Office of Utilities Regulation

Cost Model for Mobile Termination Rates

Consultation Document

OFFICE OF UTILITIES REGULATION

Publication Date: February 21, 2012

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Abstract

This Consultation Document has been prepared to set out the approach that the Office of Utilities Regulation ("OUR") plans to take to develop a cost model to calculate the cost of wholesale mobile call termination in accordance with the requirements of the Telecommunications Act ("Act") and determine the corresponding prices at which interconnection is to be provided.

The Act stipulates that prices for interconnection shall be established between the total long-run incremental cost ("TLRIC") of providing the service and the stand alone cost ("SAC") of providing the service.

This Consultation Document seeks to explain how the Act relates to the current best practice in determining the cost and prices of wholesale mobile call termination.

This Consultation Document sets out in some detail the OUR's plans to develop a generic Bottom-Up model dimensioned for 70% of the current traffic level in the Jamaican market using current cost information and a network node layout that reflects the network of Digicel and LIME.

After receiving and considering the responses to this Consultation Document, the OUR plans to undertake the modelling needed and determine symmetrical wholesale mobile call termination rates for a period of 5 years (2012 to 2017). In parallel, data requests will be sent to telecommunications operators. The data requested will be necessary regardless of the approach ultimately used by the OUR in the development of the LRIC model.

Comments from Interested Parties

Persons who wish to express opinions on this Consultation Document are invited to submit their comments in writing to the OUR. Responses to this document should be delivered or sent by post, fax or e-mail to:-

Rohan Swaby
P.O.Box 593,
36 Trafalgar Road,
Kingston 10
Fax: (876) 929-3635
E-mail: rswaby@our.org.jm

Responses are requested by March 20, 2012.

Any confidential information should be submitted separately and clearly identified as such. In the interest of promoting transparent debate, respondents are requested to limit as far as possible the use of confidentiality markings. Respondents are encouraged to supply their responses in electronic form, so that they can be posted on the OUR's Website (www.our.org.jm).

Comments on responses

The OUR's intention in issuing this Consultation Document is to stimulate public debate. The responses to this Document are a vital part of that public debate, and so as far as possible, should also be publicly available. The OUR considers that respondents should have an opportunity both to examine the evidence and views put forward in other responses, with which they may disagree, and to comment on them. The comments may take the form of, correcting a factual error, putting forward counterarguments and/or providing data relating to cost, traffic, revenues, etc.

Comments on responses are requested by April 3, 2012.

Arrangements for viewing responses

To allow all responses and comments to be publicly available, in addition to posting these responses and comments on its website, the OUR will keep copies of the responses and comments that it receives on files in the OUR's Information Centre. These can be viewed and copied for visitors to the OUR's Offices. Individuals who wish to view the responses and comments should make an appointment by contacting Kishana Munroe (Public Affairs/Information Officer) by one of the following means:-

Telephone: (876) 968 6053 (or 6057)
Fax: (876) 929 3635
E-mail: kmunroe@our.org.jm

At the pre-arranged time the individual should visit the OUR's offices at:

3rd Floor, PCJ Resource Centre,
36 Trafalgar Road,
Kingston 10

The individual will be able to receive photocopies of selected responses and/or comments on responses at a price which reflects the cost to the OUR.

Timetable
The timetable for the consultation is summarized in the table below:-

Summary of the timetable for public consultation

Event	*Date*
Deadline to Receive Responses to Consultative Document	By March 20, 2012
Deadline to Receive Comments on Responses	By April 3, 2012
Publish Determination Notice	By May 1, 2012

Chapter 1: Legal and Regulatory Framework

1.0 As part of its overall functions to regulate specified services and facilities under section 4(1) of the Act, and in keeping with its express power to determine the rates which may be charged in respect of the provision of a prescribed utility service under section 4(4) of the Office of Utilities Regulation Act, the OUR is authorised to determine the prices charged by telecommunications operators for the provision of interconnection services.

Section 4(1)(a) of the Act states:

> ***"(1) The Office shall regulate telecommunications in accordance with this Act and for that purpose the Office shall -***
>
> ***(a) regulate specified services and facilities"***

Section 4(4) of the Office of Utilities Regulation Act states:

> ***"(4) The Office shall have power to determine, in accordance with the provisions of this Act, the rates or fares which may be charged in respect of the provisions of a prescribed utility service."***

1.1 A "specified service" is defined in section 2 of the Act to mean, *inter alia*, a telecommunications service, while a "prescribed utility service" is defined in section 2 and the First Schedule of the Office of Utilities Regulation Act to include the provision of telecommunication services.

1.2 The legal framework governing interconnection, which is a type of telecommunication service, is set out in sections 27 – 37 inclusive of the Act. Section 29 of the Act requires all carriers to permit to other carriers interconnection to its public voice network. Subsection (1) of that section states:

> ***"Each carrier shall, upon request in accordance with this Part, permit interconnection of its public voice network with the public voice network of any other carrier for the provisions of voice services".***

1.3 The OUR is empowered under the Act to make a determination as to the charges for call termination services included in these interconnection arrangements. Sections 29(4) and (5) of the Act state:

*"(4) **The Office may, either on its own initiative in assessing an interconnection agreement, or in resolving a dispute between operators, make a determination of the terms and conditions of call termination, including charges**".*

"(5) When making a determination of an operator's call termination charges, the Office shall have regard to the principle of cost orientation, so however, that if the operator is non-dominant then the Office may also consider reciprocity and other approaches."

1.4 The Act grants specific powers to the OUR to assess and approve the terms and conditions of interconnection, including charges, offered by a public voice carrier which is determined by the Office to be dominant. These terms and conditions are required under the Act to be embodied in a reference interconnection offer. Some of the relevant sections of the Act are extracted and set out below:

"***28(1) Subject to subsection (2), the Office shall determine which public voice carriers are to be classified as dominant public voice carriers for the purposes of this Act."***

"32(1) Every dominant carrier shall, and any other carrier may, lodge with the Office a proposed reference interconnection offer setting out the terms and conditions upon which other carriers may interconnect with the public voice network of that dominant or other carrier for the provision of voice services."

"32(4) A reference interconnection offer or any part there of shall take effect upon approval by the Office in the prescribed manner."

1.5 Sections 30(1)(a)(iii) and 33 of the Act further stipulate the principles upon which interconnection charges should be based.

"30. – (1) Without prejudice to section 29, dominant public voice carrier shall provide interconnection in relation to a public voice network in accordance with the following principles –

(a) the terms and conditions under which it is provided shall be -

…

(iii) charges shall be cost oriented and guided by the principles specified in section 33;"

"33. - (1) Where the Office is required to determine the prices at which interconnection is to be provided by a dominant carrier, it shall, in making that determination, be guided by the following principles –

(a) costs shall be borne by the carrier whose activities cause those costs to be incurred;

(b) non-recurring costs shall be recovered through non-recurring charges and recurring costs shall be recovered through recurring charges;

(c) costs that do not vary with usage shall be recovered through flat charges and costs that vary with usage shall be recovered through charges that are based on usage;

(d) costs shall include attributable operating expenditure and depreciation and an amount estimated to achieve a reasonable rate of return;

(e) prices for interconnection shall be established between the total long run incremental cost of providing the service and the stand alone cost of providing the service, so, however, that the prices shall be so calculated as to avoid placing a disproportionate burden of recovery of common costs on interconnection services;

(f) where appropriate, interconnection costs shall include provision for a supplementary charge, being a contribution towards the access deficit of the interconnection provider.

(2) Where the Office has been unable to obtain cost information that it is reasonably satisfied is relevant and reliable, it may take into account comparable international benchmarks.

(3) In subsection (1)(f) "access deficit" means the amount by which a carrier's revenue from connection and line rental charges falls short of the cost of providing access lines due to regulatory constraints on those charges." ;

1.1 On March 30, 2004, the OUR issued a supplementary consultative document entitled "*Assessment of Dominance in Mobile Call Termination*" (TEL2004/03) in which it proposed that "*each mobile carrier is dominant in relation to the voice call termination service it offers*." At the end of its consultative process, the OUR published a Determination dated September 2, 2004 entitled "*Decision on Assessment of Dominance in Mobile Call Termination*" (TEL2004/10) containing "*Determination 4.0: All mobile carriers are dominant with respect to the call termination service offered*."

1.2 Mossel Jamaica Limited ("Digicel") lodged an appeal of the OUR's decision on dominance in call termination with the Telecommunications Appeal Tribunal. The Tribunal upheld the OUR's Determination and dismissed Digicel's appeal, publishing its findings on May 31, 2010. As of that date, all mobile carriers were required to file reference interconnection offers with the OUR in accordance with section 32 of the Act for its assessment and approval of the terms and conditions of interconnection, including charges.

1.3 In July 2008, the OUR issued a consultative document entitled "*Principles of Long-run Incremental Cost Model for the Jamaican Telecommunications Market*" (Tel 2008/10 : Con/03). The OUR received responses to the document from Digicel and Cable and Wireless Jamaica Limited ("LIME"). The OUR has considered these responses and now continues the consultative process to set mobile termination rates in this current Consultative Document, following its determination of dominance of all mobile carriers in call termination.

Chapter 2: Introduction

2.0 Having determined that all mobile operators "*are dominant with respect to the call termination service offered*" and bearing in mind the statutory requirement that interconnection charges must be cost oriented, the OUR needs to establish the charges that are to be used for call termination and is starting first with mobile call termination where the current rates are much higher than those for fixed call termination (see Table 1).

2.1 The OUR will develop a cost model as the basis of establishing the rates. "Cost orientation" is a term that covers a range of different costing standards and the purpose of this consultation is to set out in more detail the approach that the OUR intends to take and to seek comments on this approach. This consultation therefore addresses issues such as:

- How the most up-to-date approach to cost modelling and lessons learned in other countries should be taken into account (Chapter 3: The Choice of Cost Standard);
- Which costs should be included (Chapter 3: The Choice of Cost Standard);
- How shared costs should be treated and allocated between different services (Chapter 3: The Choice of Cost Standard);
- Whether a Top-Down or a Bottom-Up model should be used (Chapter 4: Type of Model);
- Whether a generic model or separate specific models for Digicel and LIME should be developed, and if a generic model is used on what size network should it be based (Chapter 4: Type of Model);
- How costs should be allocated to the different services (Chapter 5: Cost Allocation);
- How depreciation should be handled (Chapter 6: Depreciation and Cost of Capital);
- What should be the main characteristics of the network modelled (Chapter 7: Network Details);
- Whether different prices should be set for peak and off-peak times (Chapter 8: Glide Paths, Price Gradients);
- What should be the charging basis for mobile termination should (Chapter 8: Glide Paths, Price Gradients).

2.2 Following this consultation, the OUR plans to proceed with the development of a suitable model. The results will be sent to the operators

for comment and then the OUR will determine the wholesale mobile call termination rates for a period of 5 years (from 2012 to 2017), taking account of any further comments from the operators.

2.3 Up to late 2011, there were three mobile operators in Jamaica: Claro, Digicel, and LIME. Digicel has recently merged with Claro and therefore this consultation considers only Digicel and LIME. Digicel has approximately [redacted]% or more of the market share by subscribers, traffic and revenue[1], and LIME has [redacted]% or less[2]. Table 1 sets out the current level of mobile call termination charges.

Operator	Termination rate in JMD /minute Mobile To Mobile (Peak Rates)	Termination rate in JMD /minute Fixed To Mobile (Peak Rates)
Digicel	[redacted] to LIME	[redacted] to LIME
LIME	[redacted] to Digicel	[redacted] to Digicel
Flow		[redacted] to Digicel; [redacted] to LIME

Table 1: Mobile to Mobile Termination Rate versus Fixed to Mobile Termination Rates

2.4 Before the merger between Digicel and Claro, LIME and Claro were using lower rates of [redacted] or [redacted] JMD/minute[3] between themselves. The rates in Table 1 are asymmetrical and differ substantially depending on whether the call originates from a fixed or mobile network. Furthermore both operators use much higher rates of between [redacted] JMD/minute to [redacted] JMD/minute, for calls that originate outside Jamaica.

2.5 The rate of [redacted] JMD/minute equates to [redacted] Eurocents/minute or [redacted] US$cents/minute[4].

2.6 Figure 1 shows the fall in average termination rates in Europe for the period from 2005-2014. Since 2010, rates have been reduced more substantially because Europe is changing to the Pure LRIC basis for

[1] This is estimated by summing Claro and Digicel's market shares using OUR data for Q2 2011. OUR is aware that after the merger between Claro and Digicel, Digicel's market share may not be the simple addition of Digicel and Claro's market shares before the merger but this is a first approximation (for traffic market share, this is however probably a good approximation).
[2] Numbers redacted due to confidentiality. The OUR intends to give formal notice to operators of its intention to publish some data marked as confidential.
[3] LIME's slightly higher rate takes account of the incoming calls transiting LIME's fixed switches close to the point of interconnection, because all interconnection to LIME mobile is via its fixed network.
[4] Equivalent to [redacted] US$/minute using Purchasing Power Parity (PPP). (2009 PPP values)

mobile termination rates (see paragraph 3.11) and are tending towards 1 Eurocent/minute in several countries (see Table 2: Comparison of TLRIC and the Pure LRIC rates).

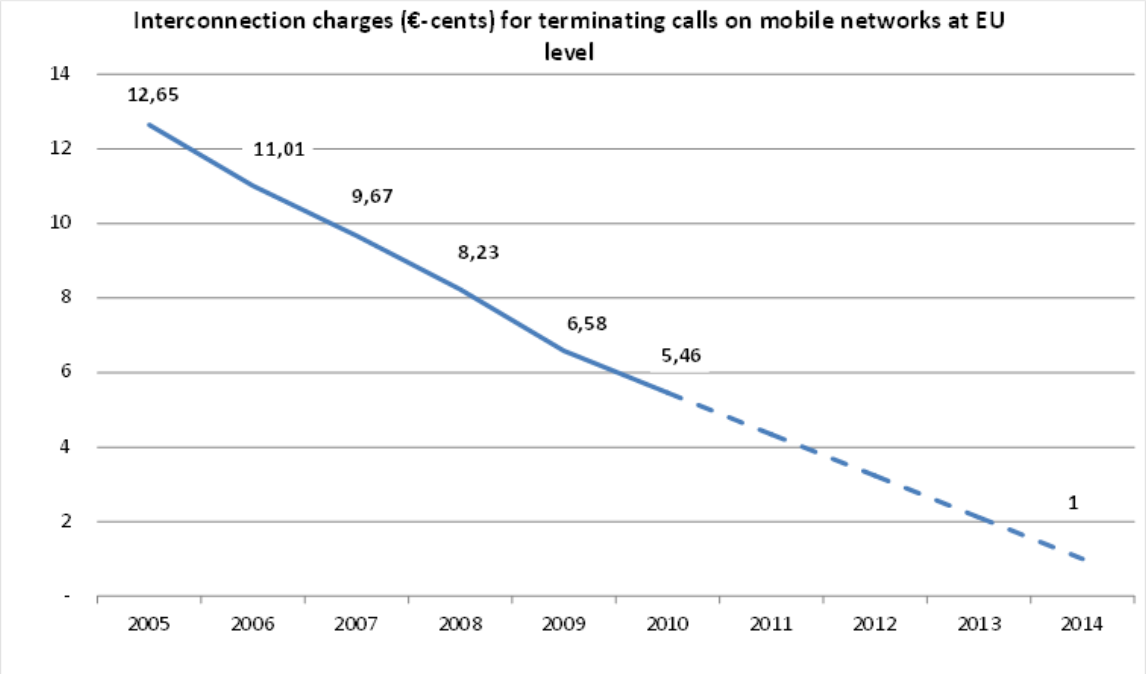

Figure 1: Average European mobile termination rates[5]

2.7 Outside Europe, the rates broadly fall into three categories:

- Countries that have followed the early European approach (which is the case of Caribbean countries, see Figure 2), and that still have high termination rates;
- Countries that have deliberately adopted different models and have low or zero termination rates, e.g. Singapore and India;
- Countries that use the same rates as for fixed call termination because they use the same number ranges and the Receiving Party Pays principle for the retail charges for the mobile part of the call, e.g. the USA.

[5] Source: EU Digital agenda scoreboard 2011 for values between 2005 and 2010 and forecasts based on France, United Kingdom, Belgium and Netherlands for which pure LRIC rate is around 1 Eurocent/minute.

2.8 Figure 2 shows a trend towards lower mobile termination rates in the Caribbean but are still much higher compared to the pure LRIC level towards which mobile termination rates are tending in Europe.

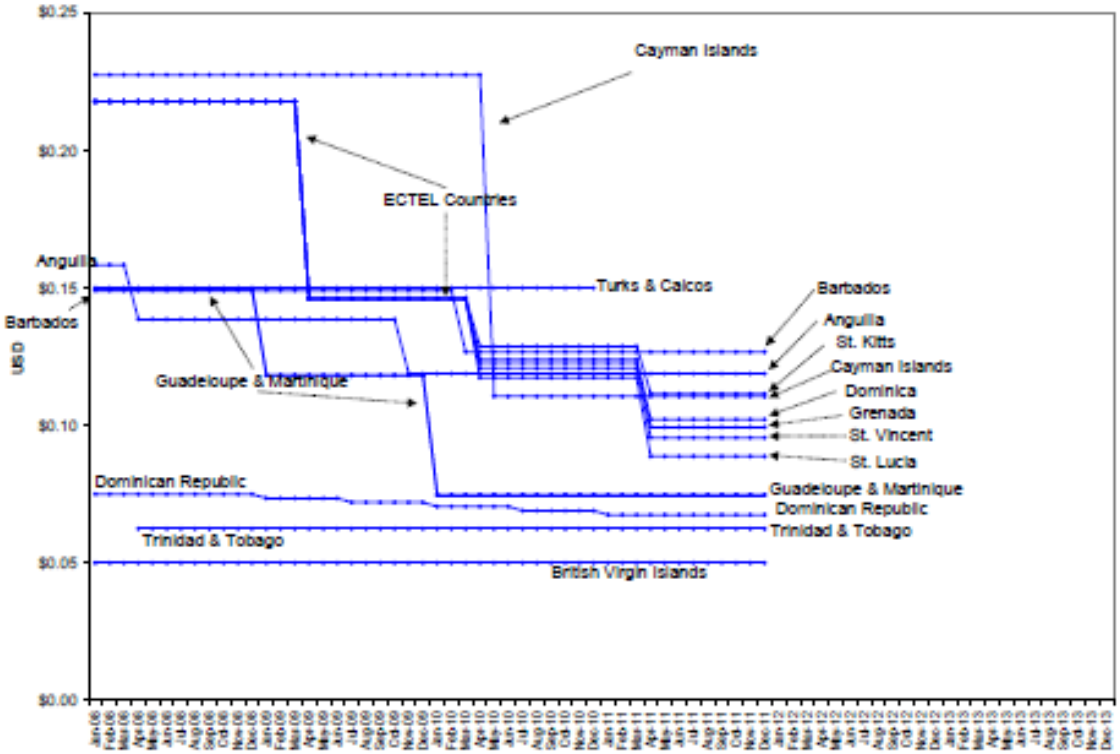

Figure 2: Evolution of MTR in the Caribbean[6]

[6] Review of Mobile Termination Rate Consultation Document issued by the Turks and Caicos Islands Telecommunications Commission On July 19, 2010

Chapter 3: The Choice of Cost Standard

Main options

3.0 The main issue concerns which costs should be recovered by wholesale mobile call termination rates and the way in which common or shared costs are treated. Costs, such as the cost of buildings, base stations and radio masts, are shared between different services. There are three different approaches to "cost orientation"[7]:

- **Stand Alone Costs (SAC)**, where the service is the only service provided. This means that all the common costs are included and attributed to that service whose cost is being calculated.

- **Total Long Run Incremental Costs (TLRIC)**, where the common costs are shared on an equitable basis between all the services that are provided. The equitable sharing of common costs between different services can be completed using several approaches (see Chapter 6: Depreciation and Cost of Capital). There are a number of variations broadly similar to TLRIC but these variations lack precise definition and, as these are not referred to in the Act, they are not mentioned further. Although this approach is not defined in the law, some elements of definition can be found in the 2010 consultation document in which the OUR stated: "*The standard of Long-Run Incremental Cost (LRIC) is increasingly applied by regulatory authorities for purposes of setting cost-based prices. The reason is that costs on the basis of LRIC correspond to those that a firm must meet in a vigorously competitive market*" and, about the increment: "*In the case of a mobile network there is usually no separate service of access to the network so there would correspondingly be only one increment, i.e. 'conveyance'*"[8].

- **Pure Long Run Incremental Costs (Pure LRIC)**, where only the incremental costs of the service are included and all or almost all of the common costs are excluded. This is the approach followed by the European Commission.

Each of these approaches to cost orientation is detailed in Annex 1.

[7] There are other cost standards that are sometimes used (for example Forward Accounting Costs or marginal costs) but these are the main ones used for mobile termination rates and/or quoted in the Jamaican law

[8] Source: OUR Consultation Document Tel 2008/10:Con/03 "Principles of Long-run Incremental Cost Model for the Jamaican Telecommunications Market"

Constraints of the Act

3.1 Section 33(1)(e) of the Act states:

> *"(e) prices for interconnection shall be established between* ***the total long run incremental cost of providing the service and the stand alone cost of providing the service****, so, however, that the* ***prices shall be so calculated as to avoid placing a disproportionate burden of recovery of common costs on interconnection services****;"*

3.2 While no definition is provided in the Act for TLRIC, the Act does not allow Pure LRIC to be used:

- first because of the use of the word "Total" which means that all costs including common cost should be covered; and

- second because "*prices shall be so calculated as to avoid placing a disproportionate burden of recovery of common costs on interconnection services*", it is understood from this sentence that a proportionate share of common costs should be recovered by mobile termination rates which the pure LRIC does not allow.

3.3 The Act constrains the prices to be set between the Stand Alone Costs and the TLRIC costs. Stand Alone Costs are higher than TLRIC costs and the requirement in the Act to "*avoid placing a disproportionate burden of recovery of common costs on interconnection services*" means that the rates should be set at a level closer to the TLRIC costs than to the Stand Alone Costs. This will avoid a disproportionate burden of common costs because the Stand Alone Costs approach allocates all costs to the particular service which is disproportionate.

Current Best Practice Approach to Cost Modelling

3.4 The Act is based on the European approach to call termination rates where rates are "cost oriented". This section describes how regulation of mobile termination rates evolved in Europe, which provides interesting insights. The "cost orientation" approach originates from the practices for international calls before competition was introduced, where call termination was seen as a service to the network that originates the call. With the introduction of competition, it became necessary to control the rates for this service and the obvious solution was to base them on costs. Hence almost all countries in Europe adopted cost based termination

centre on the concept of the call termination being a "service to the originating network"[9].

3.5 A practical constraint for regulators was the lack of information on costs. Early models were Top-Down models based on the historical costs in company accounts with adjustments being estimated to predict current costs.

3.6 Economists developed the concept of TLRIC[10] to share the common costs and provide a price signal that better reflected the economics of the current market and so gave realistic signals to potential investors. This approach was applied to all services including wholesale call termination but also to new services that the incumbent was obliged to provide (call origination, local loop unbundling, bitstream, etc.). In November 2000, the Independent Regulators Group (IRG) published a document that lists the requirements that a LRIC approach should fulfil: "*Principles of implementation and best practice regarding FL-LRIC cost modelling*" and this document represents the consensus approach to TLRIC.

3.7 More regulators developed models and there were gradual reductions in termination rates both as a result of better regulation and increases in economies of scale. Many regulators recognized that every operator, however large or small, had dominance[11] in call termination to its own numbers. The issues of tariff transparency with number portability led to pressure to have symmetrical rates between operators who were required to port numbers among themselves.

3.8 Regulators, however, became increasingly aware that high termination rates had a negative effect on the market, because operators proposed significant differences between on-net and off-net prices, which favoured the larger operators, and so they started to examine the issues more closely.

[9] The costs of mobile coverage were included. The inclusion of coverage costs contrasted with the treatment of fixed networks where the costs of the local exchange lines were paid through line rentals and so the cost of coverage was excluded from the termination rates. The European approach led to mobile termination rates that were much higher than fixed termination rates.

[10] See for example, Larson, Alexander C., and Steve G. Parsons. 1995. "'Building Block' Cost Methods for Pricing and Unbundling Telecommunications Services: Implications for the Law and Regulatory Policy."

[11] The term "significant market power" is commonly used in Europe. In many countries, regulators only regulated the rates of those operators that were dominant in the retail market and new entrants set rates higher than those of the established operators.

3.9 In May 2009 the European Commission adopted a "*Recommendation on Regulatory Treatment of Fixed and Mobile Termination Rates in the EU*" (2009/396/EC). This Recommendation took a radically different approach, which would lead to much lower termination rates and in practice remove the differences in the treatment of fixed and mobile termination. The key recommendations were (only most important text reproduced):

- *"NRAs should set termination rates based on the costs incurred by an efficient operator. This implies that they would also be symmetric. (paragraph 1)*

- *The evaluation of efficient costs is based on current cost and the use of a Bottom-Up modelling approach using long-run incremental costs (LRIC) as the relevant cost methodology. (paragraph 2)*

- *NRAs may compare the results of the Bottom-Up modelling approach with those of a Top-Down model which uses audited data with a view to verifying and improving the robustness of the results and may make adjustments accordingly. (paragraph 3)*

- *The cost model should be based on efficient technologies available in the time frame considered by the model. Therefore the core part of both fixed and mobile networks could in principle be Next-Generation-Network (NGN)-based. The access part of mobile networks should also be based on a combination of 2G and 3G telephony. (paragraph 4)*

- *Within the LRIC model, the relevant increment should be defined as the wholesale voice call termination service provided to third parties. This implies that in evaluating the incremental costs NRAs should 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, whereby the latter costs should be disregarded for the purpose of calculating wholesale termination rates. (paragraph 6)*

- *The recommended approach for asset depreciation is economic depreciation wherever feasible. (paragraph 7)*

- *Any determination of efficient cost levels which deviates from the principles set out above should be justified by objective cost*

differences which are outside the control of the operators concerned. Such objective cost differences may emerge in mobile termination markets due to uneven spectrum assignments. (paragraph 9)"

3.10 This new approach is proving to have a major effect on the levels of mobile termination rates, primarily because it excludes the cost of coverage by treating call termination as the last increment after coverage has already been paid for by the other services. The extensive Explanatory Note to the Recommendation explains the approach in more detail and states the treatment of coverage explicitly.

3.11 Since the Recommendation was published, some NRAs in Europe have developed the necessary bottom up cost models and have published their requirements for mobile termination rates to fall during the period to end 2012.

3.12 Table 2 compares the former TLRIC and the Pure LRIC rates for four countries with different populations. OUR reminds that the current rate in Jamaica is [redacted] Eurocents/minute or [redacted] US$cent/minute[12].

Country	Population	TLRIC rate (before new approach) Eurocents/min	Pure LRIC rate (2013 onwards) Eurocents/min
France	66m	5.8	0.8
UK	62m	4.2	0.7
Belgium	11m	7.2-11.4	1.08
Netherlands	16m	7.3	1.2

Table 2: Comparison of TLRIC and the Pure LRIC rates

3.13 This move to the pure LRIC approach in Europe was the consequence of the observation that high mobile termination rates could create significant competition issues. For example, in the presence of network effects in mobile markets, high mobile termination rates prevent small operators from proposing retail offers that are comparable to larger operators which terminate the majority of their calls on-net. These competition issues were raised by several studies such as:

- Laffont, Rey, Tirole (1998b), Lopez (2008), Birke et Swann (2006), Hoernig (2007). These studies show that, when operators have

[12] Equivalent to [redacted] US$/minute using PPP. (2009 PPP values)

asymmetrical sizes, larger operators will use on-net/off-net price differentiation to increase their market share.

- OUR notes that such price differentiation is difficult to replicate for small operators when termination rates are high. This has been demonstrated by Harbord et Pagnozzi (2008), Peitz (2005), Cricelli, Grimaldi et Levialdi (2007), Hoernig (2007), Gabrielsen et Vagstad (2005)[13].

3.14 In the Explanatory Note that accompanied the European Recommendation, the European Commission explained that mobile termination rates based on pure LRIC would avoid cross-subsidisation between operators and customers:

> *"When deciding on the correct level of the regulated wholesale termination rate, it is essential to ensure that the methodology adopted promotes efficient production and consumption decisions and minimises any artificial transfers and distortions between competitors and consumers. Therefore, regulators should construct models which set wholesale termination charges as close to incremental cost as possible. The closer the termination price of all operators is to the incremental cost, the more likely it is that this will lead to the most efficient and least distortionary use of call termination services, and minimise the risk of problems such as cross-subsidisation between operators and customers and inefficient pricing and investment behaviour. Therefore, it is justified to apply a pure LRIC approach where the relevant increment is the wholesale call termination service and which includes only those costs that would not be incurred if that service were no longer produced (i.e. avoidable costs). A pure LRIC approach, while recognising the essential objective of short-run*

[13] Birke D., Swann P., 2006, "Network Effects and the Choice of Mobile Phone Operator", Journal of Evolutionary Economics
Calzada, Valletti, 2005, "Network Competition and Entry Deterrence", Economic Journal
Cricelli, Grimaldi, Levialdi, 2007, "Interchange flow between mobile network operators: asymmetry and discrimination"
Gabrielsen, Vagstad, 2005, "Why is on-net traffic cheaper than off-net traffic? Access markup as a collusive device and a barrier to entry", European Economic Review
Hoernig S., 2007, "On-net and off-net pricing on asymmetric telecommunications networks", Information Economics and Policy
Laffont J. J., Rey P., Tirole J., 1998b, "Network Competition: II. Price discrimination", RAND Journal of Economics
Peitz M., 2005, "Asymmetric regulation of access and price discrimination in telecommunications", Journal of Regulatory Economics
Lopez A. L., 2008, "Foreclosing Competition through Access Charges and Price Discrimination", IDEI Working Paper

marginal cost pricing, also recognises that cost structures in network industries tend to be characterised by substantial fixed costs and (by assuming that all costs become variable over the long run) provides for the recovery of service-specific fixed costs and variable costs which are incremental to providing the service over the longer term." (p16-17)[14]

3.15 The European Commission warned also:

"High termination charges may be used to foreclose a new entrant network, where a large proportion of originated calls are off-net. High termination rates may also facilitate collusive behaviour between two or more terminating operators." (p6)

"Late entrants argue that due to large traffic imbalances and on-net/off-net price differentiation they cannot compete effectively at the retail level. A large proportion of calls originated on late entrant networks are terminated on other networks, i.e. offnet. If new entrants pay a regulated termination charge in excess of actual costs they effectively give a transfer to the large network. As a result, their ability to offer retail rates comparable to the retail rates of an established operator, which terminates a majority of its calls on-net, is impeded." (p7)[15]

3.16 As a consequence, the theory and the observations are converging towards a need for cost oriented termination rates, which will address one of the causes of high on-net/off-net price differences and the related potential anti-competitive consequences. The OUR is of the view that it is relevant to consider the competition issues created by high mobile termination rates in Jamaica, especially in the context of high market share asymmetries between operators.

3.17 The OUR notes that the requirements of the Act date from 2000[16] before this understanding of the effects of high call termination rates had developed. The OUR has to work within the constraints of the current Act, but within these constraints it intends to follow the principle of not having mobile call termination rates that are above efficient cost oriented levels to

[14] Commission staff working document accompanying the commission recommendation on the Regulatory Treatment of Fixed and Mobile Termination Rates in the EU explanatory note {C(2009) 3359 final} {SEC(2009) 599}

[15] Commission staff working document accompanying the commission recommendation on the Regulatory Treatment of Fixed and Mobile Termination Rates in the EU explanatory note {C(2009) 3359 final} {SEC(2009) 599}

[16] It was passed on 18 February 2000 http://www.ictregulationtoolkit.org/en/Publication.2607.html

allow for fair competition. As stated in section 1.5 paragraph (e*), "prices for interconnection shall be established between the total long run incremental cost of providing the service and the stand alone cost of providing the service*". Therefore, in order to stay within the boundaries of the current Act, pure LRIC methodology is excluded from the list of potential cost standards.

3.18 Finally, OUR notes that whilst the European approach may be considered to be the current best practice the theory does not yet seem to be fully developed. Indeed, although the European Recommendation is restricted to call termination, it does not make the fundamental distinction that needs to be drawn between interconnection for connectivity (e.g. call termination) and interconnection for competition (e.g. call origination and local loop unbundling) where the assets of one operator are forcibly shared with other operators.

Termination Rates for International Calls

3.19 At present, the mobile operators apply a higher termination rate for international calls than for national calls (see Chapter 2: Introduction). This practice derives from the use of accounting rates to bring additional revenue into the country. According to one operator, over half of the revenue from wholesale mobile call termination comes from international calls. One may say that it is desirable to retain this practice because it prevents new entrants from offering lower international termination rates to foreign carriers at levels closer to the lower national rates, as such practices would reduce the overall revenue coming into Jamaica. It may further be argued that foreign carriers will not pass savings to their callers because these rates are not the focus of competition for foreign customers. Thus, Jamaican operators will lose money and the foreign operators will gain if these higher international rates are reduced.

3.20 The Act does not allow for different rates to be applied depending on the origin of the call.

3.21 At a pragmatic level, the OUR is not convinced by the above arguments. The international call market seems highly competitive and reductions in termination rates are frequently passed on to the callers, especially by operators whose main business is to offer low price international calls. An increase in the volume of incoming calls can have a multiplier effect within the overall economy. As explained by Douglas A. Galbi (1998), "*While home country citizens do not pay for incoming international calls, it should be recognized that incoming international calls have significant value to*

home country citizens. For any given telephone conversation, each party would prefer to be the called party, exactly because the called party does not pay. Increases in foreign calling prices to the home country are likely to reduce home country welfare to the extent that they reduce the volume of valued calls to the home country."[17]

3.22 Equally, the OUR has found that foreign calls are already brought into Jamaica over the internet and other means and passed to mobile networks as national calls, with changes to the Calling Line Identity. The OUR contends that this problem could largely be alleviated if carriers complied with the OUR's stipulation that each carrier should only charge a single termination rate for terminating traffic on its network regardless of where the traffic originates. This would significantly reduce the arbitrage which now exists. The OUR has long argued that the cost of terminating a call is the same irrespective of where the call originates. In any case, the introduction of TLRIC based charges will not reduce the revenue as much as Pure LRIC would and will limit the impact on international revenues. OUR notes that revenues from incoming international calls represent around 5% of operators' revenues[18].

Conclusion

3.23 Based on the analysis set out above, the OUR proposes to:

- Set mobile termination rates based on TLRIC costs. This is in order to be more in line with the best practice costing practices and fulfil the requirements of the Act that prices be calculated to avoid placing a disproportionate burden of the recovery of common costs on interconnection services.

- Explore the possibility of any future change in the Act permitting best practice cost standards such as Pure LRIC to be used;

- Set a rate for wholesale mobile call termination that is independent of the origin of the call.

Question 1: Do you agree with the overall approach that the OUR proposes to take? If not, please explain your views and reasoning.

[17] Douglas A. Galbi (1998), Distinctive Arrangements for International Interconnection?, Federal Communications Commission

[18] Based on OUR's data

Chapter 4: Type of Model

4.0 A number of important choices need to be made in the design of the cost model or models. These choices are somewhat inter-related and they determine whether symmetrical or asymmetrical rates for wholesale call termination can be set.

4.1 A fundamental choice is whether the modelling should be based on:

- A single generic model that would be used to set symmetrical mobile termination rates for all operators; or

- Separate models of each operator's network that could be used to set either an average rate or asymmetrical rates.

4.2 There are two different types of models that can be used:

- **Top-Down:** where cost inputs are taken from the operator's accounting records and are allocated to services by using service demand and allocation rules. This is based on accounting principles (accounting depreciation, accounting allocation). This method does not involve detailed network modelling. Instead, the relationships between the production of services (outputs) and costs are derived from historical observations. Costs can however be projected forward on the basis of output and cost forecasts.

  Bottom-Up: the model uses detailed data and engineering rules to (re)build a hypothetical efficient network, reflecting as appropriate the network of the modelled operator. The network is modelled so as to deliver telecommunications services and to satisfy the demand for these services. The costs of this network (including capital costs, operations and maintenance costs) are then allocated to all the services provided over that network. This approach has more of an 'engineering-based' nature than the Top-Down approach (which is more 'accounting-based') as it starts by dimensioning and building a network and identifies all components of cost at a much more granular level. This is based on economic principles (economic depreciation, economic allocation).

As an illustration, the following example details how in a network comprised solely of IP routers, the costs can be calculated through a cost model using either Top-Down or Bottom-Up principles:

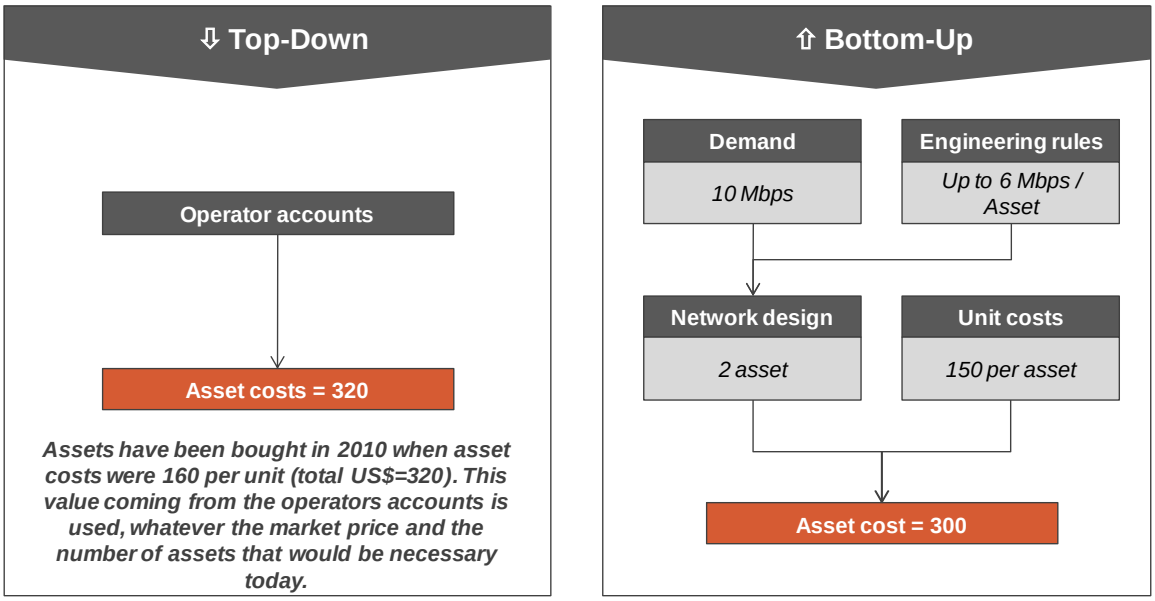

Figure 5: Comparison of the Model Types Available

4.3 The following are the main characteristics of a Top-Down model:

- The model is based on the accounts of an operator and so is always specific to a particular operator and the physical configuration of its network. Thus for two operators, two different models would be needed. If symmetrical rates are to be calculated, the average of the results of the two models could be used.

- The accounts relate to the dimensions of the real network and these dimensions may be greater than is needed for the traffic (i.e. the network may be inefficient) but it is not practicable to adjust the dimensions.

- The costs used are always historical but adjustments can be made to estimate current equivalent costs. Accounting depreciation is used and therefore can send inappropriate price signals (see Annex 5: Tilted Annuities).

- Top-Down models are much less flexible for calculating different cost standards.

Annex 2 explains the construction of a Top-Down model.

4.4 The following are the main characteristics of a Bottom-Up model:

- The model is based on the design of a hypothetical network. The hypothetical network can be based on the node topology of a real operator but with different capacities at each node (called "scorched node") or redesigned with a different topology (called "scorched earth"). A scorched node model is operator specific because a real operator's node topology needs to be used. However, it is possible to use an "average topology" if the two operators have similar but not identical topologies. This approach is strongly supported by the European Regulatory Group (ERG, now called BEREC):

  "Designing an optimal network topology is not a straightforward task. For feasibility reasons, it is appropriate to take the existing network topology as the starting point for the cost allocation process. Such a scorched node approach would imply that the existing points of presence are maintained but that technologies are optimised consistent with there being an actual or potential new entrant or efficient competitor."

Furthermore, in its previous consultation the OUR wrote:

"[…] the scorched node approach is also here taken as the most appropriate one."

- The model can be dimensioned to the traffic to be carried and can therefore calculate the costs of an "efficient operator"[19].

- The costs used are normally the prices paid recently by a real operator or prices obtained from manufacturers or other sources. There is no use of historical costs.

- The model can be dimensioned easily for all services or for individual services, and so the costs of increments can be obtained easily and different cost standards compared (SAC vs TLRIC vs Pure LRIC).

- Finally the model calculates costs from an economic point of view compared to an accounting point of view using the Top-Down methodology.

Annex 3 explains the construction of a Bottom-Up model.

[19] "Efficient" means a network that is dimensioned to carry a given level of traffic without significant/undue excess capacity.

4.5 Figure 2 shows the different model types and the related options for a country with two networks.

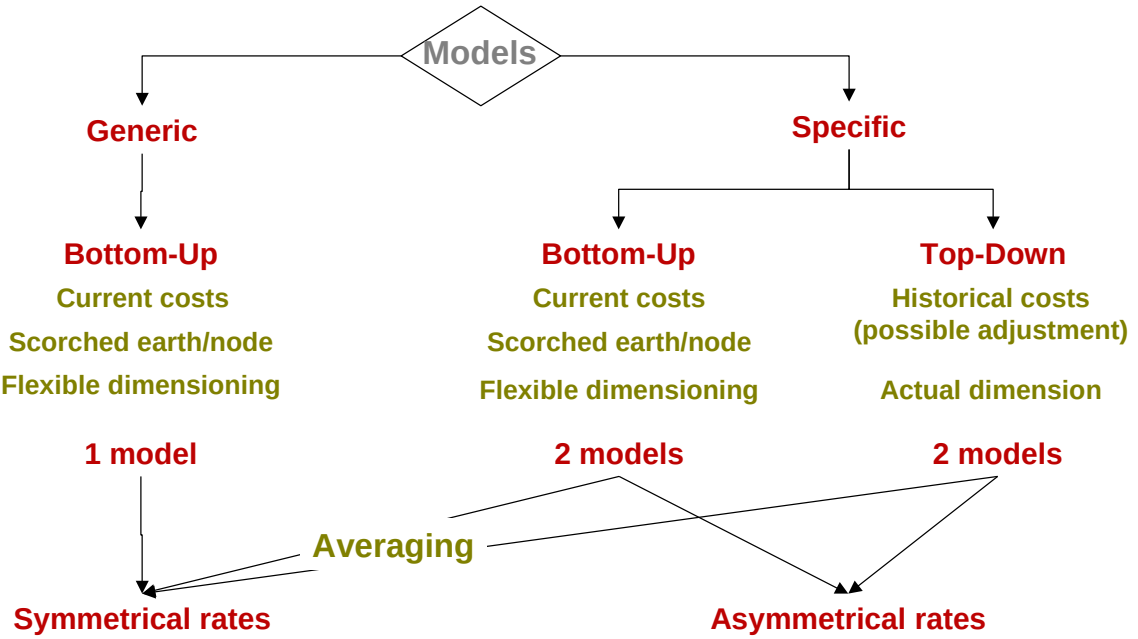

Figure 7: Model Types and Options

4.6 Each of the Top-Down and Bottom-Up approaches has distinct benefits and drawbacks:

- A Top-Down approach tends to reflect, by construction, the actual costs incurred by the operator and provides a snapshot of the reality. It reflects the existing configuration of networks, which may or may not reflect efficient network operations. Because it reflects only the current situation (which in turn will be a legacy of historical decisions), the Top-Down approach has difficulties in establishing robust forecasts. It also lacks transparency. Furthermore, any existing inefficiencies are embedded in the cost estimates. As the ITU states in its ICT Regulation Toolkit, it is more complex to deal with inefficiencies in a Top-Down model than in a Bottom-Up model:[20]

  "It is possible to make adjustments to Top-Down approaches to remove inefficiencies in the firm's current network configuration and costs, but it is difficult to do so transparently. The incumbent

[20] ITU, ICT Regulation Toolkit (http://www.ictregulationtoolkit.org/en/section.2092.html).

firm will have more information about its historic performance and its accounts than the regulator or new entrants."

- A Bottom-Up approach provides a better understanding of underlying cost structures and cost drivers. Bottom-Up cost models are more transparent and better able to analyse and determine accurately changes in cost over time under significant uncertainty or where cost structures are expected to change. It is more flexible with respect to a wide range of parameters, such as traffic volumes, allocation options, engineering rules and operating costs. Bottom-Up cost models enable dealing with inefficiencies as costs are derived from service demand through established engineering rules[21]. The main drawback of the Bottom-Up approach is that estimated costs are not necessarily in line with existing operators' costs and may not reflect achievable levels of efficiency.

4.7 The OUR proposes to develop a single Bottom-Up model based on a scorched node topology.

4.8 The reasons for this approach are the following:

- Bottom-Up models give a better understanding of the different components of cost and can be used to show the differences between different cost standards;

- Compared to Top-Down models, Bottom-Up models are more amenable to sensitivity analysis;

- Bottom-Up models offer greater transparency than a Top-Down approach, as the inputs, engineering rules and assumptions used in a Bottom-Up engineering model are all visible and can be more objectively tested. Transparency and visibility are important to help address the information disadvantage that the regulator has compared to the regulated operators.

[21] It is to be noted that a key advantage of Bottom-Up models is that, by being able to calculate the costs of a "new" network, they can provide appropriate 'build or buy' signals. This means that setting regulated prices below the cost calculated by a Bottom-Up model will not give incentives for operators to deploy their own network (because it is cheaper to buy regulated products) and setting regulated prices above the cost calculated by a Bottom-Up model will favour inefficient entry. This is important to promote efficient investment and achieve the right balance of infrastructure-based and service-based competition. However, this typical advantage of Bottom-Up models is not relevant here given the nature of the wholesale termination service.

- Bottom-Up models are the state of the art according to the European Commission Recommendation;

- Bottom-Up models allow the effects of different algorithms for sharing common costs to be explored easily;

- In developing the Bottom-Up model, the OUR will take account of whatever Top-Down information is provided by the operators and will make sure that Bottom-Up models are realistic. As a consequence, the main drawback of Bottom-Up models (see above: *"estimated costs are not necessarily in line with existing operators' costs and may not reflect achievable levels of efficiency"*) will be neutralised.

- Digicel has indicated that it does not have a regulatory cost accounting model and LIME has stated that its regulatory cost accounting model would not be able to provide some of the needed data. Given these circumstances, a bottom-up model is the most practicable approach.

Question 2: Do you agree with the proposal to use a single Bottom-Up model based on an average scorched node topology? If not, please explain your views and reasoning.

4.9 The OUR proposes to use the Bottom-Up model to set symmetrical rates for wholesale mobile call termination for the following reasons:

- Because it considers that the same price should be charged for the same service;

- Because operators only get paid for the efficient costs incurred and an inefficient operator (with higher costs) should not be rewarded by higher wholesale mobile call termination rates. This is in keeping with the objects of the Act, Section 3 (d) of which states that the objective is "*to promote the telecommunications industry in Jamaica by encouraging economically efficient investment in, and use of, infrastructure to provide specified services in Jamaica.*" Section 4 (3) (b) (iii) further states that "(3) *In the exercise of its functions under this Act, the Office may have regard to the following matters - …*

(b) Whether the specified services are provided efficiently and in a manner designed to –

…

(iii) afford economical and reliable service to its customers"

- Because asymmetric rates can generate competition issues, especially because it could prevent one operator from replicating retail offers of the other;

- This approach also represents industry best practice. The European Commission for instance recommends setting symmetrical rates. In its Recommendation, the European Commission says:

  "the Commission has for a long time recognised that setting a common approach based on an efficient cost standard and the application of symmetrical termination rates would promote efficiency, sustainable competition and maximise consumer benefits in terms of price and service offerings." (Recital 7)

  "NRAs should set termination rates based on the costs incurred by an efficient operator. This implies that they would also be symmetric." (Para 1)

  OUR notes that this is also the position adopted by the ERG[22] which states:

  "in the long run symmetric mobile termination rates may contribute to enhancing static economic efficiency (limiting allocative and productive inefficiencies), investment, innovation, regulatory certainty, and, lastly, overall welfare. Assuming that the market for mobile termination is competitive should lead to symmetric rates for MTRs, considered as homogeneous products (unless proven otherwise)"

Question 3: Do you agree with the proposal to set symmetrical rates for wholesale mobile call termination? If not, please explain your views and reasoning.

4.10 The generic model needs to be dimensioned for a particular traffic volume. At present Digicel has over ■ % of the Jamaican market by call minutes,

[22] ERG's Common Position on symmetry of fixed call termination rates and symmetry of mobile call termination rates

and LIME has less than [redacted] %. The OUR proposes to use traffic volumes of 70% of the market in the modelling, including incoming international calls. The reasons are:

- Provided that competition develops further, possibly through additional entry to the market, Digicel is unlikely to retain its [redacted]% market share in the longer term and so a lower percentage than [redacted]% should be used;

- A percentage lower than 50% should not be retained because it would not promote efficiency (as explained above an inefficient operator (with higher costs) should not be rewarded by higher wholesale mobile call termination rates);

- A higher traffic volume will tend to reduce the differences between on-net and off-net retail rates (because off-net retail rates are constrained by the level of termination rates) and so reduce the competitive advantage of larger networks;

- If however Digicel increases its market share even further, the OUR may amend the regulated prices (as explained in Chapter 8: Glide Paths, Price Gradients and Charging Basis, "[OUR*] will amend the regulated prices in case significant changes in the parameters or structure of the models needs to be reflected*").

- The networks of Digicel and LIME are quite similar and so it should be possible to establish a typical average node topology. Such average topology will allow the regulator to calculate future costs for both operators.

Question 4: Do you agree with the proposal to use traffic levels corresponding to 70% of the total market and to set symmetrical rates? If not, please explain your views and reasoning.

Chapter 5: Cost Allocation

5.0 A mobile network is shared between different types of traffic or services. There are three main distinct services:

- Voice telephony;
- Short Message Service (texts)/MMS; and
- Internet access with different technical forms at the air interface for 2G and 3G.

Whereas the traffic load for voice telephony is growing only slowly, the load for Internet access has the potential to grow rapidly and become the largest type of traffic.

5.1 Within the voice service there are different types of calls:

- On-net;
- Off-net to mobile;
- Off-net to fixed;
- Special services;
- Wholesale call termination;
- Etc.

5.2 There are three different types of costs:

- Costs that are exclusive to a particular service and that would cease if the service was discontinued;
- Costs that are shared by more than one service (joint and common costs);
- Costs that are overheads that cannot be related to any specific service, such as the top management, the accounting system and the management of regulatory conformance.

5.3 The joint and common costs (e.g. transmission, radio masts and buildings) form the majority of the costs and so a formula is needed for allocating these costs to the different services so that the cost of the wholesale call termination can be calculated.

5.4 The most common method of cost allocation is ‘required capacity’. The required capacity allocation approach allocates common costs based on the capacity used by each service at the busy hour (i.e. a 60-minute period during which the maximum total traffic load occurs). This is also the

rule generally used by operators to dimension their network (this was confirmed to be the method used by operators in Jamaica as well during meetings held in January 2012).

5.5 The bandwidth used during the busy hour is the factor that determines the dimensioning of the network. As an example, let us consider a network where two services (voice and data) are provided through the same asset. At busy hour, a total bandwidth of 100 Mbps is required of which 16Mbps is required by voice and 84 Mbps by data.

	Voice	Data	Total
Demand	16	84	100
%	16 %	84 %	100 %
Cost Allocation	16	84	100
%	16 %	84 %	100 %

Figure 8: Cost Allocation with Required Capacity Allocation

With the 'required capacity' allocation method, the share of the asset cost allocated to voice would be 16%.

5.6 In the case of mobile networks for example, assets that are shared between voice and mobile Internet (such as masts, base stations or fibre cables) would have their cost being allocated on the basis of the share of traffic of voice and mobile Internet at the busy hour.

5.7 Although 'required capacity' is the method of cost allocation used by most regulators, it has two disadvantages:

- It is somewhat unstable especially when traffic volumes are changing and the busy hour can shift from one time of day to another, when the proportions of different types of traffic can be different. For example, as Internet traffic served by dongles grow, the busy hour might shift from say 5:00 pm, when voice traffic is greatest, to say 9:00 pm when Internet traffic is greatest.

- It may not reflect the value that end-users allocate to the different services. For example, when mobile Internet traffic grows (which is the situation in many countries), less and less costs will be allocated to voice. The cost of voice will therefore decrease while its value may remain high for end users. This may create issues on retail markets.

5.8 The main alternative to required capacity is the algorithm of Shapley Shubik. The Shapley-Shubik rule has been considered by some NRAs such as ARCEP[23] in France, ComReg[24] in Ireland, and TRA[25] in Bahrain. The Shapley-Shubik rule is described in more detail in Annex 4. Shapley Shubik uses bottom up models to calculate the incremental costs of each main service type in all the possible combinations of order of arrival and then takes the average of the results. So, for example, it calculates the incremental cost of the voice service for the orders:

- Voice, then SMS, then Internet;
- Voice, then Internet, then SMS;
- SMS, then Voice, then Internet;
- SMS, then Internet, then Voice;
- Internet, then SMS, then Voice;
- Internet, then Voice, then SMS.

5.9 Although the order in which services have developed historically is Voice, then SMS, then Internet, this order is immaterial from the perspective of the current market and the economic signals that need to be given to a new entrant who would implement all services from the start.

5.10 The OUR proposes to use the 'required capacity' method as the method of allocating common costs between the different service types of Voice, SMS and internet access as it is the main approach used by regulatory authorities and is more consistent with operators' dimensioning approach.

Question 5: Do you agree with the proposal to use the 'required capacity' method as the method of allocating common costs between the different service types of Voice, SMS and internet access, but then to use the busy hour traffic volumes to allocate costs between different call types? If not, please explain your views and reasoning.

5.11 The overheads also need to be allocated to the different services. The Equal Proportionate Mark-Ups (EPMU) approach where each service is allocated a share of the common costs in proportion to that service's share

[23] See ARCEP, decision n° 2008-0896.
[24] See ComReg, decision n° D03/08.
[25] See TRA Bahrain, Development, implementation and use of bottom-up fixed and mobile network cost models in the Kingdom of Bahrain, Position Paper, 19 October 2011

of total attributable costs[26] is the preferred approach. The ITU observes that this is generally the approach followed by regulators[27]. The ERG states: "*"In a regulatory environment it is accepted that all services should bear, in addition to their incremental cost, a reasonable proportion of the common costs. The preferred method of allocating common costs is Equal Proportionate Mark-Up (EPMU)."*[28] In theory it may be better to use Ramsey pricing[29] but this is not practicable because of the difficulty in calculating price-elasticity. The OUR therefore proposes to allocate overheads according to Equal Proportionate Mark-Ups.

Question 6: Do you agree with the proposal to allocate overheads according to Equal Proportionate Mark-Up? If not, please explain your views and reasoning.

[26] ERG - Recommendation on how to implement the commission recommendation C(2005) 3480 - 2005

[27] "*Regulators have generally set uniform mark-ups*."ITU, Telecommunications Regulation Handbook.

[28] 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

[29]According to economic theory, efficiency is maximized when prices are set equal to marginal costs. However, because of the existence of fixed and common costs, Ramsey-Boiteux prices include a mark-up on the marginal cost of each service in order to contribute to the joint and common costs. The size of the mark-up on each service is inversely proportional to the price elasticity of demand for that service, as this minimises the consumption-distorting effect of raising prices above marginal cost. As a result, welfare is maximised

Chapter 6: Depreciation and Cost of Capital

6.0 The objective of the cost model is to calculate a cost per year for the wholesale call termination service from which a cost per minute can be derived[30]. However, the assets of the network have varying lives ranging from typically 3 to 5 years for modern electronics to 40 years or more for buildings and ducts. These assets are bought with capital, and this capital has an economic cost as it is either the product of investment or a loan. The issue is how to transform these capital costs into a representative cost per year. This transformation needs to take account of changes in the price of the assets over their life, which may be different for different assets, e.g. the cost of electronics is decreasing where as the cost of buildings and ducts is increasing. There are four issues:

- How should the cost of an asset be distributed over its life (called depreciation)?
- What is the life of each asset?
- What working capital is needed for the business?
- What is the cost incurred due to the purchase of an asset (Weighted Average Cost of Capital)?

Depreciation

6.1 There are two families of approach to depreciation:

- Accounting depreciation, which is based on the initial cost of the asset, e.g. Historic or Current Cost Accounting (HCA); and
- Economic depreciation, which is based on the period-by-period change in the market value of the asset, using a form of annuity. The overall cost is the sum of its depreciation and the cost of the capital employed. The annuity variants are standard, tilted and adjusted tilted annuities. Details of these different depreciation approaches are provided in Annex 5: Tilted Annuities.

[30] As explained in Chapter 8: Glide Paths, Price Gradients and Charging Basis, even if the output of the cost model will be a MTR expressed in JMD/minute, the charging basis will be on a per second basis.

6.2 In order to present the correct economic signals to the market, the method chosen should provide results (e.g. wholesale mobile call termination costs) that are independent of when the calculation starts, of the evolution of traffic and when an asset needs to be replaced. There should be no discontinuities in the evolution of unit costs because absence of discontinuities would enable the setting of stable regulated rates which will provide more visibility to the industry and to investors.

6.3 While the tilted annuity formula is the typical approach used in fixed networks, it is not well adapted when volumes of traffic grow or decrease significantly. When volumes of traffic grow significantly, the use of traditional depreciation approaches (such as standard annuities, tilted annuities or HCA) leads to unit costs that are decreasing and therefore to unstable rates. On the contrary, the adjusted tilted annuity (also called Net Present Value approach or Discounted Cash Flow approach) enables the setting of rates that are more stable (or evolving with price trends) because with this approach annuities (sum of depreciation and cost of capital) evolve in line with traffic. For example, when traffic grows by 20%, annuities grow by 20% and therefore unit costs (calculated as annuities divided by traffic) are stable.

6.4 Considering the fact that volumes of voice traffic are evolving fast in Jamaica (around 20% per annum) and that volumes of mobile Internet traffic are planned to increase exponentially around the world[31], OUR is of the view that the adjusted tilted annuity approach is more appropriate.

Question 7: Do you agree that adjusted tilted annuities should be used? If not, please explain your views and reasoning.

Asset Lives

6.5 Different lives will be assigned to different types of assets as shown in the following Table 3[32] which are the accounting asset lives of the operators in Jamaica.

[31] See for example Cisco Visual Networking Index: Global Mobile Data Traffic Forecast Update, 2010–2015 (http://www.cisco.com/en/US/solutions/collateral/ns341/ns525/ns537/ns705/ns827/white_paper_c11-520862.pdf)

[32] Source : Audited Annual Reports of operators

Asset	Minimum asset life	Maximum asset life
Buildings	20	40
Plant and Machinery	7	7
Furniture, Fixtures, and Fittings	3	15
Computer Equipment	3	5
Software	5	5
Motor Vehicle	3	5
Site Infrastructure	7	14
Leasehold Improvement and Shelters	5	15
Average	**7**	**13**

Table 3: Asset Lives

6.6 The OUR intends to use accounting asset lives of the operators in Jamaica. If they are different between operators, then the OUR will use average accounting asset lives.

Working capital

6.7 The activity of a firm either requires or generates cash for everyday operations. The amount of cash required for or generated by day to day operations is defined as working capital. More accurately, working capital can be defined as follows:

"The net balance of operating uses and sources of funds is called the working capital. If uses of funds exceed sources of funds, the balance is positive and working capital needs to be financed. This is the most frequent case. If negative, it represents a source of funds generated by the business cycle. It is described as "working capital" because the figure reflects the cash required to cover financing shortfalls arising from day-to-day operations."[33]

6.8 A telecommunications operator faces different types of costs that can generate working capital:

a. Network CAPEX;
b. Network OPEX and corporate overheads.

6.9 When making network investments, an operator generally begins earning revenues from its asset several months after the investment is completed.

[33] Corporate Finance, Theory and Practice", Vernimmen, Le Fur, Quiry, Dallocchio and Salvi, 6 February 2009

This period which goes from the payment of an asset to its first operating use consumes working capital. This period of time can vary significantly from one asset to another. For instance, it depends on whether or not the supplier allows delayed payment. The associated cost can be directly taken into account in the annuity formula as described in Chapter 6: Depreciation and Cost of Capital. If there is a one year delay between the time the investment is completed and the time that revenues are generated, then it is necessary to multiply the annuities by (1+WACC). Consequently, to avoid any double counting, the 'network CAPEX working capital' is already covered by the annuity formula.

6.10 For other costs (mainly network OPEX and corporate overheads), there can also be a period of time between staff/suppliers being paid and revenues (wholesale and retail) being earned. Two situations can thus be anticipated:

- Staff/suppliers are paid before revenues are earned: the working capital is negative and the company incurs a cost;
- Staff/suppliers are paid after revenues are earned: the working capital is positive and the company earns a profit.

6.11 Most of the time, staff/suppliers are paid at the end of the month whereas revenues are received at the beginning of the month. As a consequence, network OPEX and corporate overhead working capital is considered to be positive or at least not material. The OUR is therefore of the preliminary view that it is reasonable not to take it into account. This is consistent with the approach used by other regulators[34]. However, if operators believe this is material and are able to provide detailed information about working capital (time at which suppliers are paid, time at which staff is paid, time at which wholesale and retail revenues are earned, etc.) then the OUR will take this into consideration in the model.

Question 8: Do you agree with the approach proposed for asset lives, and working capital? If not, please explain your views and reasoning.

[34] See ComReg – Decision 0939 . *"ComReg also considered a number of models built by other countries and whether working capital was included in them, where publicly available documentation was available in this regard. It was noted that in December 2008 the Australian Competition and Consumer Commission published details on its access and core model which did not include working capital. In France, ARCEP, has consistently excluded the inclusion of working capital unless its calculation was audited. PTS (Sweden) in its 2006 publication of "Hybrid Model User Guide" refers to a calculation for working capital, but states that "based on empirical evidence from the Top-Down model the cost of working capital has been set to zero."*

Weighted Average Cost of Capital

6.12 In August 2011 the OUR published its final Determination (TEL2009005_DET001_RCN001) on the level of Weighted Average Cost of Capital to be used by telecommunications carriers. The OUR will use these figures and this approach for the cost modelling.

Chapter 7: Network Details

7.0 The following lists the main characteristics of the generic network that will be modelled. This is based on preliminary discussions with operators:

- The radio technology will be a combination of 2G and 3G. Both operators (LIME and Digicel) have deployed 2G and with the merger between Claro and Digicel, both operators will have 3G;

- The number of base stations will be the average of Digicel and LIME. Digicel and LIME have a similar number of base stations. In the context of the scorched node approach being used (see Chapter 4: Type of Model), this number of base stations will be used as a starting point;

- The frequency allocations of Digicel and LIME are similar, therefore an average frequency allocation can be used;

- 40% of base stations will be shared between operators. This is around twice the current figure but the current level of sharing seems to be unusually low and the Government in its ICT Policy plans to introduce measures to promote sharing. As a consequence, the value of 40% is more forward looking;

- The number of switches will be the average of that of Digicel and LIME;

- The backhaul and the core network will use an equal combination of microwave links and fibre transmission based on usage of operators;

- Equipment costs will be the average of recent prices paid by Digicel and LIME, or if such information is not available data from the models of other regulators will be used, some of which may be confidential. The OUR is aware that suppliers winning a contract with an operator may decide to price higher CAPEX or lower OPEX or the opposite which makes comparison between operators difficult. As a consequence, the OUR will be careful in using price information.

- Other networks will be connected directly to the switches (not via a fixed network);

- There will be no sharing with fixed communications because the development of fixed activities in Jamaica is limited.

7.1 Detailed information will be requested from the operators and will be based on their costs. Engineering rules used by operators will be modelled.

7.2 Since a generic model will be used, the OUR does not plan to take into account the costs of the merger of the Digicel and Claro networks.

Question 9: Do you agree with the proposed characteristics of the generic network? If not, please explain your views and reasoning and propose alternatives.

7.3 There are two approaches to develop a Bottom-Up model and dimension the modelled network:

- The first approach determines the dimensioning of the network and the number of assets required for a given year without taking into account what was previously built. This approach re-dimensions the network every year independently from historic investments. This does not mean that, when dimensioning the network, this approach does not take into account future traffics. Under this approach, the results of the model can also be interpreted as efficiency targets achievable in the mid-term. This approach is called here 'yearly approach'.

- The second approach relies on what was built in the previous years to estimate what should be built for the coming years. It takes into account the installed asset base. This method closely reflects the history of the deployments, corrected for potential inefficiencies. Contrary to the yearly approach, it is a lot more complex to implement and depends heavily on the availability and accuracy of extensive detailed historical data.

7.4 A numerical example of the two approaches is provided in Annex 6: Yearly and Historical Approach for Bottom-Up Models.

7.5 The OUR is of the view that the 'yearly' approach should be preferred for the following reasons:

- From a practical point of view, the 'yearly approach' requires much less information than the 'historical approach'. Indeed the 'yearly

approach' only requires information (on traffic, engineering rules, and prices) from years 2011, 2012 and future years while 'historical approach' would require information (on traffic, engineering rules, and prices) from the moment the networks of Digicel and LIME were built;

- Because a scorched node approach is proposed to be followed, the required number of assets calculated in the 'yearly approach' should be very similar to the number of assets calculated in the 'historical approach';

- When volumes of traffic are growing (which is the case for voice and data in aggregate in the Jamaican market), the number of assets calculated in both approaches for the coming years is the same because more assets are always required (this means that the assets that were deployed in the past are still necessary). This is exemplified in Annex 6: Yearly and Historical Approach for Bottom-Up Models.

- These two approaches give the same results when economic depreciation (such as adjusted tilted annuities) is used as opposed to accounting depreciation (such as straight line depreciation). This is shown in Annex 6: Yearly and Historical Approach for Bottom-Up Models.

Question 10: Do you agree with the proposal to adopt the 'yearly approach' to dimension the network? If not, please explain your views and reasoning and propose alternatives.

Chapter 8: Glide Paths, Price Gradients and Charging Basis

8.0 Models calculate unit costs of services. These unit costs can then be used to set regulated rates.

8.1 The cost model will probably estimate rates that are different from the rates currently used by the operators. In some other countries, where a large change to termination rates would occur if the results of modelling were applied immediately, the regulator sets a "glide path" for a sequence of changes to bring the wholesale termination rates to the level of costs[35].

8.2 The OUR does not intend to use the glide path approach but will set a single date for rates to be changed to the cost based level. The OUR considers that the current regime, with its advantage to larger operators and cross subsidy from fixed networks, has remained in place too long and that it should be changed to cost oriented rates as soon as possible.

8.3 The OUR intends to set rates for five (5) years (2012 to 2017) but will amend the regulated prices in case significant changes in the parameters or structure of the models needs to be reflected.

Question 11: Do you agree with the proposal not to use a glide path to introduce changes for wholesale call termination rates? If not, please explain your views and reasoning and propose alternatives.

8.4 Some operators use price gradients where higher prices are charged at peak times and lower prices at off-peak times. These differences exist in the current retail rates although the differences between peak and off-peak are not great. Where there are gradients in the retail prices, it is desirable that there should be similar gradients in the wholesale prices to avoid creating opportunities for arbitrage.

8.5 The OUR proposes to allow the operators to agree mutually to use gradients in the wholesale call termination rates, provided that the traffic weighted average rate is within the limit set by the OUR.

[35] See Annex 7: Glide Path and Pure LRIC Approach in France and United Kingdom for example of glide path

Question 12: Do you agree with the proposal to allow peak/off-peak price gradients for wholesale call termination rates? If not, please explain your views and reasoning and propose alternatives.

8.6 The charging basis for current wholesale call termination rates is a price per second. However, there are alternatives to this charging basis: wholesale call termination could be charged both on a price per call and on a price per minute basis for example.

8.7 Section 33(1) of the Act states for example;

> *"(c) costs that do not vary with usage shall be recovered through flat charges and costs that vary with usage shall be recovered through charges that are based on usage;"*

8.8 This means that additional charging bases could be envisaged where the MTR is split between a fixed charge per call and a call duration charge. However, the OUR is of the view that it would be a significant change compared to the current practice that would not bring any benefits. According to the OUR's knowledge, this practice is not widespread for mobile termination rates. OUR notes finally that it is not very clear in a mobile network whether there are costs that vary with the number of calls and costs that vary with the number of minutes which would make the change in the charging basis very subjective.

8.9 It is to be noted that, even if the output of the cost model will be a MTR expressed in JMD/minute, the charging basis will be on a per second basis. This is indeed the current charging basis and such a charging basis, compared to a per minute charging basis, enables operators to pay for what they really use (e.g. if a call lasts 30 seconds, one operator will pay for 30 seconds to the other operator for termination services and not for one minute).

Question 13: Do you agree with the proposal to calculate wholesale mobile call termination on a per second basis? If not, please explain your views and reasoning and propose alternatives.

Annex 1: Approaches to Cost Orientation:

In Chapter 3, we described that there are three different approaches to cost orientation. Companies face different types of costs that, depending on the cost orientation approach chosen, may be included or excluded from the cost stack taken into account.

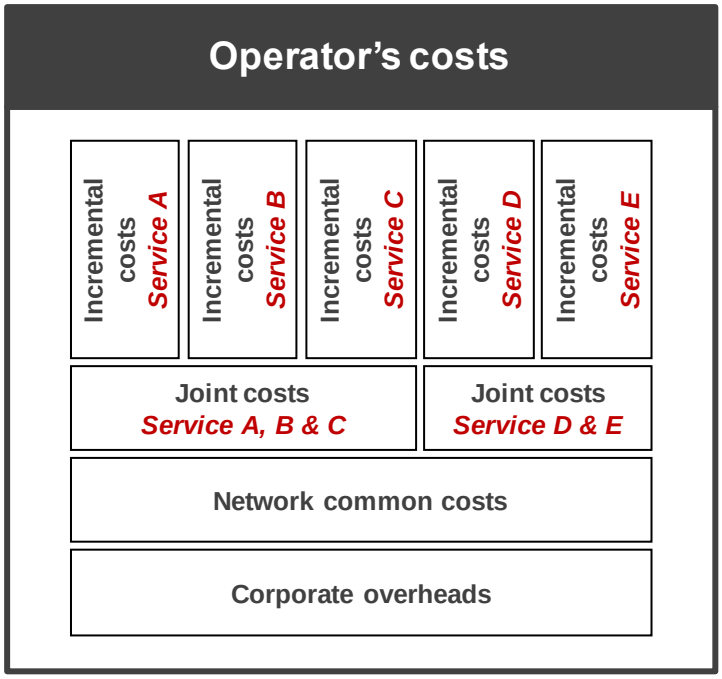

Figure A1: Overview of the Different Costs Faced by an Operator Providing Several Services

- **Incremental costs:** these are costs that are incurred when producing a given service and that would cease to exist in case production of this service was stopped. In mobile networks, for example, the SMS server cost is an incremental cost to the SMS service. For example, if mobile Internet was not offered anymore, maybe less base stations would be necessary. The cost of these base stations that would not be necessary anymore is the incremental cost of mobile Internet (even if these base stations can also be used for voice). Incremental costs can be fixed and variable.

- **Joint costs:** these are costs that are incurred by a set of services. In mobile networks, for example, the Home Location Register (HLR) is used both for on-net calls and for mobile termination and is therefore a joint cost to both the on-net voice service and the mobile voice termination service.

- **Network common costs:** these are network costs used by all services. This is the case for backhaul in mobile networks or for trenches in fixed networks.

- **Corporate overheads**: these are costs that cannot be attributed in a non-arbitrary way (non-attributable costs), such as the costs associated with the Chief Executive, or the costs of operating a car fleet. It is to be noted that some overhead costs could be variable to the traffic and therefore be included in the incremental costs.

Depending on the approach chosen, different types of cost categories will be considered:

- **The Stand Alone Cost (SAC):** Using the SAC approach is equivalent to considering an entire operator running a network that is providing solely the considered service (in this example Service A). This approach generally leads to the highest costs to be taken into consideration as no economies can be realized through the provision of another type of service.

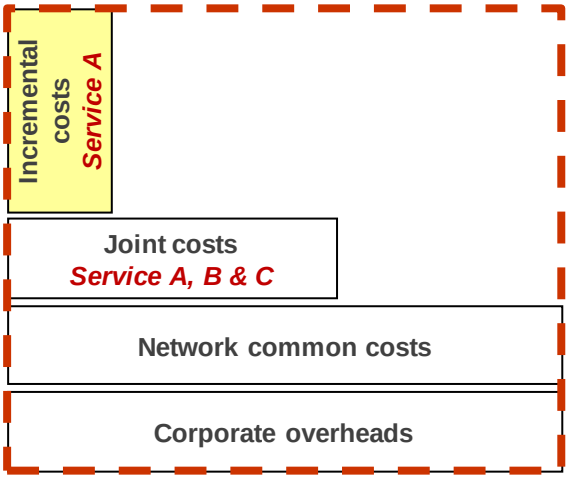

Figure A2: Cost Categories Taken into Account Using SAC Approach

- **The Total Long Run Incremental Costs (TLRIC):** With this approach joint, common and corporate overhead costs are shared on an equitable basis between all the services that are provided. Costs are calculated in the "Long Run" because in the long run all costs (including capital investments) are assumed to be variable. In other words "Long Run" means that fixed and variable costs are included. The concept of "Increment" is similar to the concept of marginal costs. While the term

marginal refers to the last unit of an output being considered (e.g. one minute of wholesale voice call termination), an increment can be thought as a finite quantity of a particular output (e.g. the wholesale voice call termination in total). There are several ways to define the increment. However the term "Total" means that the increment is the full mobile network (as it was considered by OUR in its previous consultation document on "*Principles of Long-run Incremental Cost Model for the Jamaican Telecommunications Market*"). The 'increment' is therefore composed of all services which contribute to the traffic economies of scale in the network (e.g. mobile traffic on a mobile network). With such a large increment, incremental network common costs of all traffic will be taken into account. The cost of each individual service is then derived according to the cost allocation rule used. This approach shares the economies of scale benefits among all services.

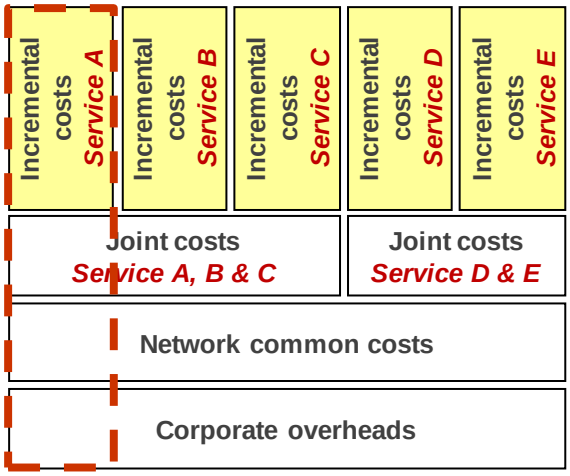

Figure A3: Cost Categories Taken into Account Using TLRIC Approach

- **The Pure Long Run Incremental Cost (Pure LRIC):** this approach considers the increment to be the traffic created by a single service (e.g. wholesale voice call termination) (service A in the Figure A4). As a consequence, the associated incremental cost is the cost avoided when service A is not produced. This cost is the difference between the total cost for producing all services and the total cost of producing all services with the exception of service A. Under this approach, service A benefits to a great extent from economies of scale as neither network joint/common costs nor corporate overheads are taken into account in so far as they are not incremental to the service increment considered. In other words, if all services were priced based on a pure LRIC approach, network common costs and corporate overheads would not be recovered. As a

consequence, these common costs have to be allocated to other services than those being priced with a pure LRIC approach.

Figure A4: Cost Categories Taken into Account Using Pure LRIC Approach

From a practical point of view, a Bottom-Up cost model can produce cost estimates in accordance with all three approaches: SAC, TLRIC and pure LRIC approaches, which is much more difficult or impossible with a Top-Down model.

Annex 2: Top-Down Models

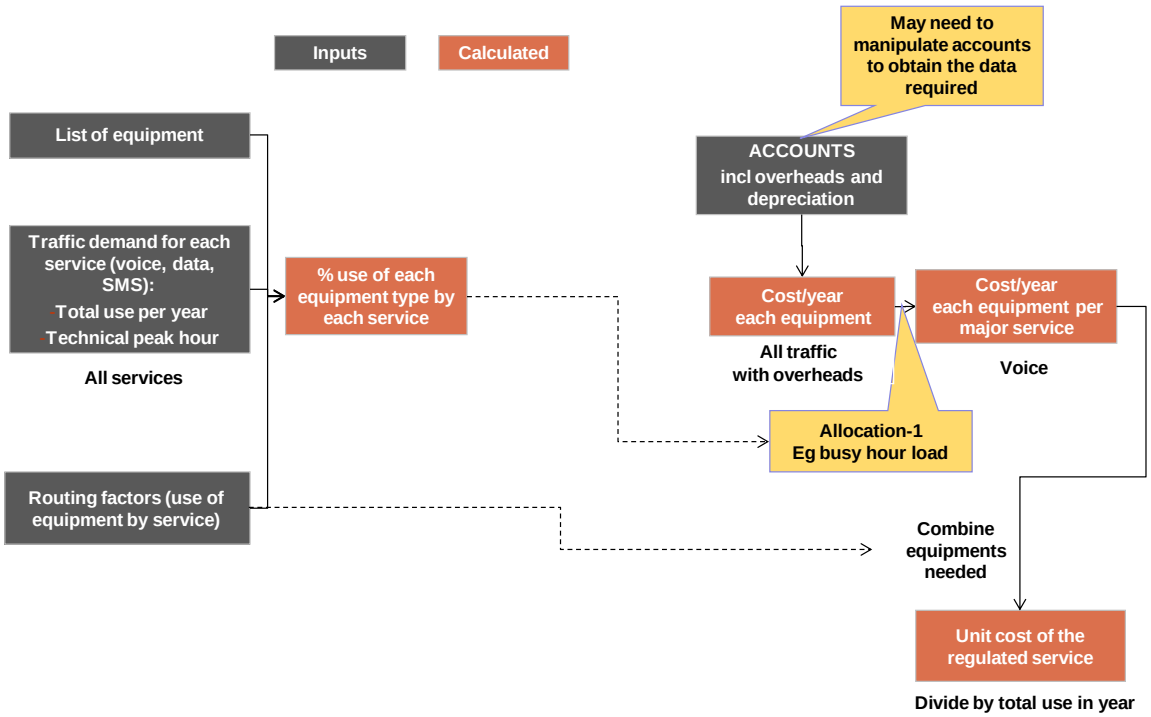

Figure A5: Calculation Flow for a Top-Down Model Top-Down Model

The Top-Down model uses traffic information, equipment list, and routing factors but does not use information on node location. The traffic information, equipment list and routing factors are used to calculate the percentage use of each type of equipment based on busy hour traffic. It is not necessary to calculate the numbers of each equipment type and therefore the engineering dimensioning rules are not needed because the Top-Down model includes the costs and the number of assets already deployed by operators.

The information from the accounts is then manipulated to provide the total cost per year of each type of equipment.

The calculations of the percentage use of each type of equipment are then used to apportion the costs per year to the different services. This share is then divided by the total number of minutes supported by each type of equipment. The unit cost (per minute) of the different types of equipment are then aggregated for

all equipment using the routing factors to calculate the unit cost of the wholesale call termination service.

It is not possible (or very difficult) to use Shapley Shubik allocations in a Top-Down model because the costs are not linked to the traffic volumes. The cost information is available only for the observed traffic volume.

Annex 3: Bottom-Up Models

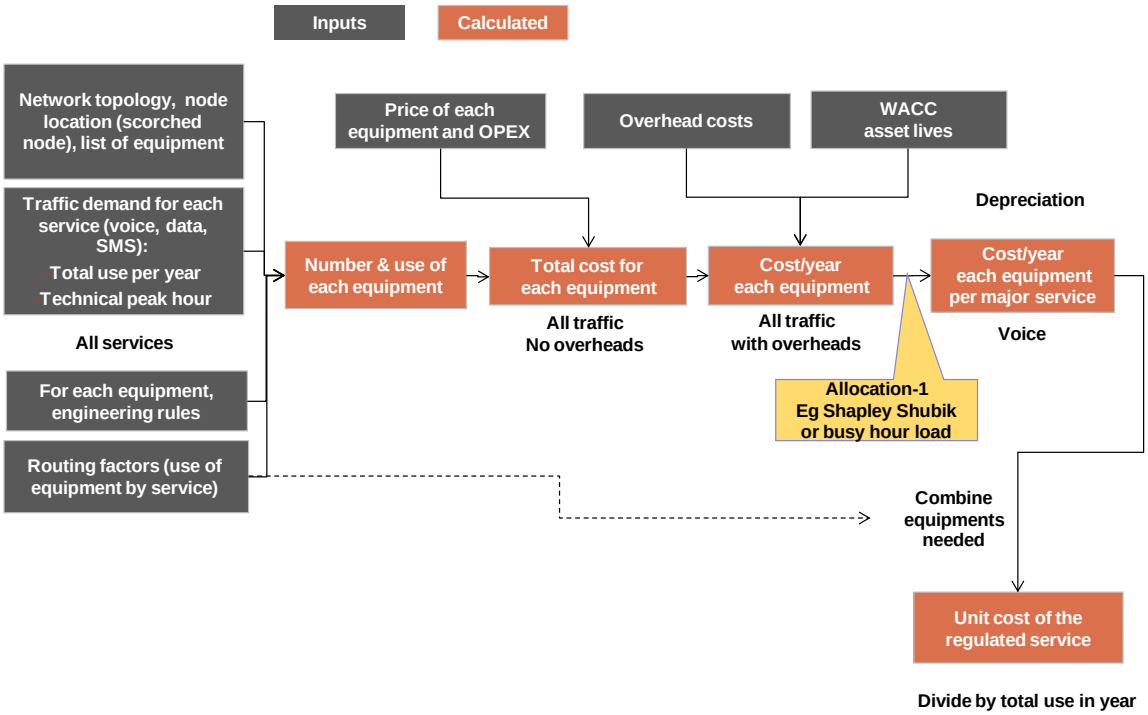

Figure A6: Calculation Flow for a Bottom-Up Model

The network design is based on the scorched node approach where the nodes are sited at the location of the nodes of a real operator.

Traffic demand is estimated each year for each type of service for the duration of the model, both as total use per year and as busy hour usage.

Equipment types are listed and their associated engineering dimensioning rules established based on discussions with operators.

Routing factors are specified for each type of service. The routing factor specifies the number of each type of equipment used by each service. For example, wholesale mobile call termination may use on average (purely for illustrative purposes):

- 1.0 interconnection transmission links;

- 1.8 mobile switches;
- 0.8 one inter-switch transmission link;
- 0.7 switch to base station controller transmission links (less than one if some equipment are located at the same site);
- 1 base station controller;
- 0.95 switch to base station controller to base station transmission links (less than one if some equipment are located at the same site);
- 1 base station (Tx/Rx).

This information is used to calculate the number of each type of equipment in order to handle the traffic volume.

The capital cost and opex costs of each type of equipment are then used to calculate the total cost of each type of equipment.

Overheads are added, and the capital is amortised over the asset life of each type of equipment with the cost of capital being factored in.

These calculations produce the total cost per year for each equipment for the total traffic volume.

The costs for each equipment are then allocated using 'required capacity' (or Shapley Shubik) to each major service type (voice, SMS, Internet).

This cost for each equipment allocated to each service is then divided by the annual traffic volume to produce the unit cost for each equipment (for example, cost of base station allocated to voice per minute).

The unit costs of each equipment are then multiplied by the routing factors and aggregated to give the total cost of the wholesale call termination service (because wholesale call termination does not have the same routing factors as other voice services).

With Shapley Shubik, it is necessary to calculate the cost of each service as a separate increment. The Bottom-Up model can be used to do this by setting the traffic volume for the service in question to zero and calculating the total cost of the network, then adding the traffic for the service in question and recalculating the increased cost of the network. The incremental costs of the different services

for the different order of arrivals of the services are used to calculate the relevant allocation key (see Annex 4: Shapley Shubik).

Annex 4:Shapley Shubik

The purpose of this part is to describe the cost allocation method known as the Shapley Shubik method.

The Shapley-Shubik allocation approach consists of setting the cost of a service equal to the average of the incremental costs of the service after reviewing every possible order of arrival of the increment.

For a given order of arrival, one calculates the incremental cost for each service. In the case of two services, if service 1 arrives before service 2, they support respectively:

$$C_1(q_1) \text{ and } \left[C_T(Q) - C_2(q_2)\right]$$

In the case of two services, the Shapley values (x1, x2) which give the percentage of total cost to be allocated are calculated as follows:

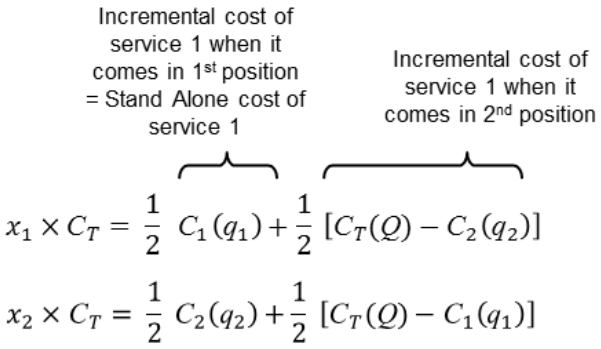

Figure A7 – Calculation of Allocation Keys with the Shapley Shubik Approach

Where x1 and x2 are the Shapley values (i.e. allocation keys)
q1is the quantity of traffic for service 1
q2 is the quantity of traffic for service 2
Q is the total quantity of traffic supported by the network (Q= q1+q2)
C_T is the total cost of the network
C_1 is the cost of the network when only service 1 is provided
C_2 is the cost of the network when only service 2 is provided

Shapley allocation guarantees an allocation for each service that is lower than its stand alone costs and higher than its pure incremental costs. Each service has incentives to collaborate and the coalition has incentives to accept each service.

As an illustration, please consider the following example:

For the 2-service network used in the reference example, 2 sequential entry scenarios are possible: voice comes first or data comes first.

Scenario 1	Scenario 2
1st investment VOICE 75 2nd investment DATA 25	1st investment DATA 80 2nd investment VOICE 20

Figure A8 – Example of Incremental Costs for Different Order of arrivals

Total cost of the network is 100 in both cases.
The cost allocation is estimated regarding the costs of each service increment in all possible entry scenarios:

	Voice	Data	Total
Scenario 1	75	25	100
Scenario 2	20	80	100
	=	=	=
Sum	95	105	200
%	*47.5 %*	*52.5 %*	*100%*

Figure A9 – Example of Allocation Key Calculated with Shapley-Shubik

Annex 5: Tilted Annuities

Economic depreciation is "*defined simply as the period-by-period change in the market value of an asset. The market value of an asset is equal to the present value of the income that the asset is expected to generate over the remainder of its useful life*"[36]. Economic depreciation therefore allocates an investment over several years by making annuities evolve with expected incomes generated by the asset over the life of the asset. In other words, for an asset that generates low revenues at the beginning of its life and high revenues at the end of its life, all things remaining equal, the economic depreciation will calculate low annuities at the beginning and higher annuities at the end of its life (the discounted sum of annuities being equal to the investment of the asset).

This is very different from the concepts of accounting depreciation (such as Historical Cost Accounting, Current Cost Accounting) which allocates investments over the life of the asset in a systematic manner without considering the market value of the asset.

In practice, economic depreciation can sometimes be difficult to calculate since it requires forecasting future demand, future operating costs, future asset prices, etc. Approximations of economic depreciation are often used. There are three methods usually used:

- standard annuity method,
- tilted annuity method
- adjusted tilted annuity method.

In any case, the sum of discounted annuities over the asset's useful life recovers the initial investment, which ensures on the one hand that costs are not over-recovered and that an investor will not be dis-incentivised to invest in the asset. The following formula is verified:

$$I = \sum_{i=1}^{n} \frac{A_i}{(1+\omega)^i}$$

[36] Source: Economic Depreciation in Telecommunications Cost Models, Alexis Hardin, Henry Ergas and John Small, A paper prepared for 1999 Industry Economics Conference Regulation, Competition and Industry Structure 12-13 July, Hotel Ibis, Melbourne

where I = Initial investment

A_i = Annuity (sum of depreciation and cost of capital)

ω = WACC

Standard Annuity Method

The first method is the standard annuity method which is appropriate when asset prices and volumes of outputs of this asset are stable. The standard annuity approach consists of calculating an annual charge A called annuity, which is identical every year and which respects the following equation:

$$I = \frac{A}{(1+\omega)} + \frac{A}{(1+\omega)^2} + \ldots + \frac{A}{(1+\omega)^n}$$

Then, A can be written as follows:

$$A = I \times \frac{\omega}{1 - \left(\frac{1}{1+\omega}\right)^n}$$

The standard annuity method is, for example, the one used by banks to calculate annuities paid by households or businesses which require a loan at a given interest rate to realise an investment. Standard annuities (sometimes called flat annuities) do not take into account changes in the asset price. They do not reflect the market evolution of the asset value and therefore cannot be considered as approximations of economic depreciation.

The Tilted Annuity:

The tilted annuity formula is probably the most widespread one used for regulatory purposes.

In the event that asset prices are expected to change over the life of the asset - which is the case in telecommunications - a tilt can be applied to the standard annuity formula to ensure that annuity (i.e. the annual charge related to an investment) in any period is equal to annuity that a new entrant would seek, having purchased a new asset.

This tilt is used to mimic the asset price path that is expected for the asset in the market. As a consequence, contrary to the standard annuity, the annuity in year Y is equal to the annuity in year Y-1, taking into account asset price changes between year Y-1 and year Y. The annuity A1 of the first year verifies the following equation:

$$I = \frac{A_1}{(1+\omega)} + \frac{A_1 \times (1+p)}{(1+\omega)^2} + \ldots + \frac{A_1 \times (1+p)^{n-1}}{(1+\omega)^n}$$

Which is the same as:

$$I = \frac{A_1}{(1+\omega)}\left[1 + \frac{(1+p)}{(1+\omega)} + \ldots + \frac{(1+p)^{n-1}}{(1+\omega)^{n-1}}\right]$$

With p being the tilt, which represents the long term price trend observed or expected for this asset

Then, annuities can be written as follows[37]:

$$A_t = I \times \frac{(\omega - p)(1+p)^t}{1 - \left(\frac{1+p}{1+\omega}\right)^n}$$

Compared to standard annuities, the recovery of costs is accelerated with a tilted annuity when asset prices decrease (and is deferred when asset prices increase). As an example: if an asset price increases by say 5% per annum, annuities will also increase by 5% per annum, as illustrated in the figure below. The following figures show how annuities for the standard annuity formula and for the tilted annuity formula evolve for an asset A requiring an investment I = 1,000 with a useful life T = 10 years and WACC of 10%.

[37] This formula can be modified to factor the cost of working capital

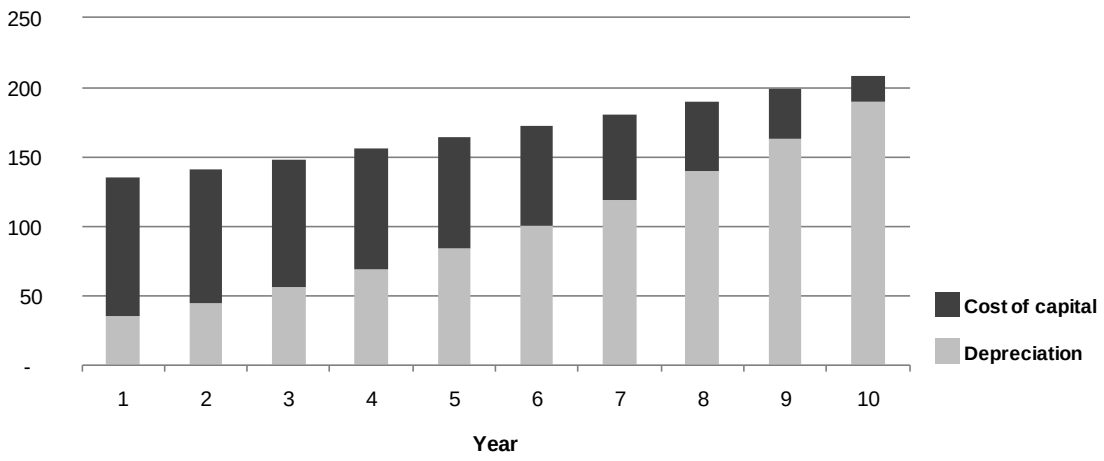

Figure A10 – Evolution of Annuities Under the Tilted Annuity Approach when Asset Prices are Raising by 5%

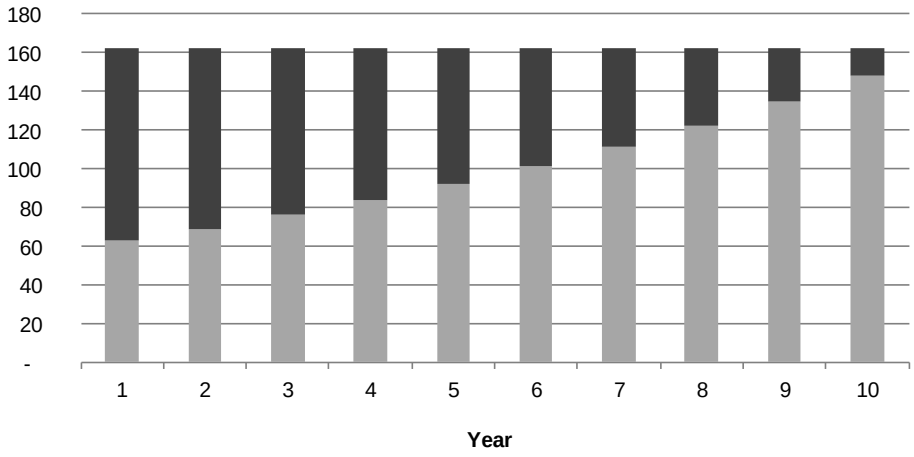

Figure A11 - Evolution of Annuities Under the Standard Annuity Approach

While providing stable annuities over the asset life, the standard annuity formula generates discontinuities when asset needs to be renewed and asset prices are moving, which is not the case of tilted annuities as shown in figures A12 and A13 below.

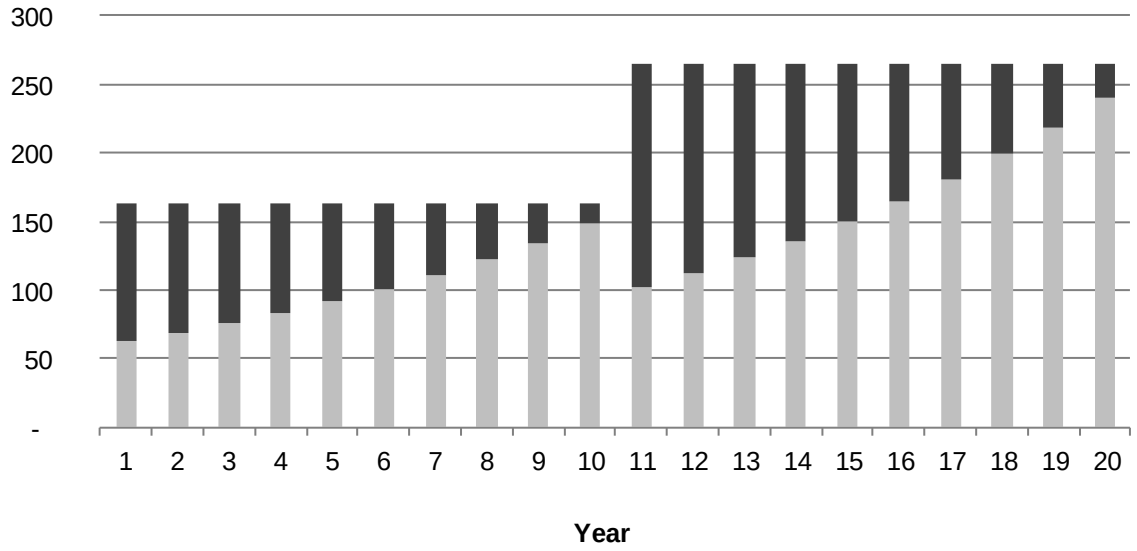

Figure A12 - Evolution of Annuities Under the Standard Annuity Approach when the Asset Needs to be Renewed After 10 Years and Asset Prices are Increasing by 5% Per Annum

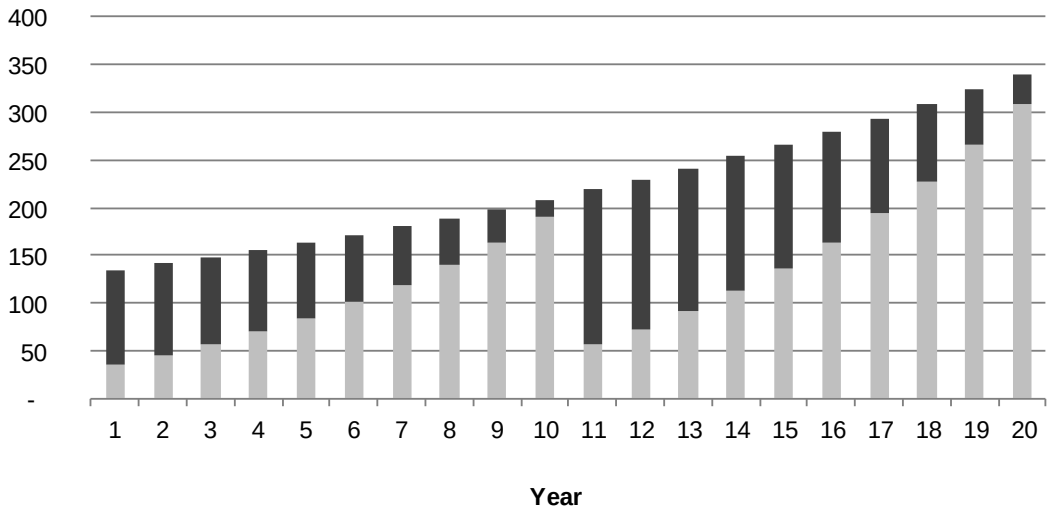

Figure A13 - Evolution of Annuities Under the Tilted Annuity Approach when the Asset Needs to be Renewed After 10 Years And Asset Prices are Increasing by 5% Per Annum

The tilted annuity formula sends appropriate 'build or buy' signals to market players. It ensures stability in the evolution of annuities. Also, two competitors entering the market at different times but acquiring access to the same assets will face the same annuities. This is a key advantage of tilted annuities over accounting depreciation (HCA, CCA) or standard annuities in the context of price regulation.

If the number of outputs produced by an asset is stable, then the tilted annuity is a good approximation for economic depreciation. However, the tilted annuity may not be a good proxy for economic depreciation when the level of outputs produced by an asset is not stable, which is not always the case in telecommunications. For example, in mobile Internet, data traffic tends to increase fast. In such a case, the annuities divided by the number of outputs (for example the number of minutes or the number of Mbytes) will decrease significantly and will not be stable.

It is possible to modify the tilted annuity formula to compute annuities that take into account the evolution of the number of outputs produced by assets. This is referred to as an adjusted tilted annuity or Discounted Cash Flow (DCF) approach or Net Present Value (NPV) approach. By accounting for changes in the number of outputs produced, annuities reflect changes in the market value of the asset, which corresponds to the definition of economic depreciation. With such an adjusted tilted annuity, the annuity per output remains stable and follows the evolution of asset prices.
Let I be the investment, C the constant unit cost, p the tilt (price trend of asset) and Ni the number of outputs sold in year i. The investment can be computed as follows:

$$I = \sum_{i=1}^{n} \frac{C \times (1+p)^{i-1} \times N_i}{(1+\omega)^i}$$

The result of such a formula is that the value C which is the unit cost of the service (cost per minute for example) evolves with asset prices. The following figure describes the results of the adjusted tilted annuity for an asset producing volume of outputs that evolve with a logistic curve.

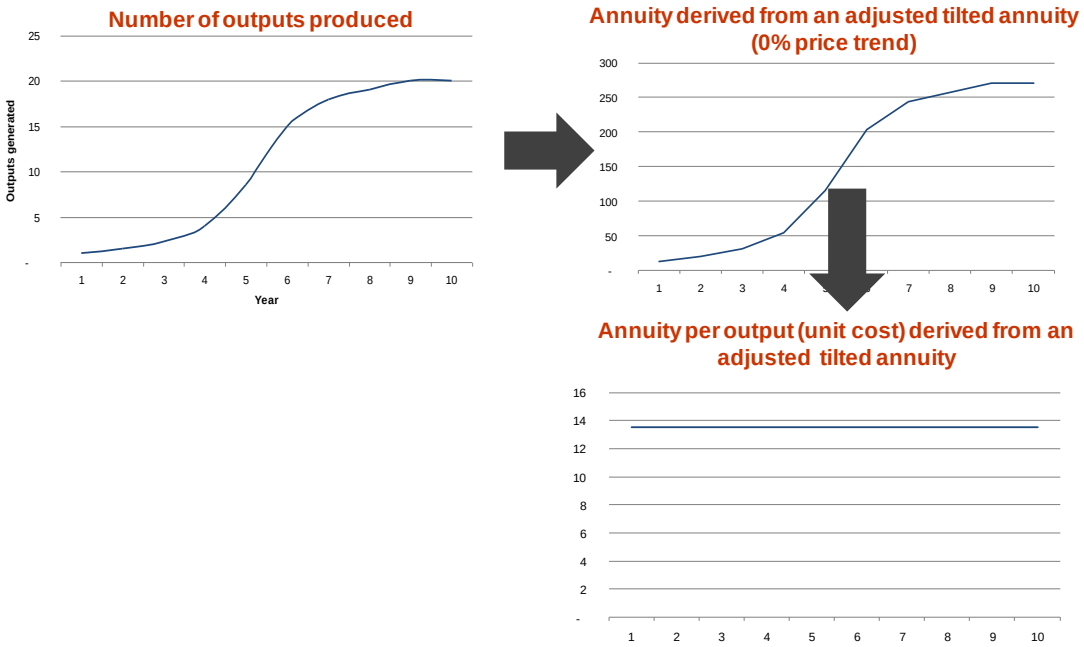

Figure A14 - Evolution of Annuities Under the Adjusted Tilted Annuity Approach when the Volume Outputs Produced by the Asset Evolve with a Logistic Curve

Adjusted tilted annuity tends to give better economic signals than other depreciation methods when the number of outputs produced by an asset is not stable, which is often the case in mobile networks.

Annex 6: Yearly and Historical Approach for Bottom-Up Models

The “yearly” and “historical” approaches are two different approaches to dimensioning a network for a given service and/or traffic demand in Bottom-Up models. The two methods have different views to annual investment as explained below.

1. **Yearly approach**: this way of modelling estimates the number of assets for each year for a given year without taking into account what was built previously. It can however take into account a traffic growth forecast e.g. optimise year 2008 with traffic forecast of three years, until 2011 (if this reflects current engineering rules).

   Besides serving as a signal from the regulator to operators, this represents a short to mid-term achievable target. In the long term, when assets need to be renewed because they are too old, the efficient cost incurred by operators is close to the cost obtained with the yearly approach.

2. **Historical approach**: this approach relies on what was built before to estimate what should be built for the coming years e.g. optimise year 2008 taking into account the accumulated demand from the previous years. Like the yearly approach, it can take into account a traffic growth forecast e.g. optimise year 2008 with traffic forecast of three years, until 2011 (if this reflects current engineering rules)

   This method closely reflects the history of the deployments, in an efficient manner and is therefore usually used to set the tariff at the calculated cost (no negotiation).

Nevertheless, in cases where service and/or traffic demand is increasing each year, these two approaches give the same results when economic depreciation (such as tilted annuities) is preferred to accounting depreciation. When the number of equipment required is equal or lower than that of the previous year, tilted annuities differ between the two dimensioning approaches. An example is used to illustrate these points.

The example below tries to calculate the annual cost of a given asset with the an economic depreciation approach (tilted annuity).

It should be noted that the example is for illustrative purposes but that the conclusions would remain the same with the vast majority of assets in telecommunications networks.

The example below analyses tilted annuity calculations of investment in mobile transceivers (TRX) needed for a 5-year project. Each TRX can support up to 8 connections. The number of connections is given such as it is increasing every year between year 1 and year 4 inclusive. In year 5, the number of connection lowers, the number of transceivers therefore decreases.

Calculations show that annuities (see table below) are the same for both types of network dimensioning methods every year between year 1 and year 4 inclusive. The annuity of year 5 for the second approach, the historical approach, is higher than that for the yearly approach since the latter takes into account the connection change and lowers the investment required for that year, whereas the historical approach considers that the investment stays the same as the previous year. Therefore, unit costs will be the same for the two approaches except for year 5 where they will be different, i.e. when traffic decreases.

Table 1 - Investment and annuities using a tilted annuity formula

Traffic simulation						
Year		1	2	3	4	5
No. Connections		5	14	28	35	28
No. TRX needed		1	2	4	5	4
Financial terms						
Asset life (years)		10				
Cost of each TRX (€)		100				
WACC		10%				
Price change		5%				
Yearly dimensioning - Tilted annuity						
Year		1	2	3	4	5
Investment		100	210	441	579	486
Tilted Annuity		13,4	28,2	59,3	77,8	65,4
Historical dimensioning - Tilted annuity						
Year		1	2	3	4	5
Equipments for year 1	Investment	100				
	Tilted Annuity	13,4	14,1	14,8	15,6	16,3
Equipments	Investment		105,0			

for year 2	Tilted Annuity		14,1	14,8	15,6	16,3
Equipments	Investment			220,5		
for year 3	Tilted Annuity			29,6	31,1	32,7
Equipments	Investment				115,8	
for year 4	Tilted Annuity				15,6	16,3
Equipments	Investment					0
for year 5	Tilted Annuity					0
Tilted Annuity		13,4	28,2	59,3	77,8	81,7

Figure A15 - Investment and Annuities Using a Tilted Annuity Formula

Annex 7: Glide Path and Pure LRIC Approach in France and United Kingdom

Figure A16 shows the changes in rates required by ARCEP the French regulator.

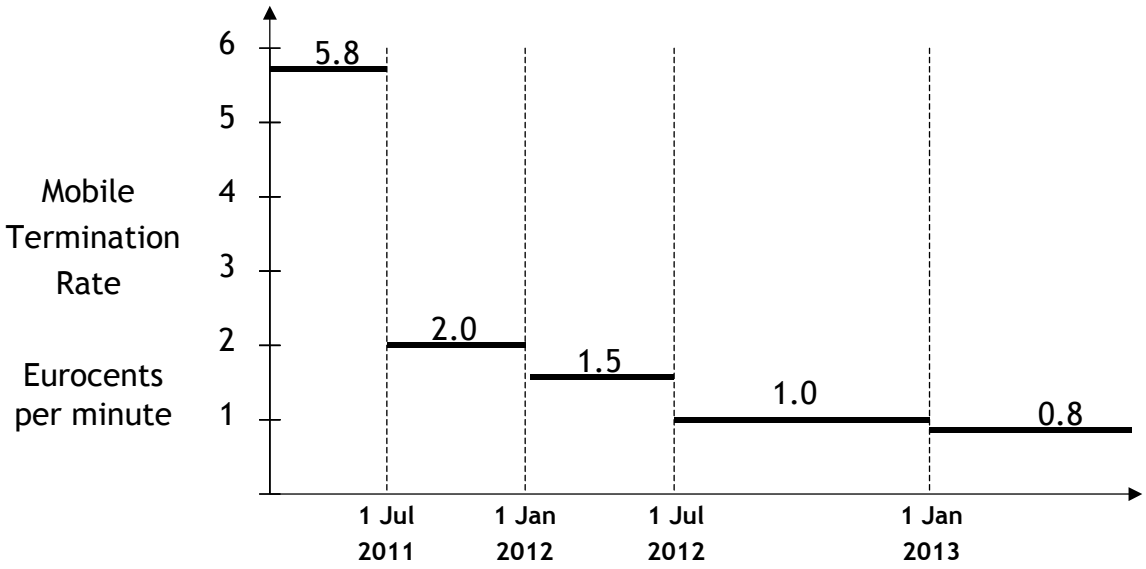

Figure A16: ARCEP (France) Mobile Termination Rate Limits

Figure A17 shows the changes in rates required by OFCOM the UK regulator.

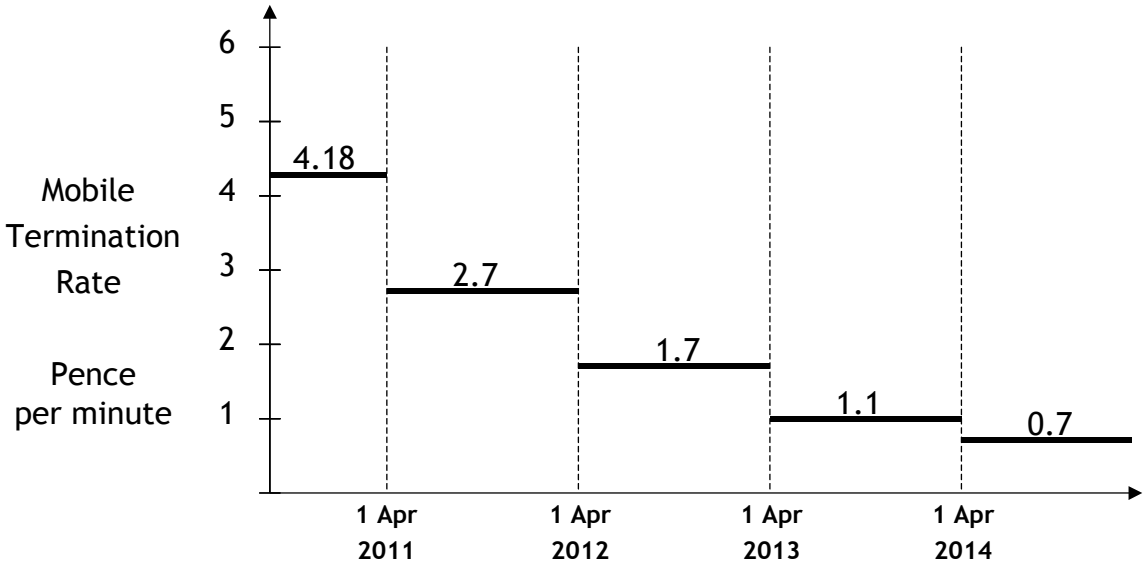

Figure A17: OFCOM (UK) Mobile Termination rate limits

List of questions

Question 1 (page 22): Do you agree with the overall approach that the OUR proposes to take? If not, please explain your views and reasoning.

Question 2 (page 28): Do you agree with the proposal to use a single Bottom-Up model based on an average scorched node topology? If not, please explain your views and reasoning.

Question 3 (page 29): Do you agree with the proposal to set symmetrical rates for wholesale mobile call termination? If not, please explain your views and reasoning.

Question 4 (page 30): Do you agree with the proposal to use traffic levels corresponding to 70% of the total market and to set symmetrical rates? If not, please explain your views and reasoning.

Question 5 (page 33): Do you agree with the proposal to use the 'required capacity' method as the method of allocating common costs between the different service types of Voice, SMS and internet access, but then to use the busy hour traffic volumes to allocate costs between different call types? If not, please explain your views and reasoning.

Question 6 (page 34): Do you agree with the proposal to allocate overheads according to Equal Proportionate Mark-Up? If not, please explain your views and reasoning.

Question 7 (page 36): Do you agree that adjusted tilted annuities should be used? If not, please explain your views and reasoning.

Question 8 (page 38): Do you agree with the approach proposed for asset lives, and working capital? If not, please explain your views and reasoning.

Question 9 (page 41): Do you agree with the proposed characteristics of the generic network? If not, please explain your views and reasoning and propose alternatives.

Question 10 (page 42): Do you agree with the proposal to adopt the 'yearly approach' to dimension the network? If not, please explain your views and reasoning and propose alternatives.

Question 11 (page 43): Do you agree with the proposal not to use a glide path to introduce changes for wholesale call termination rates? If not, please explain your views and reasoning and propose alternatives.

Question 12 (page 44): Do you agree with the proposal to allow peak/off-peak price gradients for wholesale call termination rates? If not, please explain your views and reasoning and propose alternatives.

Question 13 (page 44): Do you agree with the proposal to charge wholesale mobile call termination on a per minute basis only? If not, please explain your views and reasoning and propose alternatives.