Appropriateness of the TSLRIC definition

Schedule 3 Investigation in the regulation of mobile termination

A report prepared by Marsden Jacob Associates
for TelstraClear

Final: 19 November 2004

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1. Introduction

1. TelstraClear has requested that Marsden Jacob Associates (MJA) respond to two of the questions raised by the Commerce Commission (hereafter the 'Commission') in the Schedule 3 Investigation into the regulation of mobile termination. These two questions are:

   - 7.2(c) Are there any other ways in which TSLRIC needs to be specified more tightly than the existing definition in Part 1 of Schedule 1?
   - 7.2(d) If so, what is the justification and exactly how should the final pricing principle be amended to take them into account?

2. As such our report only considers the specific issues related to the specification of TSLRIC and does not address the separate issue of including any mark-ups (e.g. for network externalities) in addition to those that may be defined as common costs to TSLRIC.

3. The comments and opinions expressed in this paper are those of MJA and do not necessarily reflect those of TelstraClear. No part of this submission is confidential and MJA has no objection to it being made publicly available.

1.1. Specification of TSLRIC

4. A price based on TSLRIC (including a mark-up for forward-looking common costs) approximately mirrors the price that would prevail in a competitive market and sends the right build/buy signals to new entrants. Furthermore, it allows efficient incumbent operators to recover their forward-looking costs, providing the correct incentives to upgrade the network without over-compensating at the expense of new operators. As such the TSLRIC concept is equally appropriate for fixed PSTN interconnection and as mobile termination.

5. It is sometimes argued that a price based on TSLRIC (including a mark-up for forward looking common costs) is not appropriate in the mobile sector, since it is characterised by high levels of investment and rapid technological change. Likewise it also argued that TSLRIC was originally developed to apply to the fixed networks of incumbents, which were mature, used stable, predictable technology and had established usage patterns and that this is in direct contrast to mobile technologies that may operate on different

technology platforms that are constantly evolving and have more volatile demand patterns.[1]

6. If implemented appropriately, however, the TSLRIC approach will address all these issues. The cost of capital will reflect the characteristics of the mobile sector and in particular that of the designated service mobile termination. Likewise technological development and the need to recover costs as asset prices change will be taken into account with an appropriate specification of the annualisation methodology and underlying parameters.

7. Schedule 1 defines TSLRIC as follows:

> *"'TSLRIC', in relation to a telecommunications service,—*
>
> *(a) means the forward-looking costs over the long run of the total quantity of the facilities and functions that are directly attributable to, or reasonably identifiable as incremental to, the service, taking into account the service provider's provision of other telecommunications services; and*
>
> *(b) includes a reasonable allocation of forward-looking common costs."*

8. This TSLRIC definition may readily be applied to both mobile and fixed networks, and consequently does not require amendment.

9. TSLRIC is basically LRIC where it is made clear that the relevant increment in the service under consideration is the total output of that service. The application of LRIC principles is well recognised. Today most regulators and experts generally agree that forward-looking LRIC is the ideal approach for calculating the level of interconnection charges.[2] Specifically, the rapid implementation of LRIC principles for mobile termination in an increasing number of countries is a witness to the increasing acceptability and applicability of approach.

10. Because TSLRIC only considers product specific costs it makes no allowance for common costs associated with multiple products. A firm that only receives revenue equal to TSLRIC on all its service would make a loss. For this reason, it is usual to allocate some of the common costs associated with a regulated service to the revenue that can be earned from that service. Hence, mark-ups are required to recoup a portion of joint and common

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1 See for example, Competition Commission (1999), *Cellnet and Vodafone: Reports on references under section 13 of the Telecommunications Act 1984 on the charges made by Cellnet and Vodafone for terminating calls from fixed-line networks*, para 5.25, p 202.

2 See for example Intven, H. (ed) (2000), *Telecommunications Regulation Handbook*,, November, World Bank, Washington, for an overview.

costs, which are not included in TSLRIC.[3] This is clearly reflected in the Telecommunications Act's definition.

11. Overall, we therefore regard the definition of TSLRIC in the Act as a standard and robust definition.

12. In terms of implementing the TSLRIC pricing principle we note that there are areas of significant commonality between application of TSLRIC to fixed PSTN interconnection and mobile termination, as well as areas of difference. These matters are discussed in this report. It should be noted that the definition of TSLRIC in the Act is sufficiently generic to provide the Commission with the flexibility to accommodate such differences.

13. The Commission's TSLRIC Principles Paper[4] details the approach the Commission intends to make on the implementation of TSLRIC. The aim of the paper is to promote consistency and transparency concerning the application of the TSLRIC pricing methodology in access determinations and provide guidance to access providers who are required to calculate the price payable for a designated interconnection access service under section 45 of the Act. As such the paper is concerned with principles that apply to access disputes that may arise for fixed network services.

14. When the focus is on the calculation of TSLRIC of mobile termination a detailed understanding of the costs that make up a mobile network (as in the fixed network) is an important first step. While many of the cost elements in a mobile network have equivalent corresponding elements in the fixed network, there are also elements that differ, cf. section 2.

15. A fundamental difference is that mobile phones transmit and receive voice signals to and from the fixed network using radio connections, whereas fixed phones use wired connections. The mobile customers can therefore roam freely within the coverage provided by the operator. The fixed network customer can only access the network from a single point. Distinct from the fixed network the mobile network provides coverage. This, in particular, presents some challenges for designing a TSLRIC framework.

[3] TSLRIC including joint and common costs is sometimes termed TSLRIC+.

[4] Implementation of TSLRIC Pricing Methodology for Access Determinations under the Telecommunications Act 2001, Principles Paper, 20 February 2004.

1.2. Overview of issues

16. Based on our review of the Principles Paper we have identified a number of elements or issues that are generic to TSLRIC and some which need additional specification in order to be applied to mobile termination. The additional specification is entirely consistent with the definition of TSLRIC in the Telecommunications Act – and therefore no amendments are required.

17. The more generic TSLRIC issues are:

- *annualisation options* – conclusion: use tilted annuities;[5]
- *valuation of assets* – conclusion use optimised replacement cost;
- *methodology to estimate direct operating costs and indirect costs* – conclusion use mark-ups; and
- *bottom-up vs. top-down modelling* – conclusion adopt a bottom-up modelling approach.[6]

18. In our view, the arguments provided by the Commission in their selection of approaches and conclusions are equally applicable in the current context.

19. The Commission also outline the basic methodology for estimation of the cost of capital. While we agree with the general framework in terms of creating consistency with the other determinations, the Principles Paper focuses on the fixed network business. It is therefore not directly applicable to the case of mobile termination.

20. Of particular importance is the specific issue related to the estimation of a separate (non-observable) beta value for the service, mobile termination. These issues are similar to those related to the estimation of the beta value for the TSO. MJA has previously provided advice on this issue, including the likely range of the cost of capital for mobile termination.[7]

21. The issues that we have identified as needing additional specification, from that provided in the Commission's TSLRIC Principles Paper, in the context TSLRIC for mobile termination are:

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5 We note that both Oftel and the Swedish regulator PTS opted for using economic depreciation. The main argument in both cases seems to have been a belief that economic depreciation is better than tilted utilities when costs are changing rapidly.

6 We note the Swedish regulator opted for applying both top-down and bottom-up approaches. The final model used for price setting was a hybrid bottom-up model.

7 Marsden Jacob Associates, *The Cost of Capital for Mobile Operators Investigation into Regulation of Mobile Termination*, 19 July 2004.

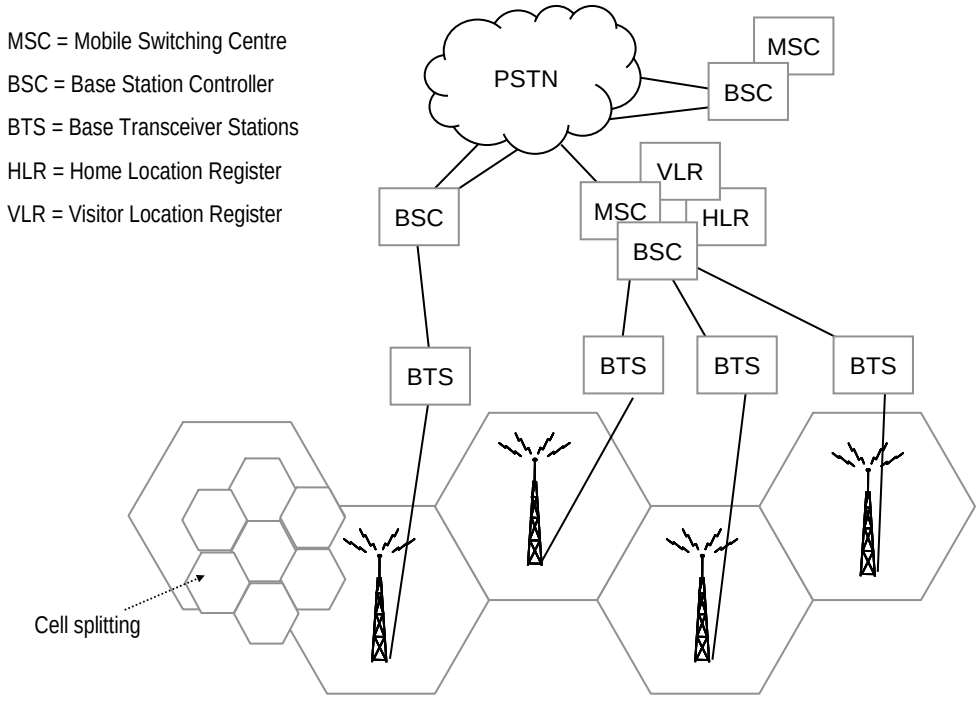
- definition of the increment;
- definition of scorched node; and
- defining the relevant benchmark for regulated termination charges.

22. To assist our discussion on these issues in the following sections, we begin by briefly reviewing the main characteristics of mobile network.

2. The Mobile Network

23. The figure below illustrates the basic structure of a mobile network.

FIGURE 1: SCHEMATIC STRUCTURE OF THE MOBILE NETWORK



24. The base station subsystem comprises Base Transceiver Stations (BTS) and Base Station Controllers (BSC). The BTS corresponds to the transceivers and antennas, used in each cell of the network. The BSC manages the radio resources (handovers, frequency hopping, power level etc.).

25. The Mobile Switching Centre (MSC) performs the switching functions of the network. It provides also the connection between the mobile network and the fixed PSTN network.

26. Since mobile subscribers can move around freely in the entire network's geographical coverage area, the mobile phones constantly identify there presence in the network so that the network may register the whereabouts of the phone. The functionality of analysing call data is placed at the MSC/BSC and includes databases, storing location information and permitted services of the subscribers belonging to the covering area of a MSC: the Home Location Register (HLR), the Visitors Location Register

(VLR). When a mobile terminal is moved around from one MSC coverage area to another, these registers are updated.[8]

27. The number of channels in a mobile network can be increased by the use of smaller cells or cell splitting as illustrated in the figure. By limiting the transmission power of the BTS and then re-using frequencies the BTSs can have a radius between a few hundred metres to more than 30 km.

28. Since urban areas typically require a larger capacity per square km the average size of urban cells will tend to be larger than in rural areas. Increasing the number of cells will result in an increase in the number and therefore costs of BTSs, antennas and towers.

29. The amount of available spectrum will determine how the network is configured. With less spectrum more cells will be required to permit greater frequency re-use. With more spectrum, fewer cells will be required since larger cells are possible.

30. In comparison to fixed networks, mobile networks have much less investment in network plant dedicated to individual customers like the fixed local loop. However, there are some costs which are sensitive to the number of customers served. These customer driven network costs include, for example, location updates.

[8] There are also additional registers including: the Authentication Centre (AUC) register and the Equipment Identity Register (EIR).

3. Definition of Increment

31. The Commission's view is that:[9]

> *"…any TSLRIC of interconnection services should define the increment as the total or whole volume of interconnection service that the access provider produces or is likely to produce."*

32. In addition the Commission note that:

> *"The total service should in principle include all services that use the assets used by the designated interconnection services. This definition of the total service takes into account the access provider's provision of other telecommunications services, in the sense that these services share costs with interconnection services."*

33. The Commission adopts a definition that combines 'increment' with 'total service'. This suggests that the Commission adopts an increment definition that includes a group of services. Alternatively, it may suggest that TSLRIC considers the costs that are caused by the provision of a defined increment of output related to the "total service", where total service includes all services that use the same assets as mobile termination, and hence a group of services.

34. In the fixed network this translates into two predominant increments: the core network increment where the main cost driver is the traffic and the access network increment where the main cost driver is the number of subscribers. While assets are still likely to shared[10] between increments under this definition it effectively eliminates a large proportion of shared and common costs that otherwise would have arisen if a more narrow definition of increment where adopted.[11]

35. The question is how this increment definition translates to a mobile TSLRIC framework. As stated above measuring the LRIC of mobile call termination

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9 Implementation of TSLRIC Pricing Methodology for Access Determinations under the Telecommunications Act 2001, Principles Paper, 20 February 2004. p 9

10 For example the line card is often allocated to the access increment. However, the line card is situated and takes up space in the exchange building where equipment costs are predominately related to the core increment. Building costs (asset) are therefore shared between the two increments.

11 For example a small change in the volume of a service or the addition of a particular service.

suggests an increment definition which is the addition of a group of services or all services with the same cost driver.

36. The definition therefore depends on the key factors driving the cost of mobile networks. These factors include:[12]

- Number of subscribers - this affects the size of certain of the network elements such as the HLR, the billing system and the number of SIM cards that need to be purchased;
- Call traffic volume in the busy hour - this is the key variable in determining the capacity that the network must support. The number of lines and the number of radio channels, as well as most of the other supporting network infrastructure, will be designed to support this level of traffic. Decisions on how much capacity is provided also determine some aspects of the quality of service that the network provides;
- Number of incoming and outgoing call attempts - the MSC within the mobile network must be able to cope with call attempts including those for unsuccessful incoming calls; hence the amount of processing capacity in the MSC is driven by the total number of call attempts as well as the total traffic in the busy hour;
- Traffic on the transit layer in the busy hour - the cost of the transit layer, which includes the transit switching centres and all the associated lines, is driven by the traffic it must carry; and
- Coverage provided - the area covered and the depth of coverage (in particular, the quality of in-building coverage) are the principal drivers determining the number of cell sites that the network uses (the other being the call traffic in the busy hour as cells can also be added for capacity reasons). To provide equivalent coverage for an 1800 MHz network requires more cell sites than a 900 MHz network.

37. Defining the increment according to cost driver is therefore somewhat more problematic for mobile networks than for the fixed network. However, in a mobile network, the majority of network equipment is deployed in response to traffic demands and only a small amount is deployed in response to subscriber numbers. Therefore, one option would be to group increments as below (as Oftel has done in the UK):

[12] The definition of cost drivers are based on the Competition Commission (1999), *Cellnet and Vodafone: Reports on references under section 13 of the Telecommunications Act 1984 on the charges made by Cellnet and Vodafone for terminating calls from fixed-line networks*, para 5.30, p 203.

- *subscriber increment*- the network's capacity to handle users of the network;
- *traffic increment*- the network's capacity to handle traffic (including voice minutes and data services); and
- *coverage increment* - the geographical extent of the network.

38. The subscriber increment would include those network-related costs that are driven by the number of subscribers on the network, assuming a constant output of the various traffic-related services produced by the network. On this basis, the increment of subscribers includes the cost of handsets and SIM cards. Hence these costs should not be allocated to the service of providing termination.

39. The traffic increment may be defined as the increment of traffic from all services using the network, voice services only or even more narrowly as the increment of voice termination.

40. The first approach is probably the one most close in spirit to the TSLRIC definition. Hence the traffic increment would include both voice and data traffic, so services such as sending SMS messages or data packets via GPRS would be in the same increment as call termination.

41. However, this increment definition results in a less clear definition of what the costs are without the increment in place. When the increment is defined as that related to voice calls the incremental costs would be the difference between the costs of providing a network that did not carry voice calls versus a network that does carry voice calls. When the increment includes all traffic the incremental cost would be the difference between the costs that does not carry any traffic and a network that carry traffic.

42. In this case it could be argued that the traffic increment would actually be the entire network. All services provided are related to conveying voice and data across the network; costs that are neither incremental to services nor shared between them are not network costs.

43. An alternative is to define the incremental costs of service traffic, as the costs of the extra network elements and capacity required in order to provide the final services, additional to those required to provide coverage or part of the subscribers' increment as discussed above. The main advantage of this approach is that shared costs will be transparent and mainly related to the costs of providing coverage.

44. Coverage is an important cost driver but is not readily attributable to either subscribers or traffic. A mobile network is initially deployed in the form of a large coverage network. However, this initial network already contains a considerable amount of capacity. Additional capacity is required to support traffic levels over and above that already deployed, and additional subscriber numbers in excess of the initial capacity.

45. The analysis of coverage is central to the difference between fixed and mobile networks. However coverage is defined, the element of joint costs to the other increments will be a large proportion of total costs – much larger than for any fixed network. In order to calculate the cost of call termination, a decision will needed on how these costs should be allocated. This decision will have a substantial impact on the final results.

46. This is clearly demonstrated by an analysis of the approach to account for coverage costs by the Oftel mobile LRIC model.

47. Oftel classifies coverage costs into two categories: those arising from the so-called minimum coverage presence (MCP) and those arising from coverage capacity. MCP costs are defined as the costs of a network management system and of acquiring, preparing and leasing the number of sites needed to meet the coverage requirements. The costs related to coverage capacity are defined as those which relate to the provision of traffic-handling capacity in the coverage sites.

48. The MCP costs are treated as common costs to be recovered through mark-ups on the services increments, whereas the costs related to coverage capacity are considered part of the LRIC traffic. According to Oftel, the magnitude of common costs is therefore small (3-5%)[13].

49. However, it could be argued that some of costs related to coverage capacity identified by Oftel are in reality either fixed costs (the costs of the antennas, for example, do not depend on the amount of traffic carried) or subject to a relevant degree of scalability. In this case the whole of coverage costs can be treated as common costs.

50. Moreover, these costs being fixed costs rather than driven by capacity, the cost causation principle is of no use when allocating them to the service increments. So, even accepting the point of view that part of coverage costs should be attributed to the traffic increment any allocation of these costs to

[13] Oftel (2001), Common Network Costs, p 4, available at:
http://www.ofcom.org.uk/static/archive/oftel/publications/mobile/ctm_2002/network_costs.pdf

terminating (or originating) traffic does not follow the cost causation principle. For example, if capacity had been used as an allocation key for these costs, this approach would carry equivalent results to those obtained through equi-proportionate mark-ups.

51. An alternative could be to define the coverage increment as the cost required to build a network that provides full geographic coverage and is capable of carrying traffic, but is only dimensioned to carry the minimum amount of traffic. This was actually the original approach adopted by Oftel. However, as noted above Oftel concluded that a better reflection of cost causation would be provided by regarding those coverage costs that relate to traffic-handling capacity as being part of the incremental cost of traffic.

52. In practical terms a coverage increment defined according to these principles could be estimated by assuming that coverage network costs are those you have as traffic in the network approaches zero or what the network design converges to as traffic approaches zero.[14]

53. In Sweden, Post och Telestyrelsen opted for a two increment approach: traffic and subscribers. Coverage was not explicitly treated as an increment, but as a network common cost to the traffic and subscriber increments. The reasoning behind the identification of common network costs was:[15]

> *"In a particular area (e.g. urban) where the initial coverage sites, sector or TRXs have become traffic driven (in the long run) then the corresponding variable costs of sites, sectors or TRXs would be present in the long run marginal cost of traffic, and hence would be treated as network common costs.*
>
> *Correspondingly, the costs of coverage sites, sectors or TRXs which are not traffic-driven (in the long run) would be considered as long-run fixed cost, and hence network common costs."*

54. The problem of the treatment of coverage costs is an intrinsic characteristic of mobile networks. In the fixed network, the costs arising from providing an access increment are driven by the number of subscribers. Each subscriber will need to be provided with its own connection with the core network, most probably through the means of physical line. An additional subscriber would cause additional access costs, whereas an increase in traffic, for a give number of subscribers, would cause no additional costs to arise. In the mobile network, on the other hand, it may be argued that

[14] Note that traffic should not be zero as this would correspond to no network.

[15] Conceptual issue: What size of increment, Update for Industry, 17 March 2004, Analysys for PTS, p 3

coverage costs are mainly fixed and not clearly driven by either traffic or number of subscribers.

55. Further analysis of the precise treatment of coverage is outside the scope of this paper. However, if mobile termination is designated and the Commission decide upon a TSLRIC as their final pricing principle, the treatment of coverage should be subject to industry consultation. Nevertheless, as a starting point we would recommend the use of three increments:

- a subscriber increment
- a traffic increment; and
- a coverage increment.

4. Definition of Scorched Node

56. With cost drivers and increments determined as above, the costing approach is to produce a design that matches the cost driver levels. These designs could reflect:

- actual technology in use and existing network configurations; or
- forward-looking technology.

57. These options are discussed in the next section. However, a specific issue remains: how to define scorched node? In the fixed network the Commission concludes that:[16]

> *"…forward-looking costs ought to be based on a network design where the location of core network nodes is taken as given. Hence the Commission considers that a scorched node assumption for network design is the most appropriate for TSLRIC modelling.*
>
> *However, the application of new technology in a forward-looking network design may result in, for example, the replacement of small remote concentrators or switches with customer access transmission systems. It is possible, therefore, that the equipment at some network nodes would change in a forward-looking view, affecting whether or not that element would be included in the TSLRIC calculation."*

58. Under the scorched node approach the optimal network design is constrained by the existing locations of nodes in the operator's network. For a mobile operator this is equivalent to employing a network design that reflects the actual number of base stations and switches currently deployed.

59. The approach thereby takes account of the fact that networks evolve over time and that operators as a result always will be somewhat constrained by their existing network topology. However, the technology at and in between existing switching nodes should be optimised to meet the demands of a forward-looking efficient operator.

60. In the fixed network the scorched node approach can be modified in order to replicate a more efficient network than is currently in place. This could for example be achieved, as suggested by the Commission (cf. quote above), by changing the nature of some nodes in order to achieve a more efficient

[16] Implementation of TSLRIC Pricing Methodology for Access Determinations under the Telecommunications Act 2001, Principles Paper, 20 February 2004, p 20

network. This is sometimes referred to as a modified scorched node approach.

61. The scorched node assumption may be interpreted in a number of different ways (even within the Commission's current definition for the fixed network). It is therefore necessary to specify how it would be interpreted in the context of the mobile network.

62. The term 'node' in the fixed network definition is usually understood as a node that performs switching (although this is not always clearly specified). In a mobile network there are only a limited number of MSCs. Hence, a strict interpretation of the scorched node assumption may allow considerable room for optimisation. If the scorched node is also taken as the BTS the degrees of freedom in optimisation are reduced.

63. Mobile network design and dimensioning involves a large number of complex engineering judgements subject to a number of constraints including for example local planning rules. To accurately capture the peculiarities and details of network design in a regulatory model it is therefore likely to be reasonable to take as a point of departure the hierarchical structure of the mobile operators' networks.

64. More generally the scorched node assumption could be interpreted as a constraint in the optimisation process, ensuring 'reality' is built into the cost estimate, by using actual statistics about the design of the mobile operator's network. Given this is the case the following more general definition could be used: *The scorched node constraint requires that the relationship between the drivers of node deployment and actual node placement should be similar to those seen in the networks of Vodafone and Telecom*.[17]

65. Under this definition the modelled operator would not necessarily have to have exactly the same number of nodes and distribution of nodes as the real operators. However, the definition would, for example, capture issues related to in-building coverage and cell splitting, as 'scorched node data' would be used to ensure that it is comparable with that provided by the operators.

66. Given that different scorched node assumptions may be interpreted in the context of mobile networks, we recommended that this issue be subject to industry consultation (assuming mobile termination is regulated, with TSLRIC as a pricing principle).

[17] This definition is similar to that adopted by the Swedish regulator PTS.

5. Relevant benchmark

67. In the fixed network only one operator is modelled. However, there are currently two mobile network operators with differing scales and scope. Hence, either a common set of assumptions for both operators must be made if a single mobile termination charge is to be calculated. Alternatively, the Commission could model the costs of both operators.

68. While there is a wide range of technology options available for fixed and mobile operations, the choice for a fixed network is simplified by the fact that only one operator is modelled and there is no dependency on spectrum allocations and choice over different mobile standards. The type and nature of spectrum available to the operator will affect the way in which the network can be used to support services, and the resulting costs of that network. Similarly, the technologies considered as part of the costing calculation, for example, GSM, CDMA or W-CDMA will influence costs.

69. In the sections that follow we therefore discuss the following issues in more detail:

- the scale of the mobile operation(s);
- the scope of the mobile operation(s); and
- technological constraints and choices.

70. The discussions in these sections (in particular, the discussions relating to scale and scope) focus predominately on issues that arise due to the differences between the operators subject to designation and how to deal with such differences.

71. However, the Act already describes that two designated access services for which the Commission may determine prices on the basis of a TSLRIC pricing methodology. These are:[18]

> *"Interconnection with Telecom's fixed PSTN – Origination and termination (and their associated functions) of voice and data calls (including dialup internet calls) on Telecom's fixed PSTN.*
>
> *Interconnection with fixed PSTN other than Telecom's – Origination and termination (and their associated functions) of voice and data calls (including dialup internet calls) on a fixed PSTN other than Telecom's."*

[18] Subpart 1 of Part 2 of Schedule 1 of the Telecommunications Act

72. The final pricing principles that may apply to Interconnection with Telecom's fixed PSTN are: [19]

> *"a) TSLRIC; or*
>
> *b) if the Commission considers that TSLRIC does not give best effect to the purpose set out in s.18, whichever of the following methods that the Commission considers best gives effect to that purpose:*
>
> > *i) a pure bill and keep method; or*
> >
> > *ii) a pure bill and keep method applied to two-way traffic in balance…"*

73. In addition for Interconnection with fixed PSTN other than Telecom's the following final pricing principle may apply:[20]

> *"the price determined by the Commission (if any) for interconnection with a network of Telecom's that corresponds most closely in nature to the access provider's network"*

74. Hence this framework suggests that the Commission may set individual TSLRIC mobile termination based on individual networks. On the other hand, it does not preclude that the Commission could set (or use) a common tariff for both operators. In this respect our discussion is relevant.

5.1. Scale of Business

75. Mobile termination designation will apply to two operators: Telecom Mobile and Vodafone. In this respect the Commission could calculate the individual costs of the two operators or alternatively determine TSLRIC with reference to a notional efficient operator.

76. The size of the operator in terms of market parameters and the economies of scale an operator is able to achieve at each point in time will ultimately determine the cost of mobile termination. Definition of operator size would include information on:

- market parameters: number of subscribers, number of voice minutes, SMS messages, data and other services; and
- network parameters: extent and quality of coverage and proportion of busy hour traffic.

[19] Commerce Commission, A guide to the role of the Commerce Commission in making access determinations under the Telecommunications Act, 28 May 2002, Appendix 2, p 12

[20] Ibid, p 12

77. Hence, the characteristics of the operator used to calculate costs must be defined if a single mobile termination charge is to be calculated. An alternative would be to calculated the mobile termination charge for each operator.

78. The ability to calculate the costs of each operator is useful since it provides a better understanding of how operators may differ. However, it is also comparably a more resource intensive exercise.

79. When different termination charges are not an option and operators should charge the same prices, a level of traffic must be selected on which to base the cost calculations. This issue may be particularly problematic if there are significant asymmetries between operators and the price regulation should apply to both of them.

80. In the UK the initial approach taken by Oftel in their bottom-up LRIC model was to base the costs on a hypothetical 25% share of total minutes. The rational was that costs should be the average market share size translating to 25% with four mobile network operators in the UK. With the entry of a fifth operator, Hutchison 3G, it is now assumed that the notional mobile operator's share of minutes falls over time from 25% in 2002/03 towards 20% in about 2009.

81. An alternative approach could be to base costs on the smallest regulated mobile network operator. The output from the model would then represent a cost ceiling for the call termination charge.

82. In New Zealand, Telecom Mobile and Vodafone are of similar size.[21] This issue of differing size is therefore less of an issue. MJA would therefore recommend basing the TSLRIC of mobile termination on an average (long-term) market share of 50%. Depending on market developments over time this market share assumption should be revised.[22]

5.2. Scope of Business

83. The scope of the business in the costing exercise must be clearly defined.

84. Modern mobile networks increasingly support the use of more advanced data services such as GPRS. These services will share different network elements. The treatment of these shared costs will therefore affect the final

[21] Vodafone has a market share of 56%. Telecom Mobile's share is 44%.

[22] The Commission should ensure that any TSLRIC cost model should be sufficiently flexible to take this into account.

cost of mobile termination. Further, the inclusion of all services flowing over the network will allow for improved utilisation (for example, improved utilisation of voice network element by data services or greater exploitation of economies of scale).

85. Current 2G networks are also characterised by significant SMS usage and growing usage of MMS and GPRS. If there are economies of scope or scale in a voice and data network the costs of voice termination services should share these cost savings. We therefore recommend making provisions for including data services in the TSLRIC modelling framework.

86. A further option would be include economies of scope related to the integration of the mobile operators. Telecom and Vodafone differ in terms of integration. While Vodafone is a sole provider of mobile services Telecom is a vertically integrated operator. For example, as fully integrated operator Telecom has the potential of utilising a backbone network that is common with its fixed line business.

87. It is difficult to determine whether vertical integration has a substantial impact on the cost estimates. However, in its purest form, charges set on the basis of TSLRIC do not distort the build/buy decision of new entrants. It therefore seems appropriate that costs estimates are those of a non-integrated entrant.

5.3. Technology Constraints and Choices

88. In order to derive costs, consideration must be given to the underlying technology that is used to support the mobile termination service. This includes:

- the type of nature of the spectrum available to the operators; and
- the technology considered as part of the costing calculation

89. There exists a negative relationship between spectrum frequency and radio propagation: the higher the frequency, the smaller the maximum cell radius for a given cell. This means that, in order to provide coverage of a given area, more cells will be required, and hence, the higher the fixed common costs of coverage. Consequently, in a GSM (or 2G) context, operators with exclusively or largely 900 MHz spectrum will tend to have lower fixed common costs than their 1800 MHz counterparts.

90. Further, the greater the spectrum allocation, the lower the incremental cost, since a given cell can deploy a greater number of traffic channels and hence

carry a greater amount of traffic. Therefore, for a given amount of traffic, an operator with a greater spectrum allocation will be able to deploy fewer sites, and hence incur lower cost.

91. Therefore spectrum allocations and individual use of spectrum result in different costs. If some hypothetical amount of spectrum is defined and used as the starting point for modelling a hypothetical operator (e.g. an operator with a 50% market share as discussed in the previous section) differences in the costs of existing operators should be understood and estimated.

92. A more contentious issue may in fact be the choice of technology. For example there is the possibility of modelling a

- 2G only network;
- 2G network where some account of future developments in 3G is taken; or
- 2G and 3G network.

93. Generally, mobile networks have been characterised by different generations of technology. The latest evolution is towards third generation mobile telephony. The question in relation to TSLRIC is therefore which generation of technology and assets best reflect the efficient forward-looking operator.

94. In the Principles Paper the Commission stated that forward-looking costs should reflect the costs of using best-in-use technology with Modern Equivalent Assets (MEA). According to the Commission, MEAs is defined:[23]

> *"…as the best-in-use technology that is available to a network operator, not necessarily the technology used by the access provider."*

95. The Commission therefore seems to allow for the possibility of including 3G within the framework for estimating the TSLRIC for mobile termination.

96. Clearly, the costing of a 3G network to set termination charges for a 2G network seems inappropriate. However, a 3G network is likely to lead to the lowest cost estimates over time, but will also be subject to considerable uncertainty. Likewise the modelling of a 2G only network would not represent the best-in-use technology. The output from such an approach is

[23] Ibid, p 20

also likely to lead to the most conservative cost estimate. A common ground must therefore be found.

97. One approach would be to model a 2G network, where account is taken of the 3G in future years and the migration of traffic from 2G to 3G. However, allowing 3G to influence current network design might raise costs to current 2G users. Nevertheless, some allowance for network design that will (in the future) introduce economies of scope between 2G and 3G seems a practical approach. This would also reasonably approximate the network built by an efficient 2G operator with 3G interests.

98. Looking forward, attempts to cost individual services provided over a common network will be complicated by the roll-out of 3G networks. Attempts to isolate costs of individual services will be harder. The network topology will be designed to minimise the costs of providing all the services that the network carries. This is likely to differ to the costs of a network just providing voice traffic (or to one providing data traffic).

6. Conclusion

99. In our view the definition and specification of TSLRIC in the Act is equally appropriate for fixed PSTN interconnection and mobile termination.

100. TSLRIC is basically LRIC where it is made clear that the relevant increment in the service under consideration is the total output of that service. In addition the Commission specifies that account should be taken of common costs. This definition falls well within the general LRIC framework for cost based pricing which is internationally recognised. As such the definition of TSLRIC in the Act is standard and robust. Hence, in our view, there is no need to specify the definition differently or more tightly.

101. However, in applying TSLRIC to fixed PSTN interconnection and mobile termination, there are matters where the approach should be aligned and others where there are matters specific to fixed PSTN interconnection and mobile termination. This means that the approaches should differ and some of the aspects in the fixed PSTN TSLRIC Principles Paper are not applicable to mobile termination.

102. The issues that we have identified as needing additional specification if the mobile termination is designated and TSLRIC is applied as the final principle are:

- *definition of the increment* - we recommend a three increment approach where increments are defined for subscribers, traffic and coverage. An industry consultation should be conducted before deciding the precise definition of coverage;
- *definition of scorched node* – we recommend an industry consultation on the appropriate definition of scorched node in the context of mobile networks; and
- *defining the relevant benchmark for regulated termination charges* – if the Commission were to set one termination rate for both Telecom and Vodafone we recommend (*i*) that a charges based on a 50% market share, (*ii*) the scope of operation reflect a non-integrated entrant and (*iii*) the costs reflect the cost of a 2G operator with 3G interests.

103. Differences in the application of TSLRIC to mobile termination and fixed interconnection services should be expected. However, with careful consideration of the specific characteristics of the mobile network these issues are easily overcome and should not constrain the implementation of TSLRIC for mobile termination.