Final report for Ofcom

Feasibility of tariff information and billing measures for non-geographic calls

05 October 2010

17693-403

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1 Executive summary

Ofcom is undertaking a review of billing and tariff transparency measures for non-geographic calls (NGC). The measures under review include, but are not limited to:

- changes to the billing systems used by originating communication providers (OCPs) to correctly charge consumers if 'access' and 'service' components of NGCs are disaggregated, and then to present an itemised bill that splits these components
- the provision of pre-call announcements regarding the service charge, distinct from the network access charge levied by the OCP.

For the purpose of this review, the scope of NGCs covers numbers starting with 03, 07 (excluding mobile number ranges), 08, 09, 116 and 118.

This report presents the findings of our interviews and desk research in connection with these issues.

Our approach to the study has been two-fold, as outlined below:

- First, we carried out interviews with 18 companies involved in the UK NGC market. Interviewees included representatives from each grouping in the NGC market: service providers (SPs), terminating communications providers (TCPs), OCPs and mobile virtual network operators (MVNOs). The objective of the interviews was in order to understand the options applicable to OCPs in respect of NGC billing, and the ability/suitability of each of the stakeholder groups to provide pre-call announcements (PCAs).

- Secondly, we reviewed the publicly available information on the regulatory approach in three countries that have implemented PCAs for NGCs: France, the Netherlands and Australia.

The key findings from our interviews and case study analysis are outlined both in terms of the billing measures and subsequently in terms of the provision of PCAs.

1.1 Billing disaggregation by OCPs

For the purposes of this study we investigated OCP billing systems with respect to:

- disaggregation – ability to separate and record the access and service charge components, and then to charge the consumer the correct total amount
- granularity – the number of retail price points that OCPs can cater for within a given non-geographic number range, as the above disaggregation measure could lead to a large increase in the number of price points
- presentation – ability to provide an itemised bill (printed or electronic showing the split between the access and service components.

In the context of this report, Ofcom has defined the network *'access charge'* as the call origination charge levied by the OCP, and the *'service charge'* as the payment made by OCP to TCP including any revenue share element to the SP. This is illustrated in Figure 1.1.

Our review focused on large and small, fixed and/or mobile network operators and virtual operators (e.g. virtual operators with billing origination obligations). OCPs informed us that the large number of interdependent technical issues relating to the retail billing measures (disaggregation, granularity and presentation) were not fully addressable within the timescale of this review as no operational billing system presently functions in this manner.

Disaggregation

In order to bill consumers the correct total amount whilst splitting the access and service components, we expect that OCPs would need to amend other support systems and databases outside their retail billing systems, although the extent of modification necessary would vary considerably between OCPs (and MVNOs). The access and service components could then either be separately fed into the retail billing system (in the case of a modern rule-based system) or be combined before being fed into the retail billing system (in the case of a legacy system) to apply the correct total charge for the call in billing the consumer.

Granularity

The requirement to disaggregate NGC charges between access and service components could lead to a large increase in the number of price points. We assessed whether OCPs would be able to cater for this, and particularly whether they could match BT's capability of typically having a single price point for every block of 10 000 numbers within a number range.

We established during our review of fixed operators, mobile operators and MVNOs that OCP billing systems can (or in some instances already do) provide a level of number-range granularity and price points to the level of blocks of 10 000 numbers. Where operators choose to bundle non-geographic number ranges together under a single retail price point, as is common in the mobile sector, this is not the result of any technical constraint on the part of the respective billing system(s).

Although administratively cumbersome, we believe that all OCPs could at least replicate billing at a single price point for every block of 10 000 numbers with a number range if required to do so. In fact, many billing systems could realistically achieve a level of pricing for a block of 1000 numbers but the cost overhead to achieve this level of granularity would be significant.

Presentation

OCP legacy billing system(s) are not currently capable of the necessary bill presentation i.e. presentation in printed or electronic form of separate access and service charge elements and the necessary linking of wholesale and multiple retail systems and mediation devices/platforms.

We believe that the potential scale of the billing disaggregation and presentation is such that it would not be practical to rely solely on modern rule-based billing platforms to deliver the capability in the absence of necessary enhancements to legacy billing systems and associated OSS.

Implementation estimates

It was evident from our investigation that no OCP had at any time specified or quantified the requirements for the above three billing measures (disaggregation, granularity and presentation). Consequently, the estimates provided by interviewees should be viewed as initial, high-level estimates. Further, no consistent view emerged on either the costs or timescale involved in implementing the necessary changes. Indeed, many OCPs, both fixed and mobile, stated that without a feasibility study it is not possible to provide accurate information.

That said, the vast majority of the effort will be required to disaggregate the access and service components of the charge (largely to amend retail billing support systems and databases) as well as to present itemised bills that split the total call cost into the two charge elements. OCPs' billing systems can already provide the required level of granularity; therefore little investment would be required for this aspect.

One large fixed OCP put the cost of a new release of billing software (which would both disaggregate the access and service components and well as present an itemised bill) in the region of GBP10 million and stated that it would not be available until 2013 at the earliest. Another suggested that network development would take between 18 and 24 months, costing in excess of GBP2 million for the IT elements and in excess of GBP500 000 for associated network changes.

Some of the smaller OCPs took the view that it would take at least 18 months (with design freezes) to enable any sort of tariff database table and look-up summary tables for the billing systems.

Unfortunately, OCPs were unable to provide a split of the effort between meeting the disaggregation and presentation requirements.

1.2 Pre-call announcements

For the purposes of this study we focused on the technical and operational delivery of three possible PCA variants, namely:

A. "You will be charged '*x*' pence per minute plus your access charge."
B. "You will be charged a maximum of '*x*' pence per minute in total for the call."
C. "You will be charged a maximum of 'x' pence per minute plus your access charge."

In message types A and C above, the value of '*x*' represents the 'service charge' element.

The network access charge levied by the OCP, and the service charge payment made by the OCP to the TCP (including any revenue share element to the SP) is shown in Figure 1.1.

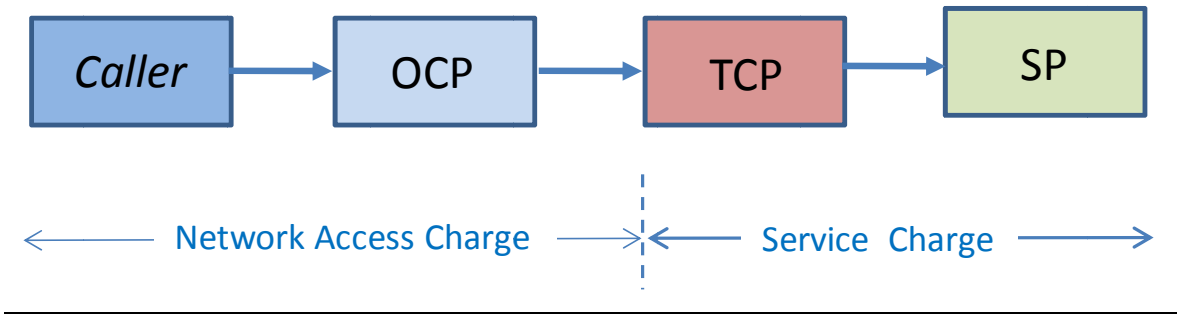

Figure 1.1: NGC routeing and tariff disaggregation [Source: Ofcom]

For SPs to provide message types A to C as PCAs, and ensure they are non-chargeable, requires termination equipment and infrastructure capable of providing a signalling interface to the terminating/originating exchange e.g. using SS7 or SIP capability. As the vast majority of SPs do not have this capability it is unlikely that SPs will be able to apply the PCA directly.

OCPs and TCPs have, to varying degrees and capability, the necessary infrastructure to provide all announcement variations listed above but no single PCA solution would prevail in either fixed or mobile networks. The TCPs we interviewed all recognised that the terminating network could be regarded as the easier and more logical delivery point to insert the PCA. However, all TCPs stated that it would take significant development to facilitate the use of PCAs.

A dynamic (real-time) tariff-based PCA capability would have to be extensively developed and tested by OCPs and/or TCPs to ensure compliance with any mandated requirements.

Efficient delivery of PCAs is essential to avoid extending the call set-up time and network loading against OCP / TCP expected traffic volumes and NGC usage. Call-holding times will increase by the average announcement length, which will result in an increase in network capacity requirements e.g. switch and transport/transmission systems.

IN service logic applied by UK operators would have to be upgraded to implement dynamic tariff-based PCAs, however the extent of IN service logic upgrade varies significantly between OCPs and TCPs dependent on the capability and extent of their respective IN implementation.

We identified a significant variance in the capability (i.e. degree of 'intelligence') of OCP and TCP announcement platforms, ranging from rudimentary switch-based solutions only capable of supplying dedicated (fixed) announcements to the use of intelligent peripherals and interactive voice response equipment (IVRs) that could provide dynamic (variable) message content.

The merits and applicability of each delivery option are illustrated in Figure 1.2 and described in more detail below:

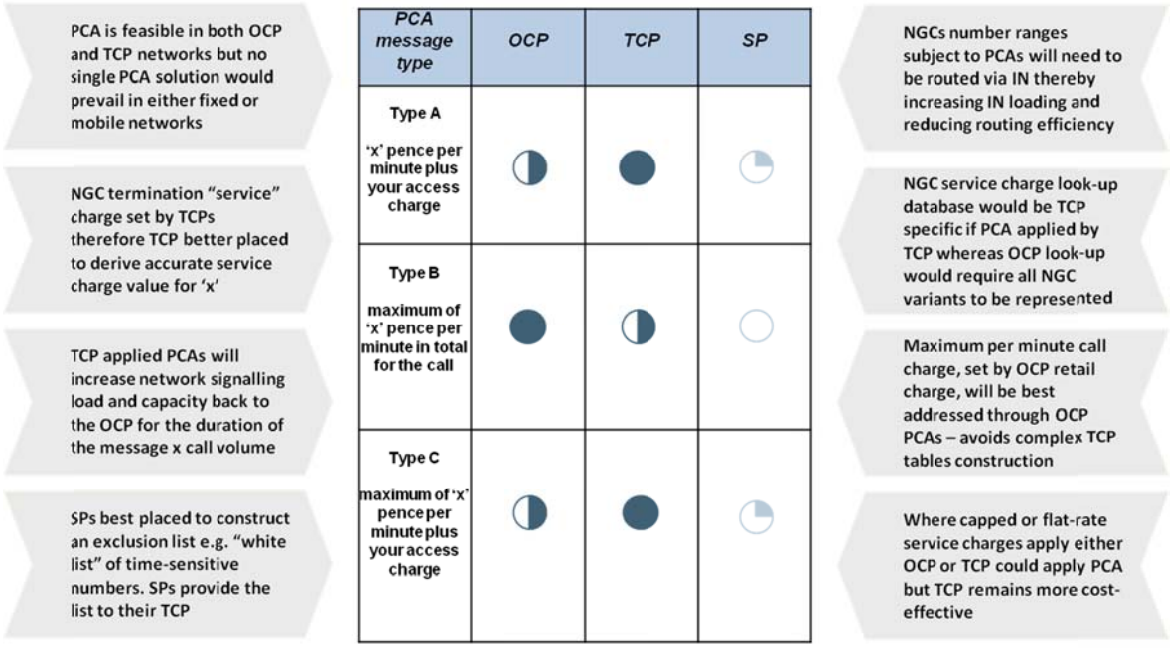

Figure 1.2: PCA delivery options [Source: Analysys Mason]

A service charge database (i.e. a look-up function for use in real-time call set-up) would need to be developed and maintained. This is because such information, where available to either the OCP or TCP will normally only be stored in off-line bill rating engines and/or external administrative billing or tariff databases which are not designed for real-time access by network/IN systems.

Interoperability testing would be required where the PCA is applied at the TCP to ensure that announcements were played correctly as non-chargeable events and call treatments are correctly applied back to the OCP.

Based on the provisional estimates provided by the OCPs/TCPs, OCP-based PCA solutions would cost between three and ten times as much as equivalent TCP-provided solutions (taken across all PCA message types) and would take between 18 to 24 months for the largest fixed and mobile operators to provide.

Our review of publicly available information on PCA implementations in other countries suggests that, to obtain the details of all SP tariff plans from a commercial database, the cost per switch plus incremental IN database costs for OCPs to deliver PCAs would be 10 to 20 times greater than the cost for same message being inserted by the TCPs.

1.2.1 OCP

Applying PCAs at the OCP will require routing all designated NGCs to their IN, possibly via the trunk (transit) layer. Given the call volumes involved, this would require significant expansion of IN, and where necessary, trunk (transit) capacity.

OCPs are better placed to offer a more cost-effective solution to providing message type B *("maximum price per minute in total for the call")* as this option only requires knowledge of the retail charge by number range (data that OCPs will already have, albeit not necessarily in the correct form for a PCA tariff look-up table).

OCP costs were estimated to be around GBP1 million (plus) for smaller networks, and between GBP5 million and GBP10 million for larger fixed and mobile networks. Again, the estimates provided by OCPs, as well as TCPs below, should be viewed as initial, high-level estimates.

1.2.2 TCP

As the technical application of PCA solutions between OCPs and TCPs is similar, the most significant differences result from the scale of implementation: each TCP has only to create and maintain the infrastructure and NGC tariff database relevant to its own (hosted) non-geographic number ranges. Depending on the size of the TCP-hosted number ranges, there will be a significant cost reduction in respect of:

- IN and peripheral upgrades
- creation and administration of the necessary tariff data and degree of accuracy.

TCPs recognised the difficulty of getting calling line identity (CLI) through and dealing with corrupt signalling and failed call attempts, all of which would need appropriate call treatments.

Where TCPs provide the PCA, the loading on the network back to the OCP will be increased as a direct result of PCAs being played. This will need to be modelled and offset against potential cost savings derived from TCP PCA implementation.

TCPs quoted development timescales of 18 to 24 months for the enhancements, with costs ranging from GBP300 000 (small in-house network configuration changes) to GBP2 million for network and IT related solutions (inc. IN and OSS).

TCPs are therefore better placed to offer a more cost-effective solution to providing message types A or C. The reverse would be true where TCPs were required to provide message type B as they would have to create and administer a database of all OCP retail charges.

1.2.3 Time-sensitive and machine-to-machine numbers

To manage and effectively control the exclusion of PCAs from time-sensitive or machine-to-machine (M2M) numbers will require the introduction (or extension) of an 'exclusion list' (similar to that used today by mobile operators for certain nominated freephone numbers). This is a feature controlled by an IN that requires the construction and maintenance of a 'look-up' table of applicable time-sensitive/M2M numbers to exclude the playing of a PCA.

Only SPs will know what equipment or service conditions apply to specific mission- or service-critical time-sensitive/M2M numbers under their control and management. It would be more cost-

effective and straightforward for SPs to inform (or work with) their respective TCPs to create a list of non-geographic numbers to be excluded from PCAs. This aligns closely with the delivery options described in more detail in Section 1.2 where TCPs provide PCAs.

If PCAs were applied by OCPs then the exclusion list would have to be supplied and updated either by every SP or a nominated third-party organisation(s) responsible for collecting and distributing the excluded numbers list. There was no clear view as to the procedures to create and maintain an accurate list amongst the OCPs interviewed, especially the fixed operators who do not utilise a scheme similar to the mobile operators, other than to recognise that it would be both administratively costly with a high resource overhead.

1.2.4 PCA findings

Based on our solution assessment, we find that:

- PCA message types A and C are most cost effectively implemented by TCPs
- PCA message type B is best implemented by OCPs (resulting from existing knowledge and application of NGC retail pricing)
- PCA call treatment for time-sensitive and M2M numbers will need to be managed by the implementation of an exclusion list.

1.2.5 PCAs in other countries

Annex D of this report provides an overview of how PCAs for NGC services have been implemented in Australia, the Netherlands and France based on information available in the public domain. No specific technical information was provided by any of the administrations reviewed. Public-domain material provides information about the general rules that apply, rather than describing how the PCAs are/should be delivered.

2 Introduction

Ofcom wishes to understand implementation feasibility of measures to improve consumer tariff transparency in the context of its review on non-geographic calls (NGC). These tariff transparency measures include, but are not limited to:

- changes to the billing systems used by originating communication providers (OCPs) to correctly charge consumers if 'access' and 'service' components of NGCs are disaggregated, and then to present an itemised bill that splits these components
- the provision of pre-call announcements regarding the service charge, distinct from the network access charge levied by the OCP.

For the purpose of this review, the scope of NGCs covers numbers starting with 03, 07 (excluding mobile number ranges), 08, 09, 116 and 118.

Analysys Mason Limited ('Analysys Mason') has been commissioned by Ofcom to carry out this study to assist the review.

Our approach to the study has been two-fold, as outlined below.

- First, we carried out interviews with representatives from companies involved in the UK NGC market. Interviewees included representatives from each grouping in the NGC market, in order to gauge the ability/suitability of each of the interest groups to provide pre-call announcements (PCAs), and the options applicable to OCPs in respect of NGC billing.

- Secondly, we reviewed the regulatory approach in three countries that have implemented PCAs for NGCs, namely France, the Netherlands and Australia.

Our interview programme was separated into the three main categories of organisation, namely:

- service providers (SPs)
- terminating communications providers (TCPs)
- OCPs.

For the purposes of this study, resellers (or aggregating SPs) who serve as an intermediary for individual SPs in assigning number ranges and negotiating / managing contracts have been included as TCPs.

2.1 Background

Non-geographic numbers have encouraged and supported the development of the market for value-added telephony services, providing SPs with effective marketing tools and revenue-generating opportunities. Nevertheless, there are consumer concerns regarding the transparency of the call charges. SPs, on the other hand, are frustrated that they cannot advertise the final price of

their service appropriately to end users because of the lack of co-ordination between the choice of number range and the prices charged to the final end user (for some number ranges and for calls made from networks other than BT).

Ofcom now wishes to further the interests of consumers, while ensuring a functioning market for the different market participants in the value chain for NGCs, with particular reference to billing and tariff transparency measures.

Calls to non-geographic numbers traverse a number of different switching and routeing stages, as shown in Figure 2.1. Calls route from the OCP over the network of one (or more) transit communications providers (transit CPs) before reaching the network of the TCP. It should be noted that in the simplest case, the OCP and TCP could be on the same network. Finally, SPs will be responsible for delivering the NGC service or information.

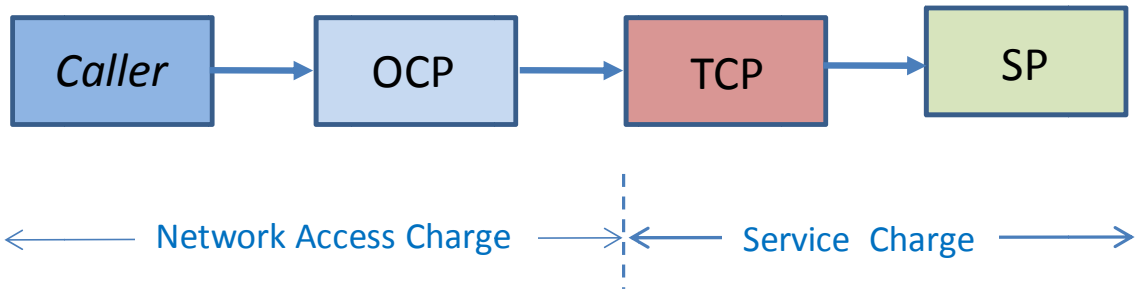

Figure 2.1: NGC routeing and tariff disaggregation [Source: Ofcom]

There is a substantial body of evidence that significant numbers of consumers are unable to determine the cost of an NGC given the wide range of retail tariffs (which depend on the calling network and called number). Point-of-call tariff information is one option for addressing this concern. The tariff announcements can include measures such as a network announcement of the service charge, distinct from the network access charge levied by the OCP, as shown above in Figure 2.1.

Experience in the provision, and subsequent removal, of PCAs applied to 070 personal numbers identified that time-sensitive and machine-to-machine services may/will have to be excluded from any move to introduce PCAs when applied to non-geographic numbers, e.g. health/social helplines, alarm services.

For the purposes of this study, Ofcom has defined the network *access charge* as call origination charge levied by the OCP, and the *service charge* as the payment to the TCP including any revenue share element to the SP, as shown in Figure 2.1.

In addition to providing consumers with tariff information at the time of making an NGC, the printed or electronic bill could also indicate the distinction between the service charge and the network access charge when applied to NGCs.

Currently, BT bills its end users for NGCs by providing for a certain number of price points (typically one price point for every block of 10 000 numbers within a number range). BT's billing granularity reflects the termination charging granularity and BT is required by regulation to adopt the same granularity for retail charges. Ofcom wishes to understand to what extent BT's level of billing granularity can be replicated by all other originators.

2.2 Structure of this document

The remainder of this document is laid out as follows:

- Section 3 outlines the approach taken for this study
- Section 4 provides the findings from our interviews and our summary recommendations. This section is presented in two parts (dealing with billing and PCAs, respectively), with each of them divided into five sub-sections:
  - delivery options
  - current practices
  - technical assessment
  - estimates of implementation cost and timescale
  - summary findings and recommendations
- Section 5 provides our conclusions to the study.

The report includes a number of annexes containing supplementary material:

- Annex A: Definitions
- Annex B: PCA questionnaire
- Annex C: Billing disaggregation questionnaire
- Annex D: Approaches to PCAs taken in other countries
  - D.1 France
  - D.2 The Netherlands
  - D.3 Australia

3 Approach

This section outlines the approach taken for this study, and is structured as follows:

- Section 3.1 describes the objectives of the interview and desk research stages of the review process
- Section 3.2 lists and categorises the companies we interviewed.

3.1 Objectives

Our approach to gathering information for this study involved two distinct elements:

- a series of interviews held with UK telecoms industry players that use non-geographic numbers to provide originating and terminating services
- an analysis of information and regulation in the public domain obtained from three other countries that have implemented PCAs for non-geographic number services.

Interviews were conducted either by telephone or at scheduled meetings using questionnaires, provided in advance to respondents. The questionnaires (one regarding PCAs and one regarding billing disaggregation) are included as Annex B and C to this report, respectively.

The objective of each interview was to establish the capability of the respondent to provide, where appropriate, either the PCA and/or the associated billing/charging mechanisms. The questions outlined below were posed to the respondents.

- What are the present technical methods/solutions available for the introduction of PCAs and printed/electronic billing information?
- Can these present solutions address the requirements for the provision of tariff-based PCAs and separation/presentation of billing information?
- How might/will solutions capable of addressing the above scenarios be implemented?
- What constraints do you see in the provision of the above (are these technical or commercial/financial)?
- What are the expected or likely cost and timescale implications in the provision of the above scenarios?

The second element of this study has been based on a review of publicly available information and regulatory instruments to determine how PCAs for NGC services are implemented in Australia, the Netherlands and France. No specific technical information is provided by any of the administrations reviewed. They provide information about the general rules that apply, rather than describing how the PCAs are/should be delivered. No data is provided by the respective regulators regarding billing disaggregation and presentation.

3.2 Companies involved in interviews

For the interviews, we selected a representative range of companies to ensure involvement of players at every stage in the NGC value chain. We conducted 18 in-depth interviews, which are listed in Figure 3.1 below.

Company	*NGC business type*	*Business description*
Multi-service operators		
BT	OCP/TCP/SP	Multi-service provider
C&W	OCP/TCP	B2B fixed carrier and services
Colt	OCP/TCP	B2B fixed carrier and services
Virgin Media	OCP/TCP	Multi-service provider
Mobile operators		
Everything Everywhere	OCP	Mobile operator (Orange & T-Mobile)
H3G UK	OCP	Mobile operator
Vodafone	OCP/TCP/SP	Mobile operator – some fixed and SP services
Resellers		
DRD Communications	Reseller/SP	Hosted and managed telecoms systems, number translation service (NTS) aggregator
FleXtel	Reseller/SP	Hosted and managed telecoms systems, NTS aggregator
The Number 118	Reseller/SP	Directory enquiries and content
SPs		
APN	SP	Premium rate SP
Designers Collective	SP	Graphic design and market campaigns
VR Build	SP	3D graphics, Web design
Equipment/solution vendors		
Alcatel-Lucent	Equipment and solutions vendor	IN and switch vendor
Intec	Equipment and solutions vendor	Billing vendor
NSN	Equipment and solutions vendor	IN and switch vendor
OpenCloud	Solutions vendor	IN solutions supplier
Oracle	Solutions vendor	Billing and database solutions vendor

Figure 3.1: List of non-geographic number service companies interviewed [Source: Analysys Mason]

4 Solution assessment

This section provides the key findings of our interview programme and our summary recommendations. The section is divided into two parts: billing disaggregation and PCAs. Each sub-section looking in detail at the following:

- delivery options
- current practices
- technical assessment
- estimates of implementation cost and timescale
- summary of findings and recommendations.

Throughout this document the following terms apply to equipment and systems (hardware and software, as deemed appropriate):

- capability – functional design capability of equipment or systems
- capacity – physical, dimensioning or performance characteristics (or constraints)

4.1 Billing disaggregation measures by OCPs

4.1.1 Delivery options

Billing disaggregation measures could be applied by OCPs in addition to the PCA measures described in Section 4.2 below. Consequently, this section focuses both on large and small, fixed and/or mobile operators and virtual operators, e.g. MVNOs that have billing origination obligations.

For the purposes of this study we investigated the OCP billing system with respect to:

- disaggregation – ability to separate and record the access and service charge components, and then to charge the consumer the correct total amount
- granularity – the number of retail price points that OCPs can cater for within a given non-geographic number range, as the above disaggregation measure could lead to a large increase in the number of price points
- presentation – ability to provide an itemised bill (printed or electronic showing the split between the access and service components.

4.1.2 Current practices

OCPs

OCPs typically have more than one billing system – many have four or more, including those dedicated to prepaid, postpaid, residential, enterprise, and wholesale carrier services. In some instances, this involves billing platforms located outside the UK.

There is wide variation in retail price plans applicable to non-geographic number ranges applied by both fixed and mobile OCPs. Price points range from BT's comprehensive and complex 10 000-number block-based pricing scheme, to mobile operators which typically price the whole range – e.g. the whole of 0871 – behind a single price point. We established during our industry review that the latter is purely a commercial decision and not constrained by technical functionality. Hence, OCP billing systems should be capable of supporting additional price points, a point we return to below.

Regardless of the commercial drivers underpinning NGC pricing, OCPs only use one retail call price calculated from the call detail record (CDR) usage data, generated by the switches/servers, to pass to the billing system, which then feeds into the bill. Therefore, it is not current practice for retail billing systems (whether legacy or modern rule-based) to disaggregate the bill between the access and service components of the charge. Also, no OCP currently 'splits' its bill(s) to show the components that go to make up the total charge, and we did not identify a methodology or mechanism used by any OCP for doing so.

However, if required, OCPs clearly have the information to split their charges between the access and service components: they determine the access component, and they are charged the service component by TCPs. However, exactly where particular information regarding the service component is held within the OCP is a key issue, as it can be held in a range of support systems and databases external from the actual retail billing system. These external support systems are generally bespoke and independent of the retail billing system. They are not currently constructed to split out the access and service components of the charge.

MVNOs

MVNO billing systems are frequently integrated with the host network's billing system and IN platform (especially for prepaid services), e.g. Virgin Mobile and the T-Mobile network of Everything Everywhere. MVNOs will have limited IT administrative access to these platforms for billing purposes, but no engineering access for advanced reconfiguration. Consequently, the only major difference that applies to the MVNO rather than to the host mobile operator lies in the respective retail price plans.

4.1.3 Technical assessment

The fact that all OCPs have more than one billing system means that any change to comply with a requirement for the billing measures being considered in this report will have to be managed

across several billing systems. This will affect the time, resource and cost of managing a complex project, which may result in new releases of billing software being needed to meet the revised billing requirements.

The main problems identified by the majority of OCPs we spoke to are:

- difficulties in splitting the bill to differentiate between the access and service charge components
- creating and managing a database (look-up table) of NGC service charges to the required degree of billing accuracy where this is not in the format envisaged.

Many OCPs, both fixed and mobile, maintain legacy proprietary billing systems that are in many instances unlikely to be capable of extensive modification to comply with the NGC access and service model requirements – this is particularly the case for mobile OCPs. Mobile and fixed OCPs alike described this as a 'nightmare', especially in respect of the older legacy billing systems. Although the majority of large fixed and mobile OCPs are in the process of upgrading their billing systems, none had specified bill disaggregation as part of their functional requirements.

Disaggregation

The key issue under consideration is whether OCPs would be able to charge consumers the correct total amount if 'access' and 'service' components of NGCs are disaggregated. In this instance, OCPs would need to add together the access component (which they determine) to the service component (which is determined by the TCP).

As discussed above, OCPs hold information regarding the service component, but it is typically held in a range of systems and databases external to the retail billing systems. In order to bill consumers the correct total amount, we expect that these could be amended to comply with the access and service charge model, although the extent of necessary modifications would vary considerably between OCPs (and MVNOs).

Once these external support systems and databases have been amended, the exact process to calculate the correct total call charge will depend on the functional capability of the OCP's existing retail billing system(s). To apply the correct total charge for the call in billing the consumer, the access and service components could either be:

- combined before being fed into a legacy retail billing system (which uses a single charge entry), or
- separately fed into a modern rule-based retail billing system which has the capability to combine separate charge elements held in multiple charge tables.

A thorough design and functional capability review of the billing systems, external charging databases and operational support systems (OSS) would be required to determine the degree of

technical difficulty that OCPs would face in order to comply with an NGC access and service charge model.

Granularity

The above requirement to disaggregate NGC charges between access and service components could lead to a large increase in the number of retail price points. A key issue is whether OCPs would be able to cater for this, and particularly whether they could match BT's capability of typically having a single price point for every block of 10 000 numbers within a number range. All OCPs stated during the interviews that their billing systems can (or in some instances already do) provide number range granularity and price points to the level of blocks of 10 000 numbers. This applies to both fixed and mobile operators and MVNOs, even where a mobile operator has currently bundled non-geographic number ranges into larger blocks for retail billing purposes – this is simply a commercial decision and is not constrained by the billing system.

Consequently, creation of the necessary tariff tables to replicate BT's current level of billing (typically one price point for every block of 10 000 numbers with a number range), although administratively cumbersome, should not be constrained by any technical issue identified during our discussions with the OCPs.

In fact, many billing systems (including BT's) could realistically go down to blocks of 1000 numbers for pricing, but that would simply add to the administration overhead and would be very resource (processing) hungry with significant consequential cost implications.

OCPs and billing vendors highlighted that an increase in the number of digits needed to determine the appropriate rates would increase the cost of:

- maintaining the reference data tables
- publishing rates for customers (e.g. phonebooks, price lists, web sites, marketing and advertising)
- potentially discriminating more numbers on invoices
- servicing customer enquiries.

Presentation

Almost without exception, every OCP we interviewed about their legacy billing system(s), with respect to the presentation of the service charge as part of the printed/electronic bill, stated that they would take a 'massive redesign' of their whole system and likely result in a new billing platform (especially as it would potentially have to link wholesale and multiple retail systems which are currently separate).

Consequently, our discussion below focuses on the opportunity to utilise modern billing systems to produce the required level of billing disaggregation and presentation. Key features of modular rule-based billing systems that would be required to implement NGC billing disaggregation measures are:

- configured to provide the desired level of granularity and price points, managed and administered by the respective OCPs, using multiple tables
- multiple charges per call / event, resulting in a separate access and service charge
- allowance for fixed connection charges (such as those used for 118 DQ) and variable charges
- rates defined at the pricing plan level with ability to apply global (reusable) rates to reduce complexity
- tables are populated and configured to the rules specified using general user interface (GUI)-based tools (it includes fixed and variable pricing and revenue-sharing information)
- bill presentation elements are template-driven and templates can be reused or modified.

4.1.4 Estimates of implementation cost and timescale

It was evident from our investigation that no OCP had at any time specified or quantified a requirement for the above three billing measures (disaggregation, granularity and presentation). Consequently, the cost and timescales estimates provided by interviewees should be viewed as initial, high-level estimates. Furthermore, no consistent view emerged on either the costs or timescale involved in implementing the necessary changes.

We recognise that implementing these billing measures would have to be managed as a complex project programme, further complicated where OCPs maintain both legacy billing systems and multiple systems for different customer segments. One mobile OCP stated that the billing system enhancement would have to be managed as multiple projects and was likely to take years to complete, with development costs running to several millions of pounds.

Many OCPs, both fixed and mobile, stated that without a feasibility study it is not possible to provide accurate information.

That said, the vast majority of the effort will be required to disaggregate the access and service components of the charge (largely to amend support systems and databases external from the retail billing systems) as well as to present itemised bills that split the two elements. OCPs' billing systems can already provide the required level of granularity; therefore little investment would be required for this aspect.

One large fixed OCP put the cost of a new release of billing software (which would both disaggregate the access and service components and well as present an itemised bill) in the region of GBP10 million and stated that it would not be available until 2013 at the earliest. Another suggested that network development would take between 18 and 24 months, costing in excess of GBP2 million for the IT elements and in excess of GBP500 000 for associated network changes.

Some of the smaller OCPs took a view that it would take at least 18 months (with design freezes) to enable any sort of tariff database table and look-up summary tables for the billing systems.

Unfortunately, OCPs were unable to provide a split of the effort between meeting the disaggregation and presentation requirements.

We believe that the potential scale of billing measures is such that it would not be practical to rely solely on modern rule-based billing platforms to deliver the capability in the absence of necessary enhancements to legacy billing systems and associated OSS.

4.1.5 Summary findings and recommendations

Disaggregation

In order to bill consumers the correct total amount whilst splitting the access and service components, we expect that OCPs would need to amend systems and databases outside their retail billing systems, although the extent of necessary modifications would vary considerably between OCPs (and MVNOs). The access and service components could then either be separately fed into the retail billing system (in the case of a modern rule-based system) or combined before being fed into the retail billing system (in the case of a legacy system) to apply the correct total charge for the call in billing the consumer.

Granularity

We established during our review of fixed and mobile operators and MVNOs that OCP billing systems can (or in some instances already do) provide a level of number range granularity and price points for each block of 10 000 numbers within a number range. Where operators choose to bundle non-geographic number ranges together, as is common in the mobile sector, this is not the result of any technical constraint on the part of the respective billing system(s).

Although administratively cumbersome, we believe that all OCPs could at least replicate BT's current level of billing (typically one price point for every block of 10 000 numbers within a number range) if mandated to do so. In fact, many billing systems (including BT's) could realistically go down to 1000 level of pricing.

Presentation

Similarly, OCP legacy billing system(s) would not be capable of the necessary bill presentation i.e. presentation in printed or electronic form of separate access and service charge elements and the necessary linking of wholesale and multiple retail systems and mediation interfaces.

The number of technical hurdles needed for each operator to address is not scalable in the confines of this review. However, we believe that the potential scale of the billing disaggregation measures and presentation is such that it would not be practical to rely solely on modern rule-based billing platforms to deliver the capability in the absence of necessary enhancements to legacy billing systems and associated OSS.

Finally, although not a technical matter in its own right, consideration should be given to simplifying and standardising the number of NGC price points in order to reduce the administrative burden on OCPs, and therefore reduce the risk of administrative mistakes and disputes occurring.

4.2 Pre-call anouncements (PCAs)

4.2.1 Delivery options

For the purposes of this study, Ofcom requested that the review focus on the technical and operational delivery of three possible PCA variants, namely:

A. "You will be charged '*x*' pence per minute plus your access charge."
B. "You will be charged a maximum of '*x*' pence per minute in total for the call."
C. "You will be charged a maximum of 'x' pence per minute plus your access charge."

In message types A and C above, the value of '*x*' represents the 'service charge' element defined as the TCP termination rate (see Figure 2.1).

The purpose of this section is to review and categorise the technical and operational strengths and weaknesses of each option for delivering message types A to C above, according to the point of delivery, e.g. OCP, TCP, SP and, where applicable, to the type of network (e.g. fixed, mobile, other). We have not conducted an independent cost analysis of possible solutions in order to determine the commercial viability of each option, however, we include cost and timescale estimates to the various options provided by our respondents during the interviews. As such these estimates do not reflect the view of Ofcom or Analysys Mason.

By reference to Figure 2.1, we discuss herein three points of delivery for PCAs, namely OCP, TCP and SP. For the purposes of this review, an SP may be an independent service or information provider directly connected to a TCP; alternatively, they may be connected to the TCP via a reseller.

As many resellers are either TCPs or have infrastructure, e.g. TDM switches or media gateways (MGWs), which would enable them to provide PCA solutions we have categorised reseller as TCP for the purposes of this study.

For SPs to provide message types A to C as PCAs, and ensure they are non-chargeable, requires termination equipment and infrastructure capable of providing a signalling interface to the terminating / originating exchange e.g. SS7 or SIP capability (see Section 4.2.3 *SPs*). As the vast majority of SPs do not have this capability it is unlikely that SPs will be able to apply the PCA directly. Small and medium-sized SPs indicated during the interviews that they would expect to have PCAs included as part of the service package from the reseller or TCP, as they would not have the capability (or the desire) to do this.

OCPs and TCPs have, to varying degrees and capability, the necessary infrastructure to provide all announcement variations listed above. The TCPs we interviewed all recognised that the terminating network could be regarded as the easier/more logical end at which to insert the PCA. However, all TCPs stated that it would take significant development to facilitate the use of PCAs.

In a telecoms environment where callers will be on different tariffs, resulting from a variety of price plans and tariff bundles, discounts, bespoke agreements etc., OCPs believe it would require complex

network and IT interactivity to deliver a message giving the correct price on a call-by-call, customer-by-customer basis.

For mobile OCPs, there is the question of what tariff information would/should be given to roamers (international and national), as the access charge element would be variable depending on the prevailing roaming agreements. Hence, a generic roaming message might be deemed more appropriate.

The merits and applicability of each delivery option is illustrated in Figure 4.1 and are described in more detail below:

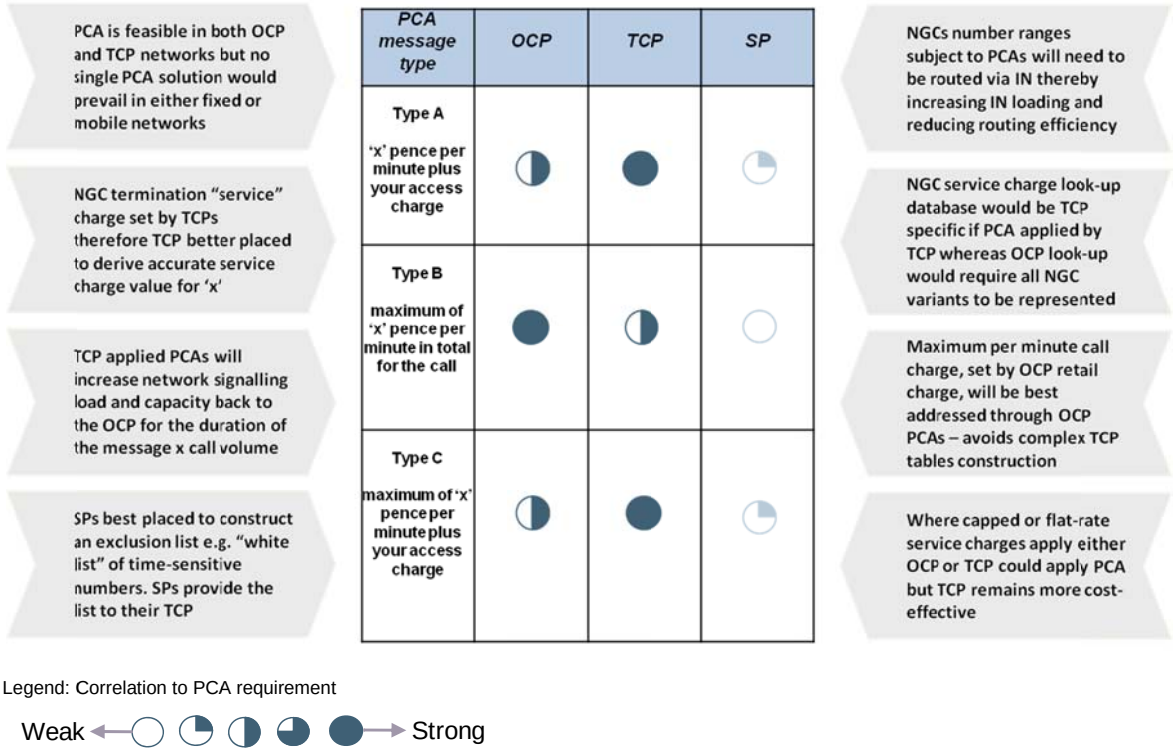

Figure 4.1: PCA delivery options [Source: Analysys Mason]

4.2.2 Current practices

The use of call announcements is now prevalent in most networks, especially where announcements have replaced old-style tones, e.g. 'the telephone number you have called is not available', rather than number unobtainable (NU) tone. Such generic messages are applied instead of tones by the relevant switches using basic pre-programmed audio cards.

The most commonly encountered non-chargeable PCA in use today is that used by mobile OCPs to indicate that calls to 0800/0500 numbers are not free from mobile networks. A typical mobile network 0800 PCA call treatment is as follows:

- the 0800 call passes through the mobile switching centre server (MSC server) MSS to the IN platform using CAMEL (CAP)
- IN obtains approval from the billing rating engine (both prepaid and postpaid) to ensure that the call can proceed (the signalling protocol used may be proprietary)

- the IN service logic adds a prefix number to the start of the dialled digits, which the mobile switching centre (MSC) uses to direct the call either to an MSC-based announcement system (basic audio cards) or an IVR/intelligent peripheral device
- a backwards speech path is connected back to the caller to play the standard 0800 'calls are not free from mobile networks' message, but the call is not established to the called number until the announcement message is complete
- on completion of the announcement (and the caller remains off-hook), the call is connected to the public switched telephone network (PSTN) (ISUP IAM is sent).

By exception to the above procedure, certain freephone numbers are treated as free from mobile networks compliant to exception lists (essentially an 'opt-out' list) produced by bodies such as the Helplines Association (THA) and the Department of Work and Pensions. Typically, these numbers provide access to social/government welfare or health and safety services. When such a number is called, the IN service logic returns an instruction to the MSC not to play the standard PCA and proceed to connect the call as free.

Other frequently encountered non-chargeable PCAs are used for TV voting or competition premium-rate services (PRS). Typically, non-chargeable PCAs are inserted when calls are made either prior to lines opening or after they have closed, the voting line has been excluded from the active list – e.g. the contestant has left, a capped number of entries has been reached or exceeded. Other specific call treatments may/will be included subject to the terms of the individual programme. Due to the special requirements of voting and competition lines, operators typically provide the call control and generic PCAs from a dedicated platform, e.g. BT manages and controls TV voting by use of its recorded information distribution Equipment (RIDE) platform. It is designed to terminate calls by playing the consumer a message rather than playing a message and routing the call on further.

Additionally, announcements may be mandated for certain PRS content, as described below, but these are generally applied on call completion and therefore chargeable.

The only recent example of a tariff based PCAs being applied to NGCs is to 070 personal numbers, following a directive by Ofcom in 2007. This resulted in a small number of OCPs deploying a range of PCA solutions based on low call volumes and the need for rapid deployment. As all solutions were subsequently removed shortly after implementation, in compliance with a retraction of the Ofcom directive, the suitability of the 070 solutions for variable tariff-based PCAs is discussed below.

Since the removal of the 070 PCA, no UK operator, regardless of network technology or type, currently deploys a non-chargeable PCA that includes a variable tariff component, due to cost of provision and there being no regulatory requirement to provide such announcements.

The following examples and illustrations are taken from our interviews.

OCPs

Within legacy TDM systems, whether fixed or mobile, the number of switch, IN and IVR (media servers, etc.) variants results in a situation where few, if any, network configurations have the required announcement capability. Although standard call progress announcements are provided by each switch, this functionality is not capable of providing more flexible announcement services such as those expected for tariff-based PCAs.

The key findings from fixed OCPs are:

- Investment constraints: Many OCPs would not be able to deliver PCAs without considerable investment in their legacy circuit-switched networks, especially where TDM digital local exchanges (DLE) do not have PCA capability (the feature having never been a design requirement).

- Routing arrangements: OCPs invariably route UK-originated NGC off-net calls on a near-end handover (NEHO) interconnect basis to the terminating operator (this includes ported numbers). As a consequence no IN intervention is applied to call processing by the OCP. This includes all NGC number ranges that are not hosted or terminated on the originating network.

Many TDM local switches do not have SSP/SCP/IN capability and do not presently provide any PCAs for originating traffic (this also applies to where the OCP is a TCP in respect of terminating traffic).

It was evident from our interviews that not all mobile operators deploy IVRs (or intelligent peripherals) for outgoing call announcements or, even when they do, that not all types of IVR can access external databases (i.e. external to the IVR) necessary to determine which tariff to insert into the PCA. One mobile operator stated that its legacy IVR platforms, which have the capability to interrogate external databases, are in the process of being replaced by IVRs that do not have this capability.

OCPs informed us that solutions used for 070 were essentially rushed, temporary solutions (which were subsequently removed at short notice), and are not scalable for all NGC ranges due to capacity limitations and throughput. OCPs frequently routed calls to core (trunk) switches (or similar) that had the necessary IN interfaces to suitable IVRs (the most commonly proposed 070 solution with the exception of BT's use of RIDE). Where IVRs or intelligent peripherals were not available, mobile operators simply installed the requisite 070 PCA on the same media gateways used for 0800 call announcements.

In some instances, IN platforms used for advanced call processing may be located outside the UK. For example, one OCP has a shared IN resource for all its European operations located in Germany. As a consequence of sharing an IN resource across national boundaries, the IN will, to a greater or lesser extent, be constrained in terms of its flexibility to provide different features. However, the OCP has to provide different call treatments in each country to suit prevailing national telecoms regulations so a centralised (remote) IN resource should not be a barrier to PCA provision.

TCPs

The majority of TCPs interviewed maintain legacy TDM-based voice networks, running a variety of local switch and MSC configurations from different vendors.

Few of the resellers we interviewed have any real experience in the delivery of PCAs; where they had, this was often gained in other European or global markets.

Resellers stated they would have to develop the capability for PCAs when acting as a TCP, i.e. when terminating NGCs, as no reseller we interviewed had implemented this requirement in the UK. Some resellers have implemented tariff-based PCAs in Austria, Italy and France in order to comply with prevailing national legislation.

One UK TCP, with operations in the Netherlands, who is obliged to provide announcements for NGCs as a TCP in conjunction with the SPs (see Annex D.2.3), suggested that the solution applied in the Netherlands could be investigated to determine its suitability for using PCAs in the UK.

From our interviews we established that, in many cases, resellers have the ability to provide non-tariff specific PCAs when acting as the OCP, i.e. when their own customers originate calls using the reseller's switch – typically a hosted private branch exchange (PBX) or Centrex solution. Those resellers that do not have the capability at the moment believed that it might be possible to adapt/develop their systems to meet the PCA requirements, by, e.g., using their voicemail platforms.

SPs

The vast majority of small and medium-sized SPs interviewed for this study rely on their TCP or reseller to insert a welcome salutation for in-bound NGCs. The announcement, and any resultant IVR interaction by the caller, is deemed to be part of the answered call and therefore chargeable.

Large SPs, managing in-bound NGCs on large contact centre platforms, will be able to offer a wider range of tailored salutations and IVR call control, but these too form part of the chargeable element of a successful call treatment, not a non-chargeable PCA.

Premium-rate SPs (typically those using 09x number ranges) apply chargeable call announcements as a matter of policy, both for advisory and regulatory reasons. The announcements provide information such as the name of service, service detail and an over-18 warning (where mandatory). The announcements are not treated as non-chargeable as technically they cannot be applied until the call is answered as many SPs do not have Class 5 Switches with the correct exchange signalling interface.

4.2.3 Technical assessment

It is evident from our interviews, as well as the international case studies, that there is no standard approach to how existing announcements are, or have been, implemented. This also applies to the degree of 'intelligence' embedded in operators' networks that would enable flexible tariff-based

PCAs to be realised in a universal fashion. As a consequence of our investigations, there are three key observations, which are outlined below:

- PCA is feasible in both OCP and TCP networks but no single PCA solution would prevail in either fixed or mobile networks.

- Dynamic (flexible) tariff-based PCA capability would have to be extensively developed and tested to ensure compliance to any mandated requirement. Interoperability testing would be required where the PCA is applied at the TCP to ensure that:
  - announcements were played correctly as non-chargeable events
  - timers did not force release of calls prematurely
  - calls matured successfully once the announcement had finished.

- To obtain and insert the correct 'x' value into the relevant PCA, a service charge database i.e. a look-up function for use in real-time call set-up, would need to be developed and maintained. For PCA message types A and C, this is likely to be a simpler task for TCPs to perform in real time.

There were concerns expressed during our interviews in respect of the provision of an accurate and meaningful PCA in the case of 118 (DQ) services where a connection fee and call charge component is used. Accuracy of information and relevance of the term access charge would need to be clarified.

We consider the implications of the above on each of the three delivery points outlined in Section 4.2.1.

OCPs

Generally speaking, PCA capability as mooted could be provided by extending the Service Logic and the capacity of the OCP IN platforms coupled with a corresponding enhancement to their respective announcement systems. All systems utilise at least one of the following protocols:

- INAP/CS1+ protocols in fixed TDM networks (e.g. using SCCP over MTP)
- CAMEL (CAP) protocols in mobile TDM networks
- SIP and Diameter (CCA) in IP-based (fixed or mobile) networks.

Where OCPs use basic call announcements, supplied either using direct switch interfaces, e.g. MSC/SSP media cards or applying basic IN Service Logic to MGWs, there will be a physical limit on the total duration of message storage capability. Typically, for a medium-sized MSS/MGW combination, this might be 250 minutes. Procurement of larger MGWs would be required where total system/network message storage is likely to exceed this threshold. This is particularly relevant where an operator (OCP or TCP) chooses to record and store individual announcements for every PCA permutation rather than have an 'envelope message' into which the relevant tariff value is inserted and 'read' (the latter is only likely to be possible using intelligent peripherals / specialised resource function (SRFs)).

For message types A and C to be applied correctly, each OCP would have to acquire the service charge for each block of NGC numbers. The service charge would have to be available from a high-availability database or IN cache to guarantee real-time access during call set-up. This is a relatively high-risk and potentially costly strategy, as there is no real precedent for such a potentially complex service affecting database in use today.

One solution, proposed by several OCPs, billing and IN vendors, would be to use an XML-based protocol such as Simple Object Access Protocol (SOAP) to interrogate billing systems or non-IN related databases to create the necessary NGC tariff look-up tables. It was suggested that the table would have to be a 'high-level' summary table to ensure speed of access and retrieval.

In order for OCPs to apply non-chargeable dynamic tariff-based PCAs, this would require, but not be limited to:

- all NGCs (or at a minimum those in specified number ranges and/or above a certain cost threshold) to become advanced calls, i.e. subject to IN multi-leg call treatments
- creation, administration and utilisation of an NGC service charge tariff look-up database or cache. Such information, where available to the OCP, will normally only be stored in off-line bill-rating engines and/or external administrative billing or tariff databases which are not designed for real-time access by network/IN systems. This will require the development of operational support systems (OSS), which is needed to ensure correct tariff data link to the billing system(s)
- sufficient signalling and service logic capacity to handle all potential PCA combinations within the relevant number groups and service charges
- addition of new IN service logic
- sufficient media server (or equivalent intelligent peripheral) capacity to play the number of announcements variants
- application of (or in the case of mobile OCPs the extension of) an 'exclusion list' to ensure PCAs are not applied when calling a time-sensitive or machine-to-machine NGC number
- OSS development to correlate additional partial call records, and apply new billing treatment rules for calls 'abandoned during tariff announcement'
- update statistics systems to report calls abandoned with new cause.

In consideration of the above requirements, it is presently standard industry practice for NGCs originating on a fixed local switch to be analysed and routed at the 10 000 number block level. Where the number range is hosted by the OCP, the call will typically be sent to the trunk layer to access the NTS (or equivalent) service, whereas calls to other TCP's number ranges are sent to the appropriate TCP at the nearest point of interconnection. This is regarded as the most efficient way to route calls as it does not involve IN intervention by the OCP.

The key steps in call processing which would be needed are:

- identify the origination of the call both by customer type and network (e.g. prepaid/postpaid, business/residential, fixed/mobile)

- decode the dialled number to a tariff list (interface to either an off-platform database or cache held on-platform and updated with a tariff feed)
- look-up the tariff list against a list of announcements to determine the correct announcement ID
- connect the caller to the correct announcement and play it (backward audio path connected to the caller)
- detect the end of the announcement
- hold the call long enough for the caller to hang-up (and prevent the call being charged)
- disconnect the caller from the announcement system
- continue call processing to determine destination
- connect the caller to the destination (normal call processing, e.g. ISUP IAM sent)
- correctly handle exception case if the caller hangs-up during the announcement or post announcement delay timer.

Applying PCAs at the OCP will require them to route all NGCs to their IN, possibly via the trunk layer. Given the call volumes involved this would (a) be regarded as inefficient, and (b) require significant expansion of their IN (and transit) capacity. Although mobile OCPs already provide IN call treatment for 0800/0500 freephone numbers (i.e. to insert the standard charging announcement) the additional load to analyse all NGCs in this manner would doubtless also exceed the IN capacity of the mobile OCPs.

A further inevitable consequence of the application of the PCAs is that call-holding times will increase by the average announcement length, which will result in an increase in network capacity requirements (switch and transport systems).

Subject to the outcome of network-specific feasibility studies, we concur with the view expressed by all OCPs interviewed (fixed or mobile) that the PCA requirement is likely to exceed the current equipment processing and storage capacity of their respective networks.

In consideration of the above, OCPs are better placed to offer a more cost-effective solution to providing message type B *("maximum price per minute in total for the call")* as this option only requires knowledge of the retail charge by number range (data that OCPs will already have, albeit not necessarily in the correct form for a PCA tariff look-up table).

OCP management of time-sensitive and machine-to-machine numbers

To manage and effectively control the exclusion of PCAs from time-sensitive or machine-to-machine (M2M) numbers will require the introduction or extension of the 'exclusion list' scheme used today by mobile network operators for certain nominated freephone numbers. This is a feature controlled by an intelligent network (IN) that requires the construction and maintenance of a 'look-up' table of applicable time-sensitive/M2M numbers to exclude the playing of a PCA. If PCAs were applied by OCPs then the exclusion list would have to be supplied and updated either by every SP or a nominated third-party organisation(s) responsible for collecting and distributing the excluded numbers list. There was no clear view as to the procedures to create and maintain an

accurate list amongst the OCPs interviewed, especially the fixed operators who do not utilise a scheme similar to the mobile operators, other than to recognise that it would be both administratively costly with a high resource overhead.

MVNOs

To implement the PCA (and billing support), the host mobile operator would have to recognise the customer and access the appropriate price plan, assemble the appropriate charge, and then play the announcement before completing the call. MVNOs do not have any interfaces at a level which would enable them to do this or configure the host mobile operator to do it on their behalf. They would simply have to submit business requirements to the host mobile operator under their services agreement.

TCPs

In most regards, the technical solutions and options detailed above for OCPs also apply to TCPs. The most significant difference is in terms of scale and application as each TCP/SP has only to create and maintain an NGC tariff database relevant to its own (hosted) non-geographic number ranges. Depending on the size of the hosted number ranges, this will significantly reduce (a) the cost of IN and peripheral upgrades, and (b) the cost to create and administer the necessary tariff data and ensure its accuracy.

For this reason, allowing for the increased network loading arising from the PCA being played from by the termination network, TCPs/SPs are better placed to offer a more cost-effective solution to providing PCA message types A and C. The reverse would be true where TCPs/SPs were required to provide PCA message type B as they would have to create and administer a database of all OCP retail charges.

If TCPs were required to provide PCA message Type B, concern was expressed about the difficulty involved in obtaining comprehensive charge information from third parties, and thought that an industry-wide common database solution, similar in scale to the proposed number portability database, would be both overly complex and highly risky.

TCPs concurred with our view that development of the capability would be required, especially where the PCA is non-chargeable and part of the call set-up, as it would involve complex signalling interactions, e.g. INAP/CS1+ or CAMEL, between the switches, SCPs, IN and IN peripherals.

In the Netherlands, TCP/SPs are obliged to provide announcements for NGCs, and a similar regime was mandated to commence in 2010 in France. In such circumstances, these solutions could be investigated to determine their suitability for using PCAs in the UK. However, in each case the additional overhead (both hardware, software and administration) of acquiring the service charge, either from the billing system or a central database of tariffs, would have to be factored in. As the latter does not exist in any TCP network, it would have to be developed from scratch, resulting in an extensive development programme (see indicative cost/timescales below).

TCP management of time-sensitive and machine-to-machine numbers

As stated in the OCP section above, only SPs will know what equipment or service conditions apply to specific mission or service-critical time-sensitive/M2M numbers under their control and management. It should therefore be a more cost-effective and straightforward option for SPs to inform (or work with) their respective TCPs to create a list of non-geographic numbers to be excluded from PCAs. NGCs would still have to be subject to IN intervention for call control.

SPs

The type of terminating equipment used by SPs will determine if a non-chargeable PCA could be applied. NGCs received by all but the largest SPs will normally terminate on individual fixed or mobile handsets, small multi-line telephone systems or non-Class 5 switches, IVRs or basic contact centre platforms. As none of these systems has a suitable signalling interface to the TCP, i.e. absence of SS7 (ISUP) or SIP signalling, NGCs would have to be answered if the SP were to play a PCA, thus making the PCA chargeable.

Small and medium-sized SPs would expect the reseller or TCP to provide any/all necessary tariff information for use in either the PCA and/or the associated billing systems.

Where SPs have the appropriate signalling capability, the call treatment will be the same as for TCPs.

SPs should be obliged to inform their respective TCP of any/all mission and service-critical numbers that would need a PCA to be excluded i.e. not played for operational or performance reasons.

4.2.4 Estimates of implementation cost and timescale

Again, it was evident that interviewees had not investigated in detail the cost and effort required to implement PCAs. Consequently, the cost and timescales estimates provided by interviewees should be viewed as initial, high level estimates. Costs will occur at two levels to:

- upgrade the capability of the network (broadly a fixed cost dependent on the current capability of each operator)
- increase relevant network / IT capacity (which is dependent on the number of NGCs to which PCAs are applied).

Estimates provided herein are primarily for capability upgrade only and additional capacity costs would have to be factored in as a result of a more detailed cost study.

The largest fixed operators stated that a timescale of 18 to 24 months is estimated to be required to develop the PCA requirement as either OCP and/or TCP and implement/commission it into the network (in the absence of conducting a full feasibility study), subject to the actual detail required to be included in the tariff announcement.

Both fixed and mobile operators (OCP/TCP) stated that their switch networks were generally only at an early stage of redevelopment towards next-generation technologies. Their roadmaps include limited deployment of next-generation solutions to overcome obsolescence in the access layer or to provide services to new-build areas, as well as introducing niche services over the next two to four years. None of the OCP/TCP respondents foresaw wholesale network replacement by next-generation technologies within the next five to ten years – hence, the DLE (and intelligent peripheral) limitations of the present TDM network in providing PCAs will remain in place for some considerable time.

Estimates for the cost of upgrading the networks of OCPs (and the associated TCP elements where OCPs host NGC number ranges) varied according to network size, topology and NTS traffic. In general terms, costs were estimated to be around GBP1 million (plus) for smaller networks, and between GBP5 million and GBP10 million for larger fixed and mobile networks.

TCPs quoted development timescales between 18 and 24 months for the enhancements, with costs ranging from GBP300 000 (small in-house network configuration changes) to GBP2 million for network and IT related solutions (inc. IN and OSS).

In respect of developing accessible tariff tables for use with PCAs and retail (OCP) billing systems, respondent views and system capabilities differed widely. One respondent stated that although its proprietary billing system contained all reseller tariffs for 'on-net' NGCs, it would cost something in the region of USD150 000 and a period of six months to develop a real-time data access capability. In contrast, another reseller stated that the total cost for developing a tariff information-based PCA solution, including the billing elements, in such a way as not to require significant changes to its system infrastructure and call set-up/holding times, could take more than 18 months, with cost running to GBP1 million or more.

Subject to the size and complexity of the respective OCP and TCP networks, the estimates provided by our respondent operators demonstrate that OCP costs would be three to ten times as much as equivalent TCP-provided solutions (taken across all PCA message types).

This is also borne out by our international analysis, as the study commissioned by ARCEP[1] in France estimated that for a contact centre that receives 7500 calls per hour at its busiest time of the day, the set-up cost to be able to deliver a PCA (similar to message type A) would be EUR10 000. On the other hand, if the announcement were to be delivered by the OCP, the same study estimated that it would cost EUR100 000–200 000 for each telephony switch, plus an incremental investment of EUR1 million to upgrade the intelligent network platform in order to obtain the details of all SP tariff plans from a commercial database.

[1] Mentioned in *Avis n° 2009-0482 de l'Autorité de régulation des communications électroniques et des postes, en date du 2 juin 2009, sur le projet d'arrêté du ministre chargé de l'économie relatif à l'information sur les prix des services vocaux à valeur ajoutée*, available at http://www.arcep.fr/fileadmin/reprise/dossiers/sva/dossier-sva-110609.pdf.

4.2.5 Summary findings

The IN Service Logic (rule-based files) applied by UK operators would have to be upgraded to implement dynamic tariff-based announcements. The extent of Service Logic upgrade varies significantly between OCPs and TCPs, as does the capability of their actual announcement platforms. In many instances, existing switch and announcement platforms can only support rudimentary scenarios. Operators will have to consider the most appropriate switching and announcement solutions to suit their expected traffic volumes and NGC usage to ensure efficient delivery without extending the call set-up time and network loading.

Consequently, operators will be required to embark on a cost-based analysis of the most appropriate solution to meet Ofcom's PCA (and associated billing) requirements.

Based on the provisional estimates provided by the OCPs/TCPs, OCP-based PCA solutions would cost between three and ten times as much as equivalent solutions provided by TCPs (taken across all PCA message types) and would take between 18 to 24 months for the largest fixed and mobile operators to provide.

Based on our solution assessment, we find that:

- PCA message types A and C are most cost effectively implemented by TCPs/SPs
- PCA message type B is best implemented by OCPs (resulting from existing knowledge and application of NGC retail pricing)
- exclusion from PCA call treatment for time-sensitive and M2M numbers is managed by the implementation of an exclusion list under SP control. This becomes more manageable and cost-effective when PCAs are implemented by TCPs

Mitigation of risk

The present complexity and variable nature of the NGC pricing regime will undoubtedly result in costly PCA solutions. Where PCAs are deemed to be appropriate, more cost-effective PCA solutions are likely to result from a simplified and consistent set of NGC tariffs. We believe the following should be considered in order to mitigate/manage the risk:

- To reduce the cost of implementation, PCAs should only be applied on defined PRS number ranges or on NGCs above a certain cost threshold.

- PCA message lengths should be consistent and as short as possible to avoid undue post-dial delay and call holding.

- Introduction of PCAs should be phased-in by number range over a defined period of time, e.g. three to six months per range to (a) avoid network overload, and (b) manage the risk associated with time-sensitive and M2M numbers.

- Clarification as to the required degree of accuracy to be applied to PCA tariff information (allied to billing tables) as the higher the degree of accuracy, the more expensive the delivery solution will be.

Without careful management and rigorous testing, we believe that a PCA 'opt-out' scheme applied to time-sensitive and M2M numbers could lead to health and safety risks where not all vulnerable numbers are included in the 'exclusion list'. Many services would appear to fail without reason, e.g. call timers, post-dial delay impact on the operation of data modems, emergency alarm systems protecting life and property. These would have to be investigated, tested, and remedial action taken.

The benefits of an 'opt-in' system applied to all non-geographic number ranges would be that it would allow for network load to rise more slowly and in a more controlled fashion. It would also ensure that PCAs were not applied to time-sensitive, mission-critical or M2M services, thus avoiding the problems that arose when PCAs were originally applied to 070 personal number ranges.

In the case of time-sensitive services, VoIP-based resellers cannot run conventional data modems over VoIP networks, so they would not be directly affected by possible M2M problems such as those encountered in the 070 case. Social alarm systems, which might be IP based, could operate over VoIP networks.

In recognition that only the actual supplier of time-sensitive services will know a) what type of service is being offered and why it should be considered for special consideration and b) what equipment characteristics will determine if a PCA-based NGC will or is likely to fail, we recommend the following:

- The onus should be on the SP to acquire and nominate any/all non-geographic numbers under their management that they regard as time-sensitive or M2M.

- A 'white list' of time-sensitive numbers (defined as above) should be created.

Note: We have not specifically investigated the merits of the type of PCA system mandated in France where the consumer may decide to skip the PCA by pressing the '#' key (or by another similar process). French consumers may also explicitly request not to be provided with the PCA for one or more non-geographic numbers for up to three months. However, any change in the cost of the service within the specified period will override this request and will lead to the PCA being played again.

All such features would be possible, if deemed desirable in the UK, but would add further complexity to the realisation of NGC PCAs through the use of IVR-like management of dialled digits and CLI recognition and control by the TCPs/SPs.

5 Conclusion

This section lists the key findings from our interviews with NGC providers and users regarding the implications of implementing disaggregated billing measures and the provision of PCAs.

5.1 Billing measures

OCPs informed us that a thorough design and functional capability review of their respective billing systems, external charging databases and OSS would be required to determine the degree of technical difficulty in complying with the three proposed billing measures (disaggregation, granularity and presentation).

We expect that the vast majority of the effort will be required to disaggregate the access and service components of the charge (largely to amend support systems and databases external to the retail billing systems) as well as to present itemised bills that split the two elements. OCPs' billing systems can already provide the required level of granularity; therefore little investment would be required for this aspect.

OCPs (fixed and mobile) were not clear on the timescales and cost requirements and would need to conduct a feasibility study. OCPs (fixed and mobile) estimated the time period to extend both IT and network capabilities to both disaggregate the access and service components and well as present an itemised bill to be 18–24 months at a cost of between GBP2 million to GBP10 million (plus) depending on the size and complexity of the billing system(s).

5.1.1 Bill disaggregation

In order to bill consumers the correct total amount whilst splitting the access and service components, we expect that OCPs would need to amend support systems and databases outside their retail billing systems. The access and service components could then either be separately fed into the retail billing system (in the case of a modern rule-based system) or combined before being fed into the retail billing system (in the case of a legacy system).

5.1.2 Billing granularity

We believe that all OCPs/MVNOs could at least replicate BT's current level of billing (typically a single price point for every block of 10 000 numbers within a number range). Where operators choose to bundle non-geographic number ranges together e.g. mobile sector, this is not as a result of any technical constraint on the part of the respective billing system(s).

5.1.3 Bill presentation

OCPs' legacy billing system(s) would not be capable of the necessary bill presentation i.e. presentation in printed or electronic form of separate access and service charge elements and the

necessary linking of wholesale and multiple retail systems and mediation interfaces. The potential scale of the billing disaggregation measures and presentation is such that it would not be practical to rely solely on modern rule-based billing platforms to deliver the capability in the absence of necessary enhancements to legacy billing systems and associated OSS.

5.2 Pre-call announcements (PCAs)

PCA is feasible in both OCP and TCP networks but no single PCA solution would prevail in either fixed or mobile networks. Dynamic tariff-based PCA capability would have to be extensively developed and tested to ensure compliance to any mandated requirements.

Efficient delivery of PCAs is essential to avoid extending the call set-up time and network loading against OCP / TCP expected traffic volumes and NGC usage. Call-holding times will increase by the average announcement length, which will result in an increase in network capacity (switch and transport systems).

IN service logic would have to be upgraded to implement dynamic tariff-based PCAs, and there is significant variance in the capability i.e. degree of 'intelligence' of OCP and TCP announcement platforms. A service charge database (i.e. a look-up function for use in real-time call set-up) would need to be developed and maintained.

Based on provisional estimates provided by the OCPs/TCPs, OCP-based PCA solutions would cost three to ten times as much as equivalent TCP-provided solutions (taken across all PCA message types) and would take between 18 to 24 months for the largest fixed and mobile operators to provide.

5.2.1 OCP

Applying PCAs at the OCP will require routing all designated NGCs to their IN, possibly via the trunk (transit) layer, which given the call volumes involved would:

- be regarded as inefficient
- require significant expansion of IN, and where necessary, trunk (transit) capacity.

OCPs are better placed to offer a more cost-effective solution to providing message type B *("maximum price per minute in total for the call")* as this option only requires knowledge of the retail charge by number range (data that OCPs will already have, albeit not necessarily in the correct form for a PCA tariff look-up table).

5.2.2 TCP

The most significant difference from OCP-provided PCA is in terms of scale and application, as each TCP has only to create and maintain an NGC tariff database relevant to its own (hosted) non-geographic number ranges. Where TCPs provide the PCA, network load back to the OCP will increase as a direct result of PCAs being played.

Depending on the size of the TCP hosted number ranges, there will be a significant cost reduction in respect of:

- IN and peripheral upgrades
- creation and administration of the necessary tariff data and degree of accuracy.

TCPs are therefore better placed to offer a more cost-effective solution to providing PCA message types A and C. The reverse would be true where TCPs were required to provide PCA message type B as they would have to create and administer a database of all OCP retail charges.

5.2.3 SP

In the vast majority of cases SPs do not have the right signalling connectivity to the TCP to support non-chargeable PCAs. However, SPs will know (or can create) a list of any/all non-geographic numbers under their management that they regard as time-sensitive or M2M.

5.2.4 PCA findings

Based on our solution assessment, we find that:

- PCA message types A and C are most cost effectively implemented by TCPs/SPs
- PCA message type B is best implemented by OCPs (resulting from existing knowledge and application of NGC retail pricing)
- PCA call treatment for time-sensitive and M2M numbers to be managed by the implementation of an exclusion list under SP control - this is more manageable and cost-effective when PCAs are implemented by TCPs.

5.2.5 PCAs in other countries

Our research of how PCAs for NGC services are implemented technically in Australia, the Netherlands and France has been limited by what information is available in the public domain. No specific technical information is provided by any of the administrations reviewed.

The party responsible for supplying the PCA varies across the case studies; for example, in France it is the SP, whilst in Australia it is the joint responsibility of the TCP and SP. Although there is some slight variance in the actual rules applied in each country, they all ensure that call costs should be clearly stated in terms of communication (access) and service charges, or the total cost per minute. It is also evident that, in each case, the regulator has set a threshold level to apply to PCA implementation. This threshold level is based on either the PCA only applying to certain premium-rate non-geographic number ranges, or where call costs exceed a cost-per-minute threshold.

We were unable to find any publicly available information in respect of billing disaggregation and presentation in these three countries.

Annex A: Definitions of terms used in this report

ACA	Australian Communications Authority (now Australian Communications and Media Authority, ACMA)
ACM	Address complete message
ACSEL	Association de l'économie numérique
AFMM	Association Française du Multimédia Mobile
API	Application program interfaces
B2B	Business to business
CAMEL	Customised applications for mobile networks enhanced Logic – CAMEL architecture is based on the IN standards for use in mobile networks
CDR	Call detail record
CLI	Calling line identity
COBRA	Common object request broker architecture – a standard that enables software components written in multiple computer languages and running on multiple computers to work together
COIN	*Vereniging Communications Infrastructure* (Communications Infrastructure Association)
CPG	Call progress
CS1+	Capability Set 1 is a set of International Telecommunications Union – Telephony standards Q.1210–Q.1219
DCCA	Diameter credit-control application – a Diameter application used for credit control
Diameter	A computer networking protocol used for authentication, authorisation and accounting (AAA)
DLE	Digital local exchanges
DTMF	Dual-tone multi-frequency
FFT	Fédération Française des Télécoms
GUI	General user interface
HTTP	Hypertext transfer protocol
IAM	Initial address message
IN	Intelligent network – a network architecture used in both fixed and mobile works providing value-added services. The intelligence is provided by network nodes on the service layer as distinct from the switching layer
INAP	Intelligent network application part
Information provider	Alternative name for service provider
IP	Internet protocol – a protocol used for communicating data across a packet-switched network
ISUP	ISDN user part
IVR	Interactive voice response – a technology that allows a computer or telephone systems to detect voice and dual-tone multi-frequency signalling (DTMF) keypad inputs
M2M	Machine to machine
MGCP	Media gateway control protocol
MGW	Media gateway

MNO	Mobile network operator
MSC	Mobile switching centre
MVNO	Mobile virtual network operator
NEHO	Near-end handover
NGC	Non-geographic calls
NTS	Number translation service – the translation/re-routeing of calls made to non-geographic numbers to fixed or mobile termination points for delivery purposes (these may be off-shore)
NU	Number unobtainable
OCP	Originating communications provider – the entity (network) hosting the caller, also responsible for billing the calling party
OSA	Open services architecture
OSS	Operational support systems
PBX	Private branch exchange
PCA	Pre-call announcement
PRS	Premium rate services
PSTN	Public switched telephone network
Reseller (or Aggregator	Aggregating service providers who control multiple non-geographic numbers, often across several ranges. Resellers sell access to individual or groups of non-geographic numbers to information providers and generally negotiate with TCPs for services
RIDE	Recorded information distribution equipment
RTP	Real-time transport protocol
RUDE	Regulation concerning the universal provisioning of services and consumer concerns)
SBC	Session border controller – a device used in some Voice over Internet Protocol (VoIP) networks to exert control over the signalling and interactive media communications
SBC	Session border controllers
SCP	Service control point – a standard component of an IN telephone system which is used to control the service
SDP	Service data points
SIP	Session initiation protocol – a signalling protocol, widely used for controlling multimedia communication sessions such as voice and video calls over Internet protocol (IP)
SOAP	Simple object access protocol – an XML-based protocol specification for exchanging structured information across internet web-based services
SP	Service provider – the entity (individual or company) using the non-geographic number
SRF	Specialised resource function
SS7	Signalling system No. 7 – a set of telephony signalling protocols used in public switched telephone networks (PSTN) and mobile networks
SSCP	Systems security certified practitioner
SSP	Service switching point – the switching component of a telephone exchange
TCAP	Transaction capabilities application part
TCP	Terminating communications provider – the entity (network) hosting the called number

TDM	Time division multiplexing
THA	The Helplines Association
TISSC	Telephone Information Services Standards Council
WIN	Wireless intelligent network
XML	Extensible mark-up language

Annex B: PCA questionnaire

Feasibility study into tariff information and billing measures for non-geographic calls (NGC)

As part of the on-going Ofcom review on the future of Non-Geographic Calls (NGCs) we have been engaged to investigate, with input from Communications Providers (CPs), Service Providers (SPs) and equipment / solutions vendors, the technical and operational options and issues concerning provision of Pre-Call Announcements (PCAs) and the ability to produce customer bills showing the split of costs associated with the provision of NGCs.

Without prejudice to the outcome of Ofcom's review, the generic scenarios under investigation are the provision of PCAs, and associated bill production, that would allow the following announcements:

a) You will be charged x pence per minute plus your access charge

b) You will be charged a maximum of x pence per minute in total for the call

c) You will be charged a maximum of x pence per minute plus your access charge.

We intend to conduct a series of industry-wide telephone interviews or brief face-to-face meetings to understand:

- What are the present technical methods / solutions available for the introduction of PCAs and printed / electronic billing information?
- Can these present solutions address the requirements for the above?
- How might/will solutions capable of addressing the above scenarios be implemented?
- What constraints do you see in the provision of the above (are these technical or commercial/financial)?
- What are the expected or likely cost / timescale implications in the provision of the above scenarios (general estimations will be adequate at this time where actual costs are not known)?

The following questions include, but are not limited to, the type of information we would like to gather as part of the Ofcom review process:

Pre-call announcement (PCA)

1. How and where in your network / solution architecture do you apply existing call announcements?

2. Please supply a schematic of a typical / standard implementation.

3. Are any of these announcements PCAs? If so, what information do these announcements contain and what triggers the PCA?

4. Is the PCA free at the time of delivery or is it included as part of the chargeable call?

5. Typically, how long do each of the announcements last? Is there any minimum or maximum duration to an announcement?

6. Can or will PCAs be excluded from calls to time sensitive NGCs e.g. social / health helplines and/or for machine-to-machine services e.g. alarm numbers?

7. What signalling systems and/or protocols are used between network elements responsible for determining the need for an announcement e.g. dialled digits / number range, call routing, tariff or number range look-up tables etc?

8. What is the development "Roadmap" for announcement services?

9. Please supply a schematic of a proposed implementation i.e. how does/will this differ from the present solution?

10. What developments, if any, do you believe are/would be required to enable delivery of PCAs capable of delivering any combination of announcements listed above – this includes options for insertion of the PCA at either the originating or terminating network or SP?

11. What are the expected or likely cost / timescale implications in the provision of the above scenarios (note: general estimations will be adequate at this time where actual costs are not known)?

Annex C: Billing disaggregation questionnaire

Feasibility study into tariff information and billing measures for non-geographic calls (NGC)

As part of the on-going Ofcom review on the future of Non-Geographic Calls (NGCs) we have been engaged to investigate, with input from Communications Providers (CPs), Service Providers (SPs) and equipment / solutions vendors, the technical and operational options and issues concerning provision of Pre-Call Announcements (PCAs) and the ability to produce customer bills showing the split of costs associated with the provision of NGCs.

Without prejudice to the outcome of Ofcom's review, the generic scenarios under investigation are the provision of PCAs, and associated bill production, that would allow the following announcements:

a) You will be charged x pence per minute (ppm) plus your access charge

b) You will be charged a maximum of x ppm in total for the call

c) You will be charged a maximum of x ppm plus your access charge

We intend to conduct a series of industry-wide telephone interviews or brief face-to-face meetings to understand:

- What are the present technical methods / solutions available for the introduction of PCAs and printed / electronic billing information?
- Can these present solutions address the requirements for the above?
- How might/will solutions capable of addressing the above scenarios be implemented?
- What constraints do you see in the provision of the above (are these technical or commercial/financial)?
- What are the expected or likely cost / timescale implications in the provision of the above scenarios (general estimations will be adequate at this time where actual costs are not known)?

The following questions include, but are not limited to, the type of information we would like to gather as part of the Ofcom review process:

Billing

1. Is your present billing solution / implementation capable of disaggregating (separating) network access charges from service provision charges?

2. If so, is this feature enabled or what actions are necessary to enable the feature?

3. If not, what additional information or system development is required to enable such a feature?

4. Please supply a schematic of a typical / standard implementation.

5. What constraints do you see in the provision of any necessary upgrades e.g. granularity of digit decode / number ranges (are these predominantly technical or commercial/financial)?

6. What level of granularity can your existing (or proposed) billing systems cope with i.e. degree of digit decode within each NGC number range e.g. greater or less than 10k (E digit)?

7. How would your billing system / solution acquire up-to-date tariff information needed to identify the service provision charge component?

8. What protocols (and/or signalling systems) are used between network elements responsible for determining the need for a split NGC bill e.g. CDRs, dialled digits / number range, call routing, tariff or number range look-up tables etc.

9. What is the development "Roadmap" for billing services capable of delivering such services?

10. Please supply a schematic of a proposed implementation i.e. how does/will this differ from the present solution?

11. What developments, if any, do you believe are/would be required to enable delivery of disaggregated billing solutions in conjunction with the PCAs listed above?

12. What are the expected or likely cost / timescale implications in the provision of the above scenarios (note: general estimations will be adequate at this time where actual costs are not known)?

Annex D: Approaches to PCAs taken in other countries

This annex summarises our findings based on review of publicly available information of regulatory decisions concerning the provisioning of PCAs for NGC services. Our research focused on understanding how regulators in other countries have implemented PCAs and whether they put forward any arguments – technical or economic – for the implementation they chose. Our analysis evaluates the situation in three countries:

- **France –** the French regulator ARCEP has recently implemented a set of rules for NGC services which exceed a designated call cost threshold (see D.1.3), the obligation came into effect from 1 January 2010
- **the Netherlands –** in late 2008, a new set of rules was introduced which made the provision of PCAs mandatory for certain designated non-geographic number ranges (see D.2.2)
- **Australia –** this is the longest-standing example of mandatory PCAs for premium rate service numbers in the 190 range (see D.3.3), with rules being implemented in January 2002.

Below we describe these three case studies in more detail. Please note that our research was carried out based on information in the public domain and was therefore limited to documents published by regulators and other stakeholders.

D.1 France

D.1.1 Overview of non-geographic numbers in France

There are 11 different number ranges for NGCs in France, as shown in Figure D.1.

Number range	*Description (cost from a landline unless specified)*	*Targeted by PCA regulation*
080	Free (originally free from a landline, now also included in mobile plans)	No
081	Less than EUR0.06 per minute (based on a 3 minutes call) Originally at a local rate from a landline, now more expensive, calling charge now included in mobile plans	Yes, from 1 January 2011
0820 and 0821	Less than EUR0.12 per minute	Yes, from 1 January 2011
0825 and 0826	Less than EUR0.15 per minute	Yes, from 1 January 2011
0884 and 0890	Less than EUR0.15 per minute	Yes, from 1 January 2011
0891	Less than EUR0.30 per minute	Yes, since 1 January 2010
0892	Less than EUR0.45 per minute	Yes, since 1 January 2010
0893	Less than EUR0.75 per minute	Yes, since 1 January 2010
0897	Less than EUR0.60 per minute	Yes, since 1 January 2010
0898	Less than EUR1.20 per minute	Yes, since 1 January 2010
0899	Other tariffs	Yes, since 1 January 2010
3XXX	Large price range, from free of charge to EUR1.35 per call + EUR0.34 per minute	Yes or no, depending on their cost

Figure D.1: Overview of non-geographic numbering ranges in France [Source: ARCEP]

D.1.2 Regulatory framework in France

Last year, France adopted its legislation to regulate NGCs. The telecoms regulator ARCEP had previously voiced concerns that there was growing consumer dissatisfaction resulting in a reluctance towards using non-geographic numbers. These concerns were confirmed by a study ARCEP had commissioned from the *Conseil général des technologies de l'information*[2] (CGTI, government body advising on ICT policy) in 2008.[3] In particular, non-transparency of the tariffs charged, questionable business practices of some SPs,[4] and the very high cost for mobile calls were pointed out as main reasons for consumer dissatisfaction.

On 10 June 2009, France's economics and finance ministry (*Ministère de l'économie, de l'industrie et de l'emploi*) adopted an *Arrêté*[5] (piece of legislation signed by a minister, but which did not come before parliament) mandating that tariff information has to be provided to users of NGCs by means of a PCA. All non-geographic numbers are affected by this *Arrêté* as long as the overall cost of a call to a number exceeds the price of a national call to a landline.[6] ARCEP stated that PCAs are introduced because "tariff information provided to consumers before the act of buying is a fundamental principle of economic rationality and consumer protection."

This regulation is currently in the process of being implemented by the *Direction générale de la concurrence, de la consommation et de la répression des fraudes* (department of the economics and finance ministry in charge of competition policy and consumer affairs). Part of it entered into force on 1 January 2010 for all NGCs where the overall cost from a landline exceeds EUR0.15 per minute or EUR0.15 per call. On 1 January 2011, the full legislation will be implemented including all other chargeable NGCs. However, it will not apply to services provided to professional users and some machine-to-machine (M2M) calls.[7]

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2 At the beginning of 2009, the *Conseil général des technologies de l'information (CGTI)* *Conseil général de l'industrie, de l'énergie et des technologies (CGIET).*

3 *Les services à valeur ajoutée : tarification de détail et déontologie*, Conseil général des technologies de l'information, October 2008, available at http://www.arcep.fr/uploads/tx_gspublication/Rap-CGTIsurSVA.pdf.

4 For example, missed calls to prompt consumers into calling back a premium rate number, or number that do not provide any service after a short period of activity but still make money out of the calls they receive.

5 *Arrêté du 10 juin 2009 relatif à l'information sur les prix des appels téléphoniques aux services à valeur ajoutée*, available at http://www.arcep.fr/fileadmin/reprise/dossiers/sva/dossier-sva-110609.pdf.

6 A national call is defined as a call within metropolitan France, thus excluding its overseas territories.

7 If M2M calls are part of a service which has been subscribed with a written contract, and whose tariff information abide by the existing regulation, they are excluded from the PCA requirement.

D.1.3 Implementation in France

As indicated above, all non-geographic numbers are regulated similarly with regards to PCA requirements.

Implementation across number ranges in France

The sole difference concerning the introduction of PCAs is the starting date for the implementation. The first numbers which have to feature PCAs were all non-geographic numbers with a cost exceeding either EUR0.15 per minute or EUR0.15 per call. All other number ranges that are chargeable above the price of a national call will have to introduce PCAs by 1 January 2011. The notable exceptions are 080 numbers (commonly referred to as *numéros verts*), which are free of charge. These will not be required to play a PCA, either from a fixed or mobile phone.[8] Similarly, services to M2M calls can be excluded from the requirement to play a PCA if they are part of a previously agreed written service contract. In addition, services to professional users (e.g. stock market information for financial professionals) do not fall under the remit of the legislation.

PCA standards in France

A PCA has to be implemented according to the following rules:

- it has to be free of charge to callers
- it has to last at least ten seconds and the end of the announcement has to be indicated by a sound signal, warning the customer that he/she is about to be connected to the chargeable service
- it must mention the price of the service itself and the calling charge (if there is any), or the way to obtain this information.

This effectively represents a so-called communication plus service or 'C+S' model, and it replicates what has been used for years for text-based and online services in France. From the information provided in the public domain, it does not become immediately clear how the charges for the different call elements, such as origination, transit, termination and service (see Figure 2.1) are allocated across the elements of the 'C + S' model. While it appears reasonable to assume that the cost of origination forms part of the 'C' and any charges levied by the service provider will be part of the 'S', it remains unclear how charges for transit and termination are treated.

The SMS+ system, adopted by the *Association Française du Multimédia Mobile* (AFMM, professional organisation to develop text-based services) has a standardised charging structure stating that the charges will be 'x Euros per text-message plus the price of a text message'.

[8] On 26 May 2009, the Minister of Treasury and the Secretary of State for Industry indicated that French mobile operators had agreed to include some non-geographic calls within their customers' plan. See: http://www.minefe.gouv.fr/discours-presse/discours-communiques_finances.php?type=communique&id=2949&rub=1

Similarly, online services such as online banking advertise their service as 'free of charge, except for the cost of the Internet connection'.

To obtain details about the price charged for the current call to a non-geographic number, a customer may be advised during the PCA to call '3008'. This is the number of a free-of-charge service, which can be provided by fixed and mobile OCPs. The origin of the call is automatically detected and tariff information is adapted accordingly.

Analysys Mason has carried out some test calls to this number to understand the information provided during this call. Examples of the information received through calls to '3008', with the intention to enquire about the price of a number in the 0820 number range, are as follows:

- from a landline – "From your landline in metropolitan France, [you will be charged] EUR0.11 per call and a maximum of EUR0.12 per minute"
- from a mobile phone – "From metropolitan France on your mobile phone (provided by operator x), [you will be charged] EUR0.12 per minute for the service and a maximum of EUR0.38 per minute for the communication".

ARCEP is responsible for ensuring that every operator voluntarily providing tariff information uses the short code '3008'.

The consumer may decide to skip the PCA by pressing the '#' key (or by another similar process). He may also explicitly request not to be provided with the PCA for one or more non-geographic numbers for up to three months. However, any change in the cost of the service within the specified period will override this request and will lead to the PCA being played again.

D.1.4 Arguments for PCA implementation in France

Economic arguments by ARCEP

ARCEP initially considered it legitimate that the OCP should be responsible for providing the PCA, as it is the company that bills the customer for NGCs. However, it concluded that it would be significantly cheaper if the SP were to be placed in charge of the PCA, especially given the 'C + S' cost structure of the PCA.

The 'C' is a standardised cost and can be easily referenced by mentioning to call '3008'. In contrast, the granularity of pricing information at the SP level is much higher. While SPs are aware of the price of their own service, OCPs will not be able to store detailed information on the cost of each different non-geographic number without developing a costly infrastructure.

A study commissioned by ARCEP[9] estimated that for a call centre that receives 7500 calls an hour at its busiest time of the day, the set-up cost to be able to deliver a PCA would be EUR10 000. On the other hand, if the announcement were to be delivered by the OCP, the same study estimated that it would cost EUR100 000–200 000 for each telephony switch, plus an incremental investment of EUR1 million to upgrade the intelligent network platform in order to obtain the details of all SP tariff plans from a commercial database.

This does not mean that the cost of the PCA has to be borne by the service provider alone. ARCEP actually favours a comprehensive renegotiation of interconnection and revenue-sharing agreements among the different actors of the value chain for NGCs.9

Technical solution presented by the FFT and ACSEL

In response to the *Arrêté* dated 10 June 2009, the *Fédération Française des Télécoms* (French Telecommunications Federation, FFT) and *Association de l'économie numérique* (Association of the digital economy, ACSEL) submitted a technical proposal to realise the implementation of PCAs for NGCs in France. This solution is termed *Technique du pré-décroché* (pre-pick-up technique) and is illustrated in Figure D.2.

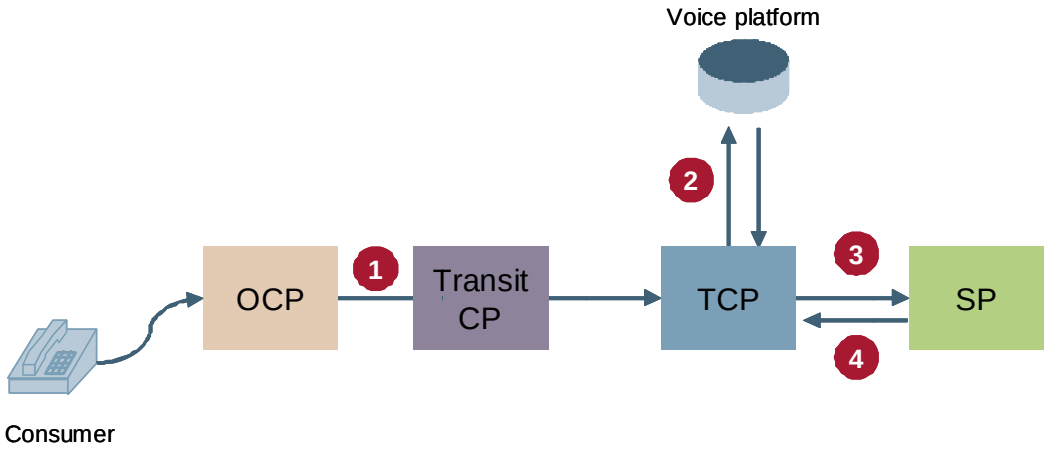

Figure D.2: *Schematic approach to 'Technique du pré-décroché' [Source: ARCEP, FFT and ACSEL submission in response to the Arrêté dated 10 June 2009]*

9 Mentioned in *Avis n° 2009-0482 de l'Autorité de régulation des communications électroniques et des postes, en date du 2 juin 2009, sur le projet d'arrêté du ministre chargé de l'économie relatif à l'information sur les prix des services vocaux à valeur ajoutée*, available at http://www.arcep.fr/fileadmin/reprise/dossiers/sva/dossier-sva-110609.pdf.

The key to this solution is that the PCA is played first before any connection to the SP service is established. In technical terms, there are four steps, as outlined below.

- **Step 1:** A circuit between the OCP, the Transit operator and the TCP is established. The OCP will only commence billing the client once it gets the 'pick-up' signal from the SP.
- **Step 2:** Through its voice platform, the TCP sends and controls the length of the PCA (the announcement may also be disseminated by the SP if it is in a position to do so).
- **Step 3:** At the end of the PCA, the TCP ensures that the call is routed towards the SP.
- **Step 4:** Following the answering ('pick-up') signal from the SP, the OCP begins to charge the client.

Effectively, this technique implies that TCPs would be best placed to run PCAs via their voice platforms. There could be instances where the service provider could do so, but given the average size of SPs, it can be expected that the majority will lack the technical infrastructure to run this solution.

D.2 The Netherlands

D.2.1 Overview of non-geographic numbers in the Netherlands

There are five different numbering ranges for NGCs in the Netherlands, as shown in Figure D.3.

Number range	*Description*	*Targeted by PCA regulation*
08x	Several number ranges used for the provision of a range of typical non-geographic services (e.g. customer services, sales enquiries). The most popular range is the 0800 range. Calls to this range are free from a landline, traffic fees may apply from mobile phones.. Other ranges include the 084/085/087 ranges, but charges are less clearly defined in these instances.	No
0900	This service is used for what OPTA describes as 'serious' or 'business information' services. One popular example is the provisioning of cheap rates to international locations. Call rates can vary strongly but start from around EUR0.01 per minute to fixed lines in other European countries.	Yes
0906	This range is primarily assigned to the provision of adult services.	Yes
0909	SPs in this range offer general infotainment services such as games or competitions.	Yes
18xy	This range is used for directory information. Call charges can vary, ranging from a fixed charge of EUR1.30 per call to a variable fee of EUR0.60 per minute.	Yes

Figure D.3: Overview of non-geographic numbering ranges in the Netherlands [Source: OPTA]

D.2.2 Regulatory framework in the Netherlands

The Dutch Ministry of Economic Affairs (EZ) amended the existing Regeling Universele Dienstverlening En Eindgebruikersbelangen (*Regulation concerning the universal provisioning of services and consumer concerns*, abbreviated RUDE) of 1 October 2008 to implement a range of regulatory measures concerning the provisioning of PCAs for NGCs.

This regulation concerned calls to the 0900, 0906, 0909 and 18xy number ranges. It applies to CPs and SPs alike. Both parties have to jointly ensure that the relevant tariff information is clearly stated before each call.

The changes to the RUDE were made based on recommendations by OPTA, the Dutch Telecommunications Authority, which is responsible for regulating non-geographic 'paid information numbers'. In addition to that, any breaches to the above regulation are overseen by ConsuWijzer, an independent body concerned with protecting the rights of consumers. ConsuWijzer can forward any relevant concerns to OPTA to ensure that the corresponding remedies are imposed, and has done so on several occasions in the past.

D.2.3 Implementation in the Netherlands

The regulation of PCAs is governed by Articles 3.2a – 3.2f of the RUDE, which lay out in detail the requirements to CPs and SPs concerning PCAs.

It should be noted that there are specific provisions in Article 3.2a stating that both parties – TCPs and SPs – are jointly responsible for ensuring that PCAs are implemented. However, if one of the parties offers PCAs, the other party is relieved of this responsibility. By shifting the question of how to introduce PCAs to the commercial negotiations between CPs and SPs, it is expected that an economically efficient outcome is achieved.

COIN

An interesting aspect of the Dutch numbering landscape is the *Vereniging Communications Infrastructure* (Communications Infrastructure Association, COIN). It was established in September 1998 with a primary focus to develop a database which should facilitate number portability. Today, COIN also manages a database containing the names of SPs, a list of the services they provide and, most importantly, the tariffs charged.

The flow of tariff information between CPs and SPs is often mentioned as a key concern as to why CPs cannot implement PCAs. Through an existing and extensive database, this problem could be overcome.

The provision of this database does not seem to be linked to the regulatory provision of PCAs. In contrast, it seems to have evolved as part of COIN's general operations as it allows operators to access this database at an annual charge. COIN is thus an interesting example of a market-based effort to alleviate these concerns.

Implementation across number ranges in the Netherlands

The regulation applies to all services provided in the 0900, 0906, 0909 and 18xy range.

NGCs to 0800 numbers, which are free of charge from a landline (with call charges varying from mobile lines), are exempt from Article 3.2 of the RUDE.

PCA standards in the Netherlands

The PCA has to include the following information:

- the cost per call
- the number the caller has dialled (as confirmation for the caller).

NGCs consist of two elements – the call charge and the service charge. If the PCA only covers the service charge, it has to be explicitly mentioned as part of the PCA that the call charge is excluded. In such a case, this second element either has to be mentioned separately (equivalent to the C+S model in France) or the consumer has to be informed clearly about where to obtain information about the call charge.

In addition to the requirements mentioned in the previous section, there are additional, more stringent rules applying to the 0900 number range. If calls to a number in this range are charged on a per-minute basis and the cost per minute exceeds EUR0.15, the maximum charge for the call has to be mentioned as part of the PCA.

D.3 Australia

D.3.1 Overview of non-geographic numbers in Australia

There is a range of different numbering ranges for NGCs in Australia. The three ranges most relevant to this study are shown in Figure D.4.

Number range	*Description*	*Targeted by PCA regulation*
13 and 1300	This non-geographic number range is frequently used for customer services (e.g. by large internationally operating companies such as LG or American Express). Calls via this range are chargeable, however at low rates. Typically, customers are charged local rates or a fixed connection fee per call from landlines. Call rates from mobile networks depend on the pricing plans of the mobile operator.	No
180x	Labelled as 'Freecall', calls to this range are non-chargeable from landlines, while fees may apply to mobile phone users. Companies use this number range primarily for sales enquiries or customer care solutions.	No

Number range	*Description*	*Targeted by PCA regulation*
190x	This number range is used by SPs offering premium-rate services. Services include, among others, specialist advice, spiritual content or dating services.[10] Charges are set by the SP and are determined either on a per-minute basis or by a fixed rate. The charges may vary from AUD0.50 to AUD5 per minute up to fixed rates of AUD33 per call	Yes, since 1 January 2002

Figure D.4: Overview of non-geographic numbering ranges in Australia [Source: ACMA]

D.3.2 Regulatory framework in Australia

Australia implemented regulation on NGCs in January 2002, making PCAs mandatory. The decision focused on the provision of the so-called 'premium rate' services. Premium rate services are defined as services charged at a premium rate[11] and are accessed via the 190 number range.

The decision was published in the Telephone Information Services Standards Council (TISSC) Code of Practice No 1,[12] and has been amended 16 times since its creation, the latest amendments being introduced in June 2010. The TISSC is also the governing body of *190 Complaints*, an independent regulatory body funded by the telephone information services industry.

190 Complaints is in charge of designing all rules applicable to the 190 premium services number range. It also deals with handling consumer complaints through an independent Arbitrator. The Arbitrator assesses complaints about premium service providers against the Code of Practice, and decides whether a breach of the Code has occurred. In cases where a breach is established, the Arbitrator decides on the appropriate remedy.

10 In contrast to other countries, the TISSC's Code of Practice does not allow adult entertainment via premium rate numbers.

11 No further information as to what defines a "premium rate" is given by the TISSC.

12 *TISCC Code of Practice No 1 of 1/1/02 – June 2010 version*, available at http://www.tissc.com.au/code.pdf.

D.3.3 Implementation in Australia

Following the development of the TISSC Code of Practice, a range of detailed provisions have been made to regulate PCAs for premium rate services.

Implementation across number ranges in Australia

Regulation of NGC services only applies to premium numbers in the 190 number range. It has been applied since 2002.

Infringements on the TISSC's Code of Practice are acted upon by the Arbitrator imposing a remedy on the SP. TCPs may only be requested to terminate a service agreement in the event of a 'very serious breach'. This assignment of penalties appears to indicate that the TISSC regards SPs as being in charge of providing PCAs.

PCA standards in Australia

Most premium rate services must be preceded by a PCA. The only premium rate services excluded are mass calling services, short duration services, and closed user access services. For the latter category, the exclusion applies if the caller has been informed of the approximate cost of a call to the service and given a personal identification number to access it.

The generic PCA must indicate:

- the name of the service
- the fixed cost of the service or the charge per minute, and
- the action required to proceed with the call, such as dialling '0'. If the caller does not take the required action to proceed, the call must be disconnected before the commencement of the fixed- or time-rate charging.

In addition to the generic PCA format described above, further announcements may be required by SPs. Depending on the nature, price or type of service, these announcements have to be played either at the beginning of the call or at regular intervals during the call.

Examples of these additional announcements include:

- messages requiring confirmation of the suitability of the caller to proceed with the call (e.g. age checks)
- further information on the SP (e.g. service hours, credentials)
- information about the duration of the call and the cost of the call so far, within the first ten minutes of the call and within ten-minute intervals after that, for time-recorded services where the service may exceed ten minutes
- the description and the fixed cost or cost per minute of the next call segment, each time the charge for a call is varied
- a 'three-beep' tone every five minutes for timed service charged at more than AUD2.75 per minute.

The rationale for these announcements is to:

- inform the caller about the duration of the call and its cost regularly throughout the call
- protect minors by restricting their access to some services
- protect the privacy of callers in the case of live services
- inform the caller about the relevance of the information provided by the service, with an indication of the source of the data or the expertise/identity of the person/organisation providing the information or advice.

D.3.4 Arguments for PCA implementation in Australia

In its *Regulation Impact Statement, Direction 2004 (No. 1),*[13] the Australian Communications Authority (ACA, now Australian Communications and Media Authority, ACMA), indicated that it primarily considered to intervene in the NGC services market due to concerns about consumers. More specifically, it stated that strengthening consumer safeguards, protecting consumers from unexpected high bills from premium rate services and mitigating the problem of minors accessing explicit material were the main reason for considering the regulation of premium rate services.

No further economic or technical arguments were provided to justify the implementation of PCAs for premium rate services by the ACA.

13 *Regulation Impact Statement, Australian Communications Authority (Service Provider Determination) Direction 2004 (No. 1)*, available at http://www.dbcde.gov.au/__data/assets/word_doc/0010/9757/Regulation_Impact_Statement_-_Australian_Communications_Authority_Direction_2004_Problem_Identification.doc