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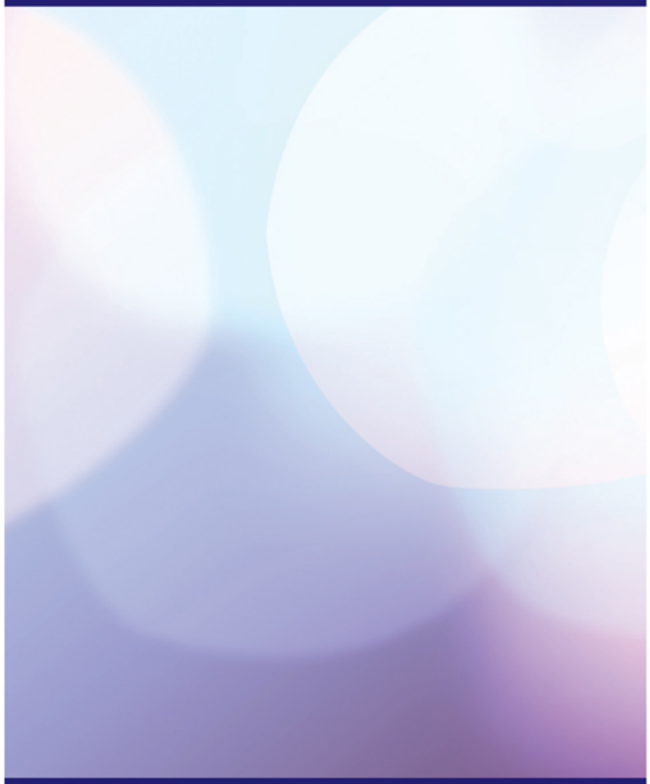

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Report for ComReg

Additional cost modelling for mobile voice origination

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Note: Where confidential data has been presented in this annex, it is indicated using the scissor symbol '✂'. A redacted version of this annex has also been prepared, suitable for publication with the MTR Specification document, with the confidential data removed.

Annex E Refinements made to the new MTR model to calculate costs of mobile voice origination

ComReg has requested that Analysys Mason refine the new MTR model to enable it to calculate costs relevant to mobile-originated voice calls (to non-geographic numbers). The principles for this new cost calculation have been developed in a separate paper for ComReg by DotEcon. This cost modelling has required not only the further analysis of network-related costs using the MTR model, but also new analysis of certain retail-related cost data from the mobile service providers (MSPs).

Various modifications to the new MTR model have been required to enable the consideration of the network costs, with further calculations added in relation to potential retail costs. This annex describes these changes. In particular:

- Annex E.1 outlines how calls to non-geographic numbers relate to the new MTR model
- Annex E.2 describes how the costs of mobile voice origination are derived in the new MTR model
- Annex E.3 sets out the changes required to the MTR model to calculate these network costs
- Annex E.4 sets out the additional data requested from MSPs
- Annex E.5 describes potential retail costs that could be relevant to retail costs.

In this annex, where "cent(s)" is used, it is intended to mean "Euro cent(s)".

E.1 Non-geographic numbers in the context of ComReg's new MTR model

Based on ComReg's consultation document 17/70, we understand that five classes of non-geographic numbers are of relevance. These are 1800 (freephone), 1850 (shared cost, per call charge), 1890 (shared cost, per minute charge), 0818 (universal access) and 076 (nomadic).[1] Calls to these numbers constitute a proportion of the mobile-originating voice traffic assumed in the new MTR model.

E.2 Calculation of network costs of mobile voice origination

The principles paper written by DotEcon indicates that the relevant increment for the calculation of the relevant network costs is defined as all mobile-originating minutes, including both mobile-originating off-net voice minutes and mobile-originating legs of on-net voice minutes. The paper also recommends a LRAIC+ calculation, but we have included a LRIC+ calculation as an alternative. We discuss these in turn below.

1 https://www.comreg.ie/publication/review-non-geographic-numbers/

E.2.1 LRIC+ calculation

In order to calculate the costs of this increment in the MTR model, the three on-net voice services (for 2G, 3G and 4G technologies respectively) have each been split into two services: an "on-net outgoing leg" and "on-net incoming leg", with the same number of minutes under both services in each year.

The network loading calculations have then been adjusted so that the network loading for each on-net minute service is now split between these two component services, so outgoing loading is associated with the "on-net outgoing leg" service and incoming loading is associated with the "on-net incoming leg". This has required changes to several calculations, which are set out in more detail in Annex E.2.2.

A new macro has been written that can now be run by pressing the "Run origination increment" button on the *Control* worksheet. The macro runs the new MTR model several times and pastes key outputs onto the *PureLRIC* worksheet.

In particular, the macro calculates and stores the following quantities in turn:

A. The pure incremental cost of mobile voice call termination (MVCT)
B. The pure incremental cost of all mobile-originating voice legs
C. The pure incremental cost of all other services (i.e. excluding the two services A and B above).

The total network costs to carry all modelled services, plus the business overheads allocated to the network business, are also stored (T). The time series of economic costs over the modelling period (2003–2053) are stored for A, B, C and T i.e. the costs assumed to be recovered in each year assuming economic depreciation is applied to both capex and opex. The common costs are then calculated in each year as T–(A+B+C). These common costs are then allocated in an equi-proportionate manner to all services except MVCT, as shown below in Figure E.1.

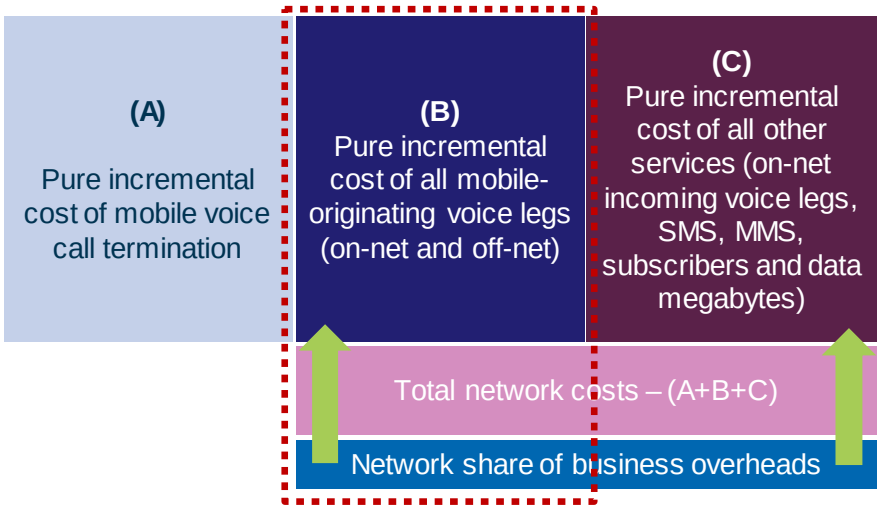

Figure E.1: Illustration of the LRIC+ approach [Source: Analysys Mason, 2019]

For a given year, the cost allocated to B using this method in that year (enclosed by the red dotted outline) is then divided by the number of mobile-voice-originated legs in that year to give a unit cost per minute. As with the rest of the calculations in the MTR model, the LRIC+ is calculated in real-terms

currency and inflation is then included as a final step. Figure E.2 presents the LRIC+ of network costs from the MTR model, when excluding and including mobile-originating on-net legs.

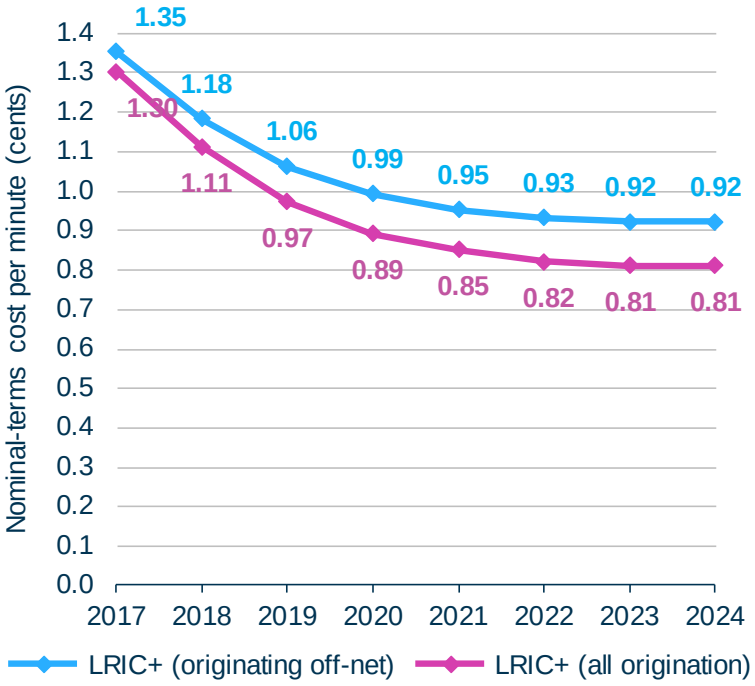

Figure E.2: Network LRIC+ of mobile voice origination over time, when on-net origination legs are excluded (blue) and included (pink) [Source: Analysys Mason, 2019]

E.2.2 LRAIC+ calculation

The calculation of a blended LRAIC+ for mobile origination has been added to the *Control* worksheet. The services included in the blend are as follows:

- 2G on-net voice minutes (outgoing leg)
- 2G domestic outgoing from mobile voice minutes
- 2G international/roaming outgoing from mobile voice minutes
- 3G on-net voice minutes (outgoing leg)
- 3G domestic outgoing from mobile voice minutes
- 3G international/roaming outgoing from mobile voice minutes
- 4G on-net voice minutes (outgoing leg)
- 4G domestic outgoing from mobile voice minutes
- 4G international/roaming outgoing from mobile voice minutes

We have also calculated a "LRAIC++" for mobile voice origination, including a mark-up for the costs unrecovered by MVCT. We assume these costs are recovered across all other services (i.e. excluding MVCT but including SMS and data services) based on an equi-proportionate mark-up calculated for each year. This calculation can be found on the *Control* worksheet. The network LRAIC+ and LRAIC++ for mobile-voice-origination is shown below in Figure E.3.

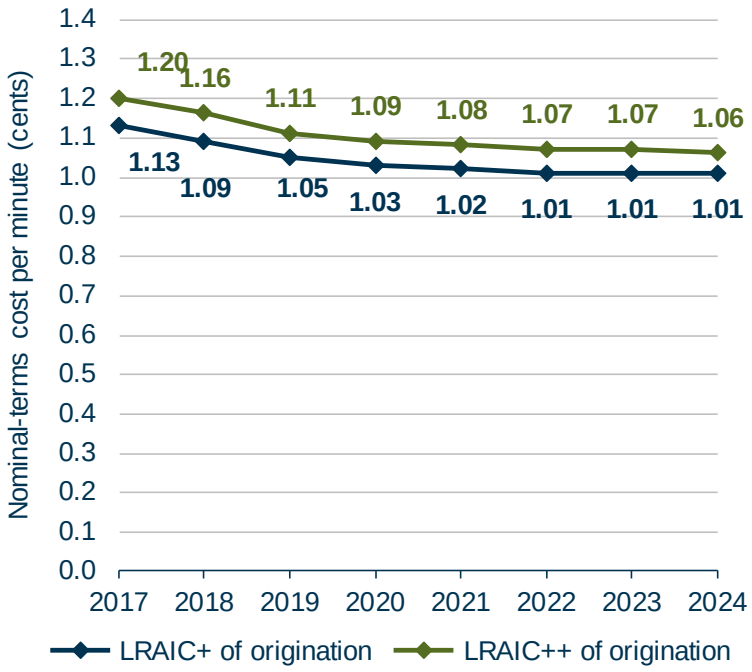

Figure E.3: Network LRAIC+ (black) and LRAIC++ (green) of mobile voice origination over time [Source: Analysys Mason, 2019]

E.3 Changes required in relation to network costs

In order to calculate the network costs of the mobile-originating voice increment in the MTR model, the three on-net voice services (for the 2G, 3G and 4G technologies respectively) have each been split into two services: an "on-net outgoing leg" and "on-net incoming leg", with the same number of minutes under both services in each year. The revised list of services can be found on the *InLists* worksheet.

In particular, the services labelled:

- 2G on-net voice minutes
- 3G on-net voice minutes
- 4G on-net voice minutes.

have been replaced with the services:

- 2G on-net voice minutes (outgoing leg)
- 3G on-net voice minutes (outgoing leg)
- 4G on-net voice minutes (outgoing leg)
- 2G on-net voice minutes (incoming leg)
- 3G on-net voice minutes (incoming leg)
- 4G on-net voice minutes (incoming leg).

This has then required further adjustments throughout the network loading and network design calculations. These changes are set out in Figure E.4 below. Each change is linked to a summary list of changes made on the *Control* worksheet.

Figure E.4: Changes made to the MTR model to derive the network costs of mobile voice origination [Source: Analysys Mason, 2019]

Worksheet	Description of change
Control	Added switches and macro button for origination increment calculation
Control	Added results and checksums for origination increment calculation
InLists	Extension of the named ranges *Voice.service.list*, *Traditional.voice.service.list* and *VoLTE.service.list* to include on-net incoming services
InLists	Added inputs for the new increments required for the mobile voice origination calculation
InMkt	Linking of volumes over time for the new on-net incoming services
InNwDes	Definition of "Proportion of voice conveyed across core-core links" for on-net incoming services
InRF	Definition of routeing factors for on-net incoming services
NwLoad	Definition of market share for on-net incoming services
NwLoad	Revision of Radio Erlangs per Erlang for on-net voice from 2 to 1
NwLoad	Extension of busy-hour voice calculations to include on-net incoming services
PureLRIC	Calculation for origination increment calculation added
RunPureLRIC (VBA module)	Macro for calculation of origination increment calculation added

A new macro has been written that can now be run by pressing the "Run origination increment" button on the *Control* worksheet. The macro runs the new MTR model several times and pastes key outputs for the mobile voice origination increment calculation (for the LRIC+) onto the *PureLRIC* worksheet. The final cost result (per mobile-originated voice minute in nominal currency) is linked through to the *Control* worksheet.

E.4 Data requested from MSPs

In October 2018, an Information Requirement ('data request') was sent to the MSPs in Ireland regarding calls to non-geographic numbers. This data request was issued in accordance with Section 13D(1) of the Communications Regulation Act 2002 (as amended). A summary of the data requested is provided below in Figure E.5.

Figure E.5: Summary of data requested [Source: Analysys Mason, 2019]

Chapter	Data requested	Years requested
Demand	Q1. Mobile-originated voice minutes to non-geographic numbers Q2. Mobile-originated voice calls to non-geographic numbers Q3. Mobile-originated voice minutes billed as out-of-bundle Q4. Mobile-originated voice minutes from prepaid Q5. 5-year forecast of mobile-originated voice minutes to non-geographic numbers	FY2017, FY2018 and FY2019 to date
Network	Q6. Description of billing systems	Current

Chapter	Data requested	Years requested
	Q7. List of software systems used to handle calls to non-geographic numbers Q8. Breakdown of employees	
Cost	Q9. Summary of fixed asset register Q10. Fixed assets related to handling of calls to non-geographic numbers Q11. Line items in trial balance that are directly attributable to non-geographic numbers Q12. Line items in trial balance that are indirectly attributable to non-geographic numbers Q13. Breakdown of bad debt	Most recent financial year for which you have audited financial statements
Revenue	Q14. Domestic revenue, wholesale revenue and roaming revenue Q15. Retail and wholesale revenue attributable to calls to non-geographic numbers	Two most recent financial years for which you have audited financial statements

Responses were received by early December 2018 from the three MNOs:

- Eircom Limited ('eir')
- Three Ireland Hutchison Limited ('3IHL')
- Vodafone Ireland Limited ('Vodafone').

as well as four MVNOs:

- Lycamobile Ireland Limited ('Lyca')
- An Post Limited ('Postmobile')
- Tesco Mobile Ireland Limited ('TMI')
- Virgin Mobile Ireland Limited ('VMI').

Clarifications to responses were sent in December 2018, with responses received by the end of January 2019. An overview of the responses is provided below in Figure E.6.

Figure E.6: Summary of responses [Source: Analysys Mason, 2019]

Chapter✂	eir	3IHL	Vodafone	Lyca	Postmobile	TMI	VMI
Demand							
Network							
Cost							
Revenue							

Key: ✓✓: largely complete; ✓: Partial response, some useful data; ✗ : Little/no useful data

E.5 Potentially relevant retail costs

Based on our analysis of the data received from all MSPs, we have identified retail costs that could potentially be added to the network-related costs derived in the new MTR model. These are:

- retail billing costs
- an allowance for bad-debt recovery
- other costs
- retail-related business overheads

We describe the additional calculations made below and summarise the costs identified as a final step.

E.5.1 Retail billing costs

One MSP (✂) was able to provide information on its estimated opex for its billing platform in its most recent completed financial year. ComReg provided the quarterly key data reporting for this MSP, allowing the traffic volumes and subscriptions for that financial year to be derived. The number of retail billing events for this demand has then been estimated on the following basis:

- one per originated call, assuming an average call duration of 3.5 minutes[2]
- one per message
- one per data session, with an average session size of 40 megabytes[3]
- one per postpaid subscriber per month
- zero from terminated traffic.

The average retail billing opex per retail billing event is then calculated to be ✂ cents, giving a retail billing cost of ✂ cents per voice call (✂ cents per voice minute assuming a call duration of 3.5 minutes). A submission from another MSP (✂) includes an estimated billing/credit management cost of ✂ cents per call, which appears consistent with the value derived from (✂).

E.5.2 Bad-debt allowance

Across all submissions, only one MSP (✂) was able to estimate a breakdown of its bad debt by mobile service for financial years ending in 2017 and 2018 respectively. In particular, this included a value for bad debt for out-of-bundle calls (excluding international roaming).

We have estimated the bad debt for out-of-bundle calls to non-geographic numbers for this MSP by multiplying the bad debt for all out-of-bundle domestic calls by the proportion of domestic retail voice revenue that is for calls to non-geographic numbers (1850, 1890, 0818 and 076 numbers only). We calculate a value of ✂ cents per minute (to the nearest 0.005 cents) by dividing this bad debt across postpaid-mobile-originated voice calls to non-geographic numbers (1850, 1890, 0818 and 076 numbers only). The value we have calculated is the same in both years for which we have data.

One MSP (✂) was able to provide information on its estimated opex for its bad-debt management platforms. It indicated that this opex was equivalent to approximately 15% of its bad debt. Therefore,

2 Sourced from ComReg's webpage (https://www.comreg.ie/model-assumptions)

3 Estimate based on an average value for the European Economic Area (EEA), as applied in the cost model of wholesale mobile roaming and termination, being developed by the European Commission. The average value is described in the cost model documentation, as published by certain EEA regulators.

we apply a 15% uplift to the bad-debt cost per minute calculated above to allow these costs to be recovered.

The average bad-debt value per minute across *all* mobile-originated voice calls to non-geographic numbers (originated by both prepaid and postpaid subscribers, but still only including calls to 1850, 1890, 0818 and 076 numbers), including 15% bad-debt management is ✂ cents per minute in 2018.

E.5.3 Other costs

As mentioned above, one MSP (✂) submitted cost data ✂. This submission included an estimated contribution per minute of ✂ cents for sales and marketing costs, as well as ✂ cents for other costs (specifically, capturing product development and IT, but excluding billing and credit management).

E.5.4 Retail-related business overheads

The MTR model assumes an uplift of 12% for network-related overheads. We therefore assume that the same uplift can be applied to the retail costs to include the mobile retail-related business overheads.

E.5.5 Summary of potential retail cost components

It is assumed that costs associated with bad debt and sales/marketing would not be relevant for calls to Freephone numbers. Therefore, the final retail cost components as calculated as shown below.

Category	Freephone numbers	Other non-geographic numbers
Billing	✂	✂
Bad debt	–	✂
Sales and marketing	–	✂
Other costs	✂	✂
Overheads	✂	✂
Total	**0.53**	**0.78**

Figure E.7: Summary of possible retail cost components identified, cents per minute [Source: Analysys Mason and ComReg, 2019]