to the termination increment. Just comparing the 'with termination' scenario to the 'without termination' scenario without any additional adjustments will not pay justice to the coverage definition of the European Commission (see above). The described thought-experiment, i.e. modelling a network capable of handling a single call, should be conducted as a first step to define the demarcation point between coverage and capacity. The hypothetical zero traffic network provides an opportunity to consider the lowest base of possible deployment – any additional expenditure over this level can be considered incremental to traffic, of which some cost in all years will be incremental to termination."*

A third respondent *"supports OPTA's attempt to understand the implications of different costing approaches where those approaches are all capable of being implemented. However, this parallel development of major costing alternatives seems to go beyond this to reflect OPTA's uncertainty on the validity of different costing approaches and the extent to which they will or will not be approved in court."* The respondent *"believes that OPTA should seek and publish legal advice at an early stage on what approaches will be valid so as to avoid AM and the parties spending considerable time in developing costing approaches that may not even be valid to apply."*

► *Analysys Mason response*

With respect to the first and third respondents, we would note that the scope of the update is with respect to both the Pure BULRIC and Plus BULRIC approaches. The final decision as to which approach will be adopted for pricing will be taken in OPTA's market analysis.

With respect to the second respondent, we refer to our response in Section 2.2 to proposed concept 2. In particular, we do not believe that our approach is inconsistent with the Recommendation, since the key step in the methodology is to understand the difference in the network in the presence of all services, and all services except termination. We believe our definition of a coverage network is appropriate for the modelled 2G networks, whilst for the 3G networks the way we account for the effects of cell breathing means that we are capturing the effect of removing termination from the network. Therefore, we do not agree with the second respondent's assertion.

In addition, we must also emphasise that the model already makes multiple adjustments to the network design in the mobile model (cell breathing, reduced 1800MHz spectrum, reduced special site deployments, reduced minimum TRX deployments, etc.), and these will be reviewed again in the light of any network information presented by the network operators, and the outcome of the spectrum auction.

Final concept 25: In order to allow OPTA to understand the cost implications of each costing approach (consistency with the EC Recommendation, comparability with earlier costing approaches, and competitive neutrality towards mobile versus fixed operations), the model will calculate *Pure BULRIC*, *Plus BULRAIC* and *Plus Subscriber BULRAIC* results.

The first point of traffic concentration

The final concept from the original specification on the first point of traffic concentration was as follows:

Original concept 26: The demarcation point between core (traffic-) and access-related costs is where the first point of traffic concentration occurs *such that resources are driven by traffic load*. In a mobile network, traffic-sensitive assets therefore occur from the air interface. In fixed networks, traffic-sensitive assets exist from an exchange/node demarcation point, which depends on the choice of technology.

We propose to maintain this concept.

► *Operator comments on concept 26*

One respondent agrees with the proposal to maintain this concept.

A second respondent agrees with this concept and the implication that for mobile networks all assets from the air interface are traffic-driven. *"Analysys Mason should be very careful to make sure that costs considered as common costs (such as coverage) are not allocated to the subscription service. This is because all or most of the common costs are common across traffic services and not common across traffic and subscription services. These common costs (common to voice and data services only) must not be allocated to the subscription service through the mark-up mechanism. As opposed to coverage provided by fixed networks, mobile coverage cannot*

be regarded as driven by the number of subscribers/subscriptions. It is therefore clearly incorrect to allocate part of the coverage costs to the subscription service."

Another respondent agrees in principle with the proposed concept but reserves the right to provide comments on the actual implementation in the models.

► *Analysys Mason response*

With regard to the second respondent, we observe that the original BULRIC model allocates coverage network costs across both the traffic and subscriber increments. In particular, common costs in the model are applied via EPMU to both the incremental costs of subscribers (a small number of costs relating to assets such as the HLR) and traffic costs (the majority of all other equipment, transmission etc.).

The network costs are caused by two drivers: the amount of voice/data traffic, and the number of subscribers (handsets) registered and active on the network. Subscribers and handsets incur costs related to the HLR, VLR and location updates, independent of the amount of traffic carried. Thus, the coverage network is also necessary to provide the subscriber service, providing an air interface control channel layer across the entire coverage network. Therefore, we do not agree that the coverage network is only common to the traffic increment, it is also common to the subscriber increment.

Final concept 26: The demarcation point between core (traffic-) and access-related costs is where the first point of traffic concentration occurs *such that resources are driven by traffic load*. In a mobile network, traffic-sensitive assets therefore occur from the air interface. In fixed networks, traffic-sensitive assets exist from an exchange/node demarcation point, which depends on the choice of technology.

5.2 Depreciation method and modelling timeframe

The final concepts from the original specification on depreciation method and modelling timeframe were as follows:

Original concept 27: Economic depreciation shall be applied to all expenditures in the fixed and mobile *Plus BULRAIC* models. In the *Pure BULRIC* models, economic depreciation will be applied to the difference in expenditures.

Original concept 28: A 50-year model will be employed. This timeframe allows us to incorporate the economic lifetime of long-lived assets (e.g. switch buildings, fibre cabling, access network infrastructure), and to assume zero future terminal value without significant impact on today's costs.

We propose to maintain these concepts.

► *Operator comments on concepts 27 and 28*

One respondent agrees with the proposal to maintain concept 27. With respect to concept 28, although the respondent *"still believes 50 years might be too long we do agree that the longest-lived assets are set for 25-40 years) we agree with the proposal to maintain this concept."*

A second respondent *"agrees with the main principles of economic depreciation. However it wants to stress that this method has to be applied in a sensible way. Incorrect demand forecasts will easily lead to a significant shift of the costs over time, eventually leading to termination rates for the coming regulatory period that are either too high or too low. For example, if the model would forecast growing voice volumes, whereas in reality a decline of voice volumes is likely, this would lead to an underestimate of the costs to be allocated in the near future and an overestimate of the costs in the longer term. Adjustments in forecasts might even lead to the conclusion that with hindsight the rates in the previous periods have been too low."*

The second respondent also *"has some specific concerns about the use of Economic Depreciation under the pure BULRIC approach. The model needs to ensure that incremental assets are treated as incremental from the point of purchase rather than the point at which they become capacity constrained. More specifically the possible outcome of Economic Depreciation in conjunction with the pure BULRIC approach is that assets are recovered in periods before they are incurred. In addition, the interplay of the pure BULRIC approach and the economic depreciation calculation can result in an artificial step reduction to the level of incremental costs. This is because the economic depreciation calculation uses a present value discounting formula to set the quantum of costs to be recovered over time. In the 'without' approach this could result in incremental purchases being 'delayed', consequently leading to a lower present value in the economic depreciation calculation. This problem is exacerbated when the amount of network equipment in the zero-traffic (i.e. coverage) network is too high. This leads to an even longer gap between when the asset is purchased in the real world and when the asset is deemed to be incremental and therefore purchased in the world without termination volumes. It is inconsistent with the long-run concept of cost recovery to artificially create common costs (through the discounting formula) due to network equipment being deemed non-capacity driven in the short-term even though in the long-run it is deemed capacity-driven. Analysys Mason needs to take extra care to ensure these counter-intuitive outcomes do not occur as a result of the interplay between Economic Depreciation and pure BULRIC."*

A third respondent notes that *"there are a number of ways in which economic depreciation can be implemented and the choice of detailed assumptions can lead to significant differences in the path of prices over time and hence to consumer outcomes"*. It will provide comments on the depreciation approach once it has had the opportunity to review a draft of the model, including the specific assumptions made in implementing economic depreciation. In response to concept 28, the respondent raises concerns with the decision to model a mobile business over a 50-year period. The respondent *"believes this approach carries a serious risk of over-estimating the period in which mobile operators can recover the cost of their investments. In particular, significant changes in technology, demand and market players could lead to a need for assets to be recovered*

in a much shorter period than their theoretical life." The respondent will comment on whether the assumed asset lifetimes in the model are realistic in the context of the consultation on the draft model.

► *Analysys Mason response*

Of the above comments, only that of the second respondent has an impact on concept 27.

We agree that there is an important relationship between the forecast of traffic and the timing of recovery of economic costs.

We do not agree with the second respondent's interpretation of the application of economic depreciation to the Pure BULRIC calculation.

It is incorrect to say that an asset must be considered incremental from the point of purchase, even if it becomes capacity constrained later. This is because, for the initial period, the incremental cost of carrying (wholesale voice termination) traffic would be zero, and the effect of a capacity constraint would be the need to deploy additional (i.e. incremental) assets. In the event of testing the cases of *with* and *without* wholesale mobile termination traffic, it is the **incremental** assets and **incremental** demand which are relevant to the calculation, not the cost of the first asset from its initial deployment, for which it was unconstrained for years prior to the capacity upgrade. If an asset becomes capacity constrained later in its life, then there will be the opportunity for it to be upgraded later – i.e. the avoidable (incremental) cost will reflect the lower time value (PV) of investment if assets are upgraded later in time due to the removal of termination traffic.

The model spreads the (avoided) PV across the (avoided) demand over all time, so an asset (avoided) in year 5 is recovered from (avoided) termination volumes from year 1 to (50).

The respondent notes an artificial step reduction in the level of incremental costs (i.e. a short-run cost effect). However, its proposed approach would also lead to this type of effect – the likelihood of an artificial step increase in the level of incremental costs. This short-run increase could arise in its method for the following reason: for some years, incremental costs would be zero, then they would rise at the point when incremental assets were required. An incremental cost of zero implies a zero termination rate, which firstly we doubt the respondent would willingly accept, and secondly, we doubt the respondent would reimburse all previous termination payments if the model calculated that zero termination rate for the years prior to 2013.

Secondly, we would in any case note that cost recovery is more controlled within the economic depreciation calculation than the respondent implies. For example, a 3G network cost cannot be recovered before the 3G network has started carrying traffic and cannot be recovered after the network has stopped carrying traffic, i.e. an asset for a particular technology must recover its costs in the period during which that technology is active. In the case of "shared network" assets, their costs can be recovered only while at least one of the 2G/3G networks is carrying traffic.

Finally, it may take many years for the coverage network to become capacity constrained. This would be expected in the case that the coverage network has significant capacity (which may well be the situation for a mobile network in the Netherlands, given the high standard of coverage required in the market to make and receive a call anywhere in the network). This is no reason to adapt the economic depreciation calculation to compensate – such effects would be dealt with under the discussion of the modelled coverage versus capacity networks.

Therefore, we do not believe that the respondent's concerns apply.

With respect to the first and third respondents' comments on concept 28, we would emphasise that although the model duration is 50 years, the original BULRIC models assume a technology-specific lifetime of 15 years. That is, all of the modelled technology-specific expenditures are recovered from the technology's volumes during the 15-year period. Assets that are effectively technology-agnostic and could continue to support the next-generation traffic (e.g. mobile network sites, fixed network buildings) do not have these migration profiles applied. These assets are therefore deployed and maintained for the full 50-year period, and their costs are recovered over all forecast traffic in that period.

Final concept 27: Economic depreciation shall be applied to all expenditures in the fixed and mobile *Plus BULRAIC* models. In the *Pure BULRIC* models, economic depreciation will be applied to the difference in expenditures.

Final concept 28: A 50-year model will be employed. This timeframe allows us to incorporate the economic lifetime of long-lived assets (e.g. switch buildings, fibre cabling, access network infrastructure), and to assume zero future terminal value without significant impact on today's costs.

5.3 WACC

The final concepts from the original specification on the WACC calculation were as follows:

Original concept 29: The capital asset pricing model will be used to calculate the cost of equity.

Original concept 30: The NERA risk-free rate of 3.8% in nominal terms will be applied. An inflation rate of 2.0% will be applied in the WACC and in re-inflating the end results.

Original concept 31: We shall apply an equity risk premium of 6.1%.

Original concepts 32, 33 and 34: Based on a benchmark of predominantly fixed and predominantly mobile operators, we estimate a β_{asset} value for the modelled mobile operator of 0.66, and for the fixed operator a β_{asset} of 0.40.

Original concept 35: The average gearing shall be 32% for the mobile WACC and 51% for the fixed WACC.

Original concept 36: We shall adopt a debt risk premium of 1.84% for a 51% geared fixed operator, and a debt risk premium of 1.78% for a 32% geared mobile operator.

We propose to maintain these concepts and their parameter values until OPTA is required to update them.

► *Operator comments on concepts 29-36*

One respondent *"believes that the equity risk premium of 6.1% is too high."* Based on examples provided from ARCEP, BIPT, BNetzA and Ofcom, the respondent *"believes that the value should be close to 5%."* The respondent agrees with the proposal to maintain concepts 32-36 until OPTA is required to update them.

Another respondent has no comments on this concept at this stage, but reserves the right to comment further during the model consultation.

A third respondent states that, *"given the ongoing uncertainty surrounding European financial markets, it would be sensible to defer consideration of the appropriate WACC parameters until the second consultation period planned for October 2012. This would enable the latest available financial data to be taken into account while also being practical as the WACC estimate can readily be inputted into the model. At this stage, we have confined our comments on the WACC to a number of general observations.*

First, the global financial crisis has had a significant impact on a range of data that is normally taken into account in setting the WACC. This calls for extreme care in assessing the data to ensure that the estimated WACC will cover the actual cost of capital of the operators over the forthcoming 2013–2016 regulatory period. In this regard, in April 2012 a report by CEG identified a serious flaw in the proposed approach by NERA to estimating the cost of capital for KPN's wholesale activities. In particular, NERA was proposing to incorrectly combine parameters values for the risk-free rate and the beta taken from a period still being impacted by the financial crisis with an estimate of the equity risk premium which does not fully reflect its value during the crisis period. The flaw in NERA's approach is that beta is a measure of relative risk. The apparent fall in the value of the beta over the crisis period did not indicate (as implied by NERA) that investing in KPN had become dramatically less risky in absolute terms, but that overall market risk had become higher. Thus, if NERA were to maintain the use of recent, relatively low measures of beta then it should consistently use a measure of the equity risk premium relevant to the recent period such as the forward looking value of 8.53% presented in Figure 4.1 of NERA's report for OPTA, The Cost of Capital for KPN's Wholesale Activities, of March 2012.

Second, we note that the appropriate beta for mobile termination is the beta for a stand-alone mobile business. In practice, many mobile operators also have fixed revenues and as such the beta for those operators will tend to understate the beta for a stand-alone mobile business. This reflects the empirical fact that fixed revenues tend to have much less non-diversifiable risk than mobile businesses. Accordingly, estimation of a mobile-only beta will require either relying on a sample of businesses that only have (or predominantly have) mobile revenues or using a wider sample and making upward adjustments to the betas of mobile-fixed businesses".

► *Analysys Mason response*

These observations will be accounted for by Analysys Mason and OPTA when the WACC is revised. With regard to the comment made by the third respondent, we would observe that the previous finding from the original BULRIC model was the opposite conclusion, i.e. disaggregating fixed and mobile asset betas from within the combined sample did not result in a higher asset beta for either pure-play fixed or mobile operators.

5.4 Mark-up mechanism

The final concept from the original specification on the mark-up mechanism was as follows:

Original concept 37: An EPMU will be applied in the Plus and Plus Subscriber BULRAIC models. There is no mark-up required in the Pure BULRIC case. The facility for non-EPMU will be provided.

We propose to maintain this concept.

► *Operator comments on concept 37*

One respondent emphasises *"(under concept 8) that, since they are in favour of the pure BULRIC approach, joint and common costs such as the cost of the spectrum used by the network should be excluded. In Italy, Spain and the United Kingdom the costs of radio spectrum are not part of the pure LRIC model."* However, under concept 37, the respondent supports the employment of the EPMU approach where possible.

A second respondent is of the opinion that *"the current EPMU approach should be reconsidered. The current EPMU-method has a strong bias towards services with a relatively high proportion of incremental costs. In the current model services with the most incremental costs attract the most common costs, which is very difficult to justify. In case of the subscription/access service it is evident that these services attract a disproportionate share of common costs. It is also possible that data services attract a disproportionate share of common costs relative to voice. Due to the high and increasing data volumes, even a small error/bias in the EPMU method might draw away a significant amount of costs from voice services to data services. The current EPMU method, that simply allocates common costs pro rata to the incremental costs of the various services is very arbitrary and needs to be refined. One of the problems of the method in execution is that it makes a simplistic judgement about each asset element – it can only be common to all 2G services,*

common to all 3G services, or common to all services weighted together. There is no view taken that some costs are common to voice services only, or to data services etc. The allocation although superficially precise is thus very simplistic and likely to lead to a misallocation of resource between services. There is a further point of principle that the common costs are not being allocated on the basis of the common cost resources used by a service, but merely on the basis of the relative financial proportion of the cost elements that the model has found to be incremental – this is arbitrary. An approach that splits cost purely on the basis of resource usage is more likely to achieve a reasonable balance of cost between services. (It could be interpreted as creating a common cost pool for each asset element, and then recovering these costs pro rata to service usage of that element only.).”

A third respondent believes that *“EPMU and even more so BULRIC would fail OPTA’s statutory duties (under the Access Directive) to promote efficiency and to maximize consumer benefits. In particular, efficient pricing that maximizes consumer benefits requires that common costs be recovered across all services with the mark-up on each service being set in inverse proportion to the relative demand elasticity of each service (i.e. Ramsey pricing).*

The respondent goes on to state that *“Oftel (Ofcom’s predecessor in the UK) has previously stated why a relatively higher mark-up should be set on termination relative to the mark-up on outgoing calls: “Oftel said that the existence of the cross-price elasticity with respect to the price of calls from mobiles meant that the mark-up over cost in this price would be smaller than the mark-up on termination. Oftel said this was because increasing the price of calls from mobiles created a larger welfare loss than an increase in the price of fixed-to-mobile calls, since the former also resulted in a reduction in the number of subscribers (via the cross-price elasticity).””*

The respondent also states that *“An example of how subscription charges can be incorporated into a Ramsey pricing framework was provided by the Ramsey model of mobile pricing submitted by Oftel to the Competition Commission in its 2002–2003 inquiry. The model took into account assumptions about the elasticity of demand for subscription and other services, as well as the interrelationship between demand for different services, and included a mark-up over marginal cost for termination. The model found an efficient termination charge level of 6.3ppm which was above the LRIC+ level of 4.51ppm determined by the CC in 2003 (Table 2.11, p.90 of the 2003 report).”* The respondent believes that Analysys Mason should apply a Ramsey-based model to determine an efficient mark-up for termination.

► *Analysys Mason response*

We do not agree with the view of the second respondent. The application of the EPMU is made based on the calculated *economic* incremental costs of each service, rather than the *incremental expenditures* of each service. In particular, these economic costs have been allocated on the basis of routeing factors which reflect how heavily each service uses the network on average. Therefore, costs are allocated proportionately more heavily to those traffic services that consume more resources on average. In this way, the distinction between voice and data services is captured. As OPTA is proposing to set a single all-day average rate for voice termination, there is no reason to

reflect service-specific busy hour factors in the resource utilisation routeing factors – this is because the corresponding lower off-peak termination cost (rate) is not transparently passed to the buyers of wholesale termination. As such LRAIC is the appropriate cost measure for the 'plus' model which uses an EPMU to arrive at *plus BULRAIC*. Alternative mechanisms such as Ramsey pricing have been discussed by OPTA in the past and rejected (e.g. see the 2006 concept paper for the 2G-only mobile BULRIC model[11]).

We would also observe that, in 2004, Vodafone (who operates in the Netherlands) stated in a public policy paper[12] that the size of fixed and common costs in a mobile business was large. Large common costs imply small incremental costs, and on that basis would be consistent with our view that pure incremental costs of traffic are relatively small compared to the LRAIC+. In particular, this viewpoint supports our general approach of the current model using a significant proportion of network costs as common costs (submitted as 23% in the policy paper, but likely varying from 15% to 40% depending on the assessment methodology).

In addition, since the coverage-related assets are allocated across both the traffic and subscriber increments on an EPMU basis, we do not believe that undue cost is allocated to the subscriber services. We would also re-affirm that EPMU is supported by regulators and practitioners on the grounds that it is objective and easy to implement, and is consistent with regulatory practice elsewhere.

We have not received any data from the network operators to refine our assumption that 50% of business overheads should be taken within the network model, and 50% within the retail increment (not modelled) for subscriber retail activities.

With respect to the third respondent, we would re-iterate the viewpoint of BEREC (formerly ERG). It believes that Ramsey pricing is practically infeasible due to the complex and dynamic information requirements regarding demand elasticities.[13] Therefore, a Ramsey construction will not be considered in the BULRIC model.

Final concept 37: An EPMU will be applied in the Plus and Plus Subscriber BULRAIC models. There is no mark-up required in the Pure BULRIC case. The facility for non-EPMU will be provided but is not proposed for calculating termination service costs.

11 See http://www.opta.nl/nl/download/bijlage/?id=34

12 See http://www.vodafone.com/content/dam/vodafone/about/public_policy/policy_papers/public_policy_series_1.pdf

13 ERG COMMON POSITION: Guidelines for implementing the Commission Recommendation C (2005) 3480 on Accounting Separation & Cost Accounting Systems under the regulatory framework for electronic communications, page 23.

Annex A Expansion of acronyms

2G	Second generation of mobile telephony
3G	Third generation of mobile telephony
4G	Fourth generation of mobile telephony
BAP	Broadband access platform
BSC	Base station controller
BTS	Base transmitter station or base station
BULRAIC	Bottom-up Long-run average incremental cost
BULRIC	Bottom-up Long-run incremental cost
CCA	Combinatorial clock auction
CWDM	Coarse wave division multiplexing
DCS	Digital Cellular Service
DSLAM	Digital subscriber line access multiplexer
DWDM	Dense wave division multiplexing
EC	European Commission
EPMU	Equi-proportionate mark-up
Gbit/s	Gigabits per second
GPRS	General packet radio system
GSM	Global system for mobile communications
HLR	Home location register
HSDPA	High-speed downlink packet access
HSPA	High-speed packet access
IG	Industry Group
IP	Internet Protocol
IPTV	Internet Protocol television
ISDN	Integrated services digital network
LTE	Long-term evolution
Mbit/s	Megabits per second
MDF	Main distribution frame
MGW	Media gateway
MHz	Megahertz
MPLS	Multiprotocol label switching
MSAN	Multi-service access nodes
MSC	Mobile switching centre
MSS	MSC server
MTR	Mobile termination rate
MVNO	Mobile virtual network operator
NGA	Next-generation access
NGN	Next-generation network
NMa	Nederlandse Mededingingsautoriteit
NodeB	Denotes the 3G equivalent of a BTS
OPTA	Onafhankelijke Post en Telecommunicatie Autoriteit
OTT	Over the top
PABX	Private Automated Branch Exchange
PBX	Private branch exchange
PoI	Point of interconnect

PV	Present value
RNC	Radio network controller
SMS	Short message service
STM	Synchronous transport module
TDM	Time division multiplex
TRX	Transceiver
ULL	Unbundled local loop
UMTS	Universal mobile telecommunications systems
VDSL	Very-high-bitrate digital subscriber line
VLR	Visitor location register
VoIP	Voice over internet protocol
WACC	Weighted average cost of capital
WBA	Wholesale broadband access
WDM	Wavelength division multiplexing
xDSL	Digital subscriber line technologies