20 April 2007

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Australian Competition and Consumer Commission
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Dear Mr Wright

Mobile termination cost model: Busy hour statistics

Thank you for the opportunity to comment further on the treatment of mobile network dimensioning within the WIK cost model. We note that the Commission has specifically asked about three key dimensioning statistics — proportion of traffic in the busy hour (BH); number of relevant BH days per year; and average traffic per customer during the BH (BH traffic). Find attached to this letter the relevant dimensioning statistics, which were also included in Vodafone's submission on the WIK cost model.

In order to respond fully to the Commission's queries about network dimensioning within the WIK cost model, Vodafone wishes to highlight the following points:

- network dimensioning within the WIK cost model;
- the approach to dimensioning in the European cost models;
- estimating annual traffic volumes; and
- number of relevant busy hour days.

Vodafone notes that the WIK cost model incorrectly dimensions the cost model network. This is due to the WIK cost model setting 'BH traffic' and 'percentage of traffic in BH' exogenously and setting annual traffic as the endogenous variable. The correct approach to network dimensioning is to have the 'BH traffic' as a function of the annual traffic, 'percentage of traffic in BH' and 'number of relevant BH days'. This is explained in more detail below.

Network dimensioning within the WIK cost model

The WIK Cost Model Report states several times that the estimation of the number of network assets needed is based on the 'average traffic per subscriber'[1]. The WIK Cost Model Report also states that the network is dimensioned so as to ensure that the traffic demand in the busiest hour of the day is met — as expressed in milli-Erlangs (mEr) per hour. This is the basic input for network dimensioning of the cost model network[2].

[1] WIK Cost Model Report, p.6 & p.80.
[2] Ibid, p.105.

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Vodafone wishes to note that there is no visibility in the WIK cost model of the direct effect of altering the BH mEr input on network asset deployment. The WIK cost model does not permit users to see the effect of changing the BH mEr input on the cost of providing mobile termination services.

The WIK cost model calculates annual traffic and dimensioning as follows:

(1) $$Annual\ traffic = \left(\frac{BH\ traffic}{\%\, traffic\ in\ BH} \right) \times Days$$

(2) $$Network\ capacity = f\left(BH\ traffic\right)$$

Equation (1) sets 'BH traffic' and 'percentage of traffic in BH' exogenously and has annual traffic as the endogenous variable. While equation (1) is arithmetically correct, it does not reflect the causation that determines network dimensioning. This approach means that any change to these figures are reflected through changes in annual traffic rather than network capacity. For example, the effect of changing the 'percentage of traffic in BH' from the original assumption of 8.5 per cent, to Vodafone's network dimensioning figure results in decreasing the annual traffic from 28.8 billion minutes to **[c-i-c]** minutes. This result is not accurate, as any increase in the percentage of traffic in the BH *should not* let lead to a decrease in total annual traffic.

The correct approach to network dimensioning is to have 'BH traffic' as a function of the annual traffic, 'percentage of traffic in BH' and number of relevant BH days, as follows:

(3) $$BH\ traffic = \frac{annual\ traffic \times \%\, traffic\ in\ BH}{Days}$$

(4) $$Network\ capacity = f\left(BH\ traffic\right)$$

Using the original assumptions in the WIK cost model, equations (1) and (3) produce the same outcomes (i.e. BH traffic equals 9.8 million minutes). However, rather than BH traffic being an exogenous variable, BH traffic is a function of the observed annual traffic and 'percentage of traffic in BH'.

This is important when one changes the 'percentage of traffic in BH' variable. As shown above, increasing 'percentage of traffic in BH' under equation (1) results in decreasing annual traffic. Whereas, under equation (3), increasing 'percentage of traffic in BH' while holding annual traffic constant, increases BH traffic. Increasing BH traffic results in increasing network capacity, as shown in equation (4). Further, exogenously estimating annual traffic is significantly easier and more rigorous than exogenously estimating BH traffic. This is due to significant public traffic data that is available through publications, including the Commission's *Telecommunications Market Indicator Report.*

Modelling of network dimensioning requires that annual traffic is a fixed exogenous variable and BH traffic and network capacity are treated as the endogenous variables.

Network dimensioning in European cost models

As explained above, the WIK cost model adopts a 'back-to-front' approach to dimensioning the network for traffic demand. This differs from the approach adopted by European regulators in dimensioning their respective mobile cost models (such as those constructed in the UK, Sweden and Netherlands). European cost models are dimensioned according to the steps below:

- start with the total number of minutes of use;
- split by geographic area (or geo-type);
- multiply by the proportion of traffic in the BH in each area, to determine the Erlang (and BH call attempt) requirement in each area; and
- derive the network capacity required in each area.

This logic follows the direction of causation: a proportion of calls fall in the BH, and it is these calls that determine Erlang and network capacity.

In the European models, if a change is made to the percentage of traffic in the BH — say an increase to reflect a more 'peaky' traffic profile — the models respond by computing a greater Erlang requirement, and so a requirement for more network capacity. This reflects reality. A more 'peaky' traffic profile will mean a lower average network utilisation and increase costs. Since the correct causal relationships are followed, the model will behave correctly to a change in the input.

In addition to the 'back-to-front' causality assumed in the WIK cost model, the WIK methodology leads to another, more significant, problem.

The WIK cost model methodology assumes that a fixed number of Erlangs (and hence minutes) is generated by each subscriber, leading to a geographical distribution of traffic that exactly matches that of subscribers (which is in turn based on resident population and working population). We are not aware that the WIK cost model has made any attempt to validate this assumption. At a very minimum, there is no reason to suppose that subscribers (estimated from resident and working population) will generate the same number of Erlangs in all geographical areas. At the very least Vodafone expects differences in calling behavior between business and residential districts.

The European models again take a different approach. Rather than basing the traffic distribution on the subscriber distribution, European regulators sought data directly from the operators on the traffic distribution across different geo-types. Table 1 compares the resulting distributions of population and traffic calculated from the Ofcom/Analysys cost model[3].

[3] The Ofcom/Analysys model does not estimate subscribers by geo-type.

Table 1: Population and Traffic Distribution from Ofcom/Analysys LRIC model

	Pop %	Traffic %	Traffic/pop ratio
Urban	6.03	12.80	2.12
Suburban 1	30.00	59.00	1.97
Suburban 2	32.78	14.00	0.43
Rural 1	21.19	5.90	0.28
Rural 2	7.00	1.70	0.24
Rural 3	2.00	0.40	0.20
Rural 4	1.00	0.20	0.20
Highways	0.00	3.00	..
Railways	0.00	3.00	..
Total	100.00	100.00	..

Source: calculated from Ofcom/Analysys LRIC model

It is immediately clear that the ratio of traffic to population is far from constant. The WIK cost model may capture a similar effect by use of both resident and working population to estimate subscribers and traffic, but it is not clear that it will capture the correct profile for Australia.

The proportion of traffic in urban areas is a very important assumption. Overall network costs are very dependent on the geographic traffic distribution. This is because rural costs are largely determined by coverage alone (independent of traffic), whilst urban and suburban costs are largely traffic dependent. Therefore, changing the distribution of traffic towards urban and suburban areas will raise overall costs.

Annual traffic

Network dimensioning, based on equation (3), requires that the annual traffic of minutes be determined exogenously. Total mobile minutes data is available from the Commission's *Telecommunications Market Indicator Report*. The most recent public version of this report covers 2004-05. Vodafone understands that the Commission has access to confidential RAF data for 2005-06 from which it can estimate annual traffic volumes.

The 2004-05 *Telecommunications Market Indicator Report* states that total mobile voice minutes for the industry equalled 16.4 billion minutes. In addition to mobile minutes, mobile networks need to be dimensioned for incoming fixed-to-mobile (FTM) calls. Telstra's annual report indicated that for 2004-05, FTM minutes were 4.4 billion. The total minutes for 2004-05 that the mobile networks needed to be dimensioned for was 20.8 billion minutes. Using the WIK cost model assumption of voice equalling 94 per cent of traffic results in total network billable minutes to be 22.1 billion.

Vodafone notes that the WIK cost model calculates annual traffic, through the use of equation (1), to be 28.8 billion minutes. This over-estimates the industry's traffic volume by around 30 per cent.

Number of relevant BH days

It is not clear what the Commission is asking Vodafone to confirm with respect to the number of days parameter. The letter of 3 April asks two different questions, namely:

- average number of days per year on which the typical BH is relevant; and
- what is Vodafone's estimate of the number of business days in the year.

If the Commission is asking Vodafone to verify the number of business days in a year, we can confirm that business days include Mondays to Fridays (5 days per week) minus the ten public holidays observed yearly in Australia. This equals 250 business days per year. However, Vodafone does not believe a focus on business days is the correct approach.

Rather, Vodafone submits that the Commission should be asking about the average number of days per year on which the typical BH is relevant. The answer is dependent on the number of days from which the BH statistic is derived. For example, if the network is dimensioned from a one-day per week average, there are 52 relevant BH days; using a three-day average there are 156 relevant BH days, and using a five-day average there are 250 relevant BH days (taking into account public holidays).

As we stated in our submission, the ITU-T Recommendation E.492 includes recommendations for determining the normal and high load traffic intensities for the month. As per ITU-T recommendation E.492, the normal load traffic intensity for the month is defined as the fourth highest daily peak traffic. If you select the second highest measurement for the month, it will result in the high load traffic intensity for the month. The result allows networks to define expected monthly traffic load. The ITU-T Recommendation uses a one-day per week average (four days per month), resulting in 52 relevant BH days.

[c-i-c]

The five-day BH average (spread across 250 days), used in the WIK cost model, results in a more smoothed traffic profile than that achieved in reality, since not all five days are equally loaded with traffic. The results in the WIK cost model assuming an unrealistically high network capacity utilisation and calculates a lower network cost.

Vodafone submits that the WIK cost model must assume network parameters that are consistent with the market reality of operating a network in Australia. **[c-i-c]** This would recognise a greater concentration of traffic in busy days and, if the cost model were correctly configured using equation (3), would result in a more accurate (but lower) network utilisation.

Traffic dimensioning parameters and the effect on BH traffic

Traffic dimensioning, as shown in equation (3), is aimed at ensuring that the cost model accurately estimates the BH traffic, and hence, correctly dimensions the mobile network. Table 2 outlines the effect that changing the parameters in equation (3) has on the estimation of the BH traffic.

Table 2 includes BH traffic estimates for two separate annual traffic volume assumptions — 28.8 billion minutes as assumed in the WIK cost model, and 22.1 billion based on the Commission's 2004-05 data. Table 2 also includes two estimates for the percentage of traffic in the BH — 8.5 per cent as per the WIK cost model and **[c-i-c]**, reflecting Vodafone's network. Finally, table 2 includes two values for the relevant BH days per year — 250 as assumed in the WIK cost model and **[c-i-c]**, reflecting Vodafone's network dimensioning.

Table 2: BH traffic estimates

[c-i-c]

Vodafone notes that using the assumptions in the WIK cost model — 28.8 billion annual traffic; 250 relevant BH days; and 8.5 per cent BH traffic — results in a BH traffic estimate of 9.8 million minutes. Using Vodafone's *actual* parameters, as used in our mobile network in Australia **[c-i-c]** results in a BH traffic estimate of **[c-i-c]** minutes. This is significantly above the BH traffic assumed in the WIK cost model. Vodafone's assumes that this has a significant effect on the assets needed to accurately dimension the modelled network — with a corresponding effect on the cost of providing mobile termination services. We are unable to confirm the extent of this, as we no longer have access to the WIK cost model.

Vodafone is willing to organise a meeting between us, our European experts and the Commission to discuss these issues further. Should the Commission require any further clarification, do not hesitate to contact us.

Regards

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