# QUALITY OF SERVICE

## RECOMMENDATIONS FOR PERFORMANCE MEASUREMENTS IN THE TELECOMMUNICATIONS, BROADBAND, PAY TV AND MOBILE INDUSTRIES

Completed by TRAQS Limited

# Table of Contents

# Executive Summary

This review has researched metrics based upon quality of service within the communications industry for the following products

- ➤ Fixed-line telephony
- ➤ Mobile Telephony
- ➤ Broadband
- ➤ Pay TV

The review, commissioned for Ofcom, has been conducted between the 20th January and 26th March 2007 and has included meetings with service providers and industry quality of service measurement bodies. Advice and opinions has also been received from representatives within the current TopComm and TopNetUK forums. To supplement the review, a desktop study of potential quality of service indicators, found on the internet, ETSI Quality of Service recommendations, and similar schemes throughout other regulated industries, has also been included. This document identifies our findings and conclusions and are formed into recommendations we consider suitable for any enhancement to the current Quality of Service scheme.

In summary, our recommendations are for the following Quality of Service measurements to be incorporated within the forthcoming consultation:

- ➤ Provision of Service – To identify the average time taken to connect a service
- ➤ Early Life Failures – To identify the quality in connecting a service
- ➤ Network Reliability – To provide the regulator confidence that Network Platforms are being sufficiently maintained and kept reliable
- ➤ Consumer Reported Faults – To identify the average duration a service will remain fault free (broadband only)
- ➤ Call Interruptions – To identify the stability of calls made over a mobile network
- ➤ Restoration of Service – To identify the average time taken to restore a service after a fault has been reported
- ➤ Repeated Faults – To identify the quality in restoring a service first time
- ➤ Complaint Handling – To identify the average time taken for a service provider to fully process a complaint
- ➤ Billing – To identify the service provider's ability in providing bills which are accurate and easy to understand
- ➤ Call Centre Availability – To identify the average time taken for a service provider to answer an incoming call
- ➤ First Call Resolution – To identify the quality of the service provider answering all of the consumer's needs in a single contact
- ➤ Download Speed Ratio – To identify the average broadband download speed compared to the advertised potential

The detail for these recommend measurements can be found in Appendix 1 – Measurement review and Recommendations, which also includes those metrics found to be unsuitable for comparable quality of service measurements.

# Background

Since the introduction of the Competition and Services (Utilities) Act 1992, the utility regulators have been encouraging service providers to publish their operational performances.

Excerpt from the Competition and Services (Utilities) Act 1992

**27B.**   (1) The Director may from time to time—

(a) determine such standards of overall performance in connection with the provision of relevant services by the designated operator as, in his opinion, ought to be achieved by that operator; and

(b) arrange for the publication, in such form and in such manner as he considers appropriate, of the standards so determined.

From this Act, the telecommunications regulator, Oftel, initiated the Comparable Performance Indicators or CPI scheme. Telecommunications providers, including the likes of BT, Telewest, Cable & Wireless, Colt and many others contributed to defining the measures which aimed to provide an overall assessment of key performance areas. The initial result was the creation of five key performance indicators:

1. Service Provisioning

2. Customer Reported Faults

3. Service Restoration

4. Complaint Handling

5. Billing Accuracy

Although during the following years additional measurements were introduced and later discarded, such as Repeated Fault Reports and Non-Pay Disconnections the initial five key performance measures remained.

The Comparable Performance Indicators scheme was administered on a voluntarily basis. Initially, the enthusiasm and encouragement of the telecommunications regulator moved the scheme forwards, but over the years the service providers became disillusioned with the scheme as it was perceived that neither customer nor service providers benefited from the publication of performance results. This was primarily driven by a lack of consumer awareness of the scheme, leading to limited use of the results by customers.

Towards the demise of the Comparable Performance Indicators scheme, a new regulator (Ofcom) was formed which incorporated all forms of communication medium under its supervision.

Under the new regulator Ofcom, the telecommunications sector was again approached and consulted on how to best meet the obligations of the Direction under General Conditions 21.1 on Quality of Service.

This Directive requires specified Communications Providers (see note 1) providing voice services at a fixed location to publish Quality of Service information covering: supply times, fault rates and fault repair times; billing complaints; and complaint resolution times.

**Notes:**
**1.** - Communications Provider means a person providing Publicly Available Telephone Services by means of a Public Telephone Network at a fixed location which has at least £4 million in net revenues per quarter and 100 million minutes of calls handled to End-Users per quarter.

# Objectives of this review

Following the successful introduction of a Quality of Service program for fixed-line telecommunications providers, Ofcom have expressed an interest in providing a similar service for other communications sectors. This report reviews the potential metrics and their value to both the consumers and providers with the following objectives:

- Review the potential Quality of Service measures for the following communications sectors:
  - ➤ Fixed-line telecommunications
  - ➤ Mobile communications
  - ➤ Broadband
  - ➤ Pay TV
- Assess the benefit of each of the potential measures and provide recommendations on those likely to be of greatest value to consumers
- Provide an outline of the potential impact on providers

# Review Methodology

The methodology employed for completing this study involved researching all of the related data sources to Quality of Service measurements.

This was initiated by reviewing the current TopComm and TopNetUK schemes and assessing their successes and failures. This was followed by reviewing any available consumer advice accessed through internet searches and websites. The validity and appropriateness of the information provided by these internet portals was assessed for consumer advice to identify whether the information related to actual Quality of Service, based upon hard evidence, or whether the output linked to either price related information or customer satisfaction results.

Further to this research, the study also involved reviewing alternative regulatory quality of service requirements through other utilities, such as Ofwat, Ofgem and the Office of Rail Regulation, and this was found to be useful in identifying common metrics which are believed to be useful for the consumer awareness on Quality of Service.

ETSI is considered to be one of the main organisations in Europe for identifying and recommending Telecommunications standards in Information and Communication Technologies Industry (ICT). Therefore, it was considered that no study would be complete without reviewing the ETSI guidelines on Telecommunications Quality of Service. This involved reviewing two standards, ETSI 201 769 and ETSI 202 057 which cover Fixed Line Telephony, Mobile and Internet Access. Again, these standards were useful in comparing the current definitions used in the TopComm and TopNetUK Quality of Service schemes with the advice and recommendations from ETSI.

The review considered that the feedback and recommendations from current Telecommunications providers is important and was therefore also included within the review methodology. This either involved reviewing recent submissions to Ofcom or the TopComm forum from some Service Providers on recommended changes to the current definitions or by pre-arranged meetings to discuss the appropriateness of the current schemes and exploring potential future measurements. During this it was identified that some broadband measurements could be comparatively obtained through an organization which specializes in observing and reporting on broadband networks. Therefore, this organisation was also included within the review stage.

Finally, as the role in overseeing any proposed scheme would be with Ofcom, the views and findings from Ofcom and their own studies and feedback on consumer awareness and requirements have also been included within the overall review.

From the previously mentioned data sources, all relevant information on Quality of Service was gathered together and then analysed to identify all measurements which could be made available to consumers. From this analysis, each measure was assessed on whether the consumer would benefit from the information, i.e. would the consumer be able to relate the measurement into real life experiences, would the consumer be interested in the range of results, and would it be a key decision factor when choosing a service provider.

From this a final sub-set of recommended measurements was identified and then by referring back to the findings of the initial research, the recommended measurements were linked to the appropriate definitions. These definitions have been captured into their own document which can be found under Appendix 2 – Definitions.

## Fixed Line Communications

From the initial phase of the current Quality of Service scheme the fixed line communications service providers formed a forum, called TopComm, to agree:

- An understanding of the Direction
- measurement definitions
- frequency for reporting
- method of publications
- how to manage, control and continually refine the processes

To date, TopComm has published two sets of quarterly performance results, and is currently working to publish the third set, covering the Q3 and Q4 2006 periods. Although successful in its implementation, TopComm acknowledge that the scheme is not fulfilling its requirement and full potential to provide consumers with the ability to choose where to obtain service based upon performance results. As with the Comparable Performance Indicators scheme, an inadequate approach to consumer awareness has resulted in a low use of the published results.

Ofcom has initiated some consumer research into the TopComm publication website in an attempt to identify whether the scheme, measurements and method of publication are of use to consumers. Initial feedback from this research indicates that although the results may prove to be useful in helping a consumer identify and choose a service provider, the actual method of publication is of a poor quality and not user friendly.

## Mobile Communications

Testing of the operators' mobile networks originally began in 1991 with Vodafone & BT Cellnet (now O2) testing their early analogue networks. The collection of this test data was originally overseen by the trade body FCS (Federation for Communication Services).

A working group chaired by Oftel, involving all four of the major mobile network operators, O2, Orange, T-Mobile and Vodafone agreed to a new working group being established in 1997.

A new roadside test specification was developed for GSM. The first set of tests to this specification commenced in 1999 and continued until November 2003 when all trials ceased and the current Mobile CPI forum was set up.

With the need to constantly improve the mobile experience for all customers the CPI forum has worked, over the past two and a half years to develop a new testing methodology to give better comparisons for customers.

The CPI forum launched a new website for consumers in September 2006 allowing the public to view the mobile network test results.

**What Is Tested**

Voice call testing is done on O2, Orange, T-Mobile, and Vodafone GSM 2G networks on selected roads and motorways, and at various locations within selected cities. The tests are carried out by automated test equipment mounted in vehicles. Calls are 90 seconds long followed by a 30 second no-call period. The results then displayed on a comparison map which shows:

> Successful calls - the call is set up and closed down in a controlled manner i.e. ended by one of the people on the call.

> Unsuccessful calls - either the set up of the call on the mobile network is unsuccessful, or after successfully setting up a call on a mobile network, the call cuts off before the end of the call.

> Good Voice Quality - the audio quality of the call is measured and if it is of acceptable quality.

> Poor Voice Quality - the audio quality of the call is measured and if it is unacceptable in quality. This could indicate breaks in the call, echo, crackling on the line, silence or robotic voice symptoms.

The output of the test results can be found on the TopNetUK website. To use the site, the user must first input a "search location" for the particular geographic area of interest. Once the "search location" has been found, the site displays two ordinance surveys maps where the user can select one of the four mobile network providers on each map. The maps are then updated with green or red dots to indicate call success or failure and quality success or failure.

Apart from the network "call" performance in certain geographical areas, the website does not provide any indication as to the customer service or operational performance of the service providers.

**Mobile Service Providers - MNO's and MVNO's**

There is perhaps not enough public awareness of the differences between a Mobile Network Provider (MNO) and a Mobile *Virtual* Network Provider (MVNO). The MVNO does not have its own network and consequently will lease network space off the MNO. Therefore, any network experience observed by the MVNO customer will be part of the same experience observed by the MNO customer of the parent network owner. This may mean that if measures related to network experiences were placed side by side the consumer would not be able to differentiate between the MVNO and the parent MNO. It could be argued that the MVNO customer should be made more aware of the MNO network performance as this may influence their decision on where to select service from. The area where performances could be differentiated easily is the customer service experiences, i.e. the experienced observed when contacting the provider's call centre.
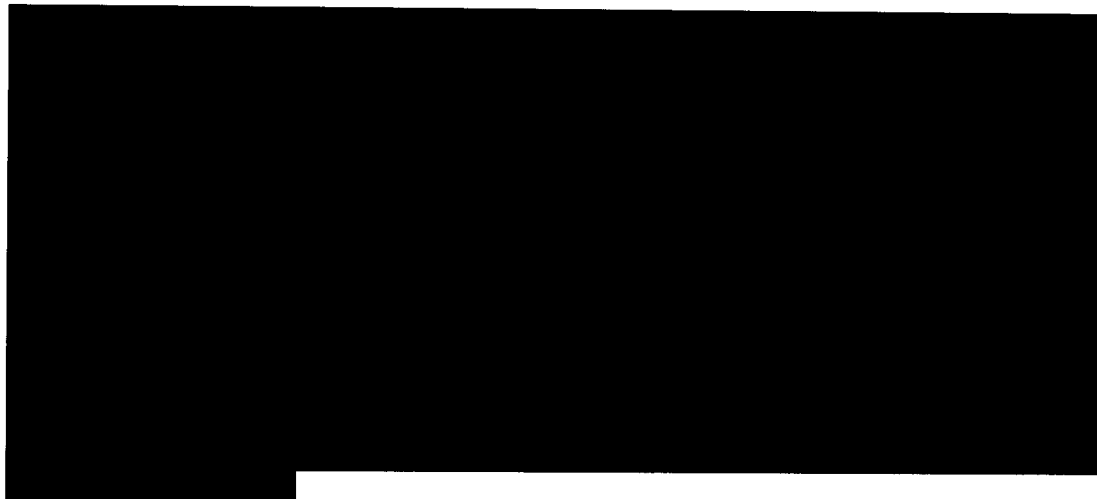
In summary, for most measurements the MVNO performance is subject to the capability of the MNO. The question is, does the consumer know this and would this affect their choice?
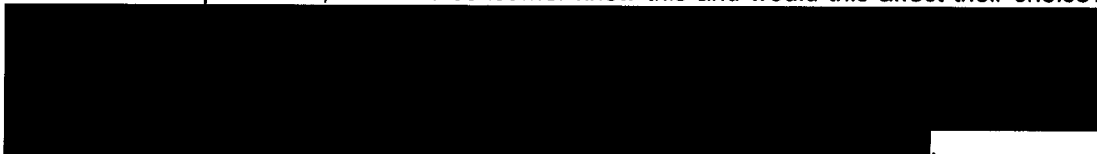
**Broadband & Pay TV**

To date, there are no official Ofcom supported Quality of Service measures for broadband and Pay TV. However, consumers may access information comparing the various providers via a variety of website review and comparison sites, as noted in the website review.

# Website Review

There are many websites available to consumers comparing products and services across a variety of industries and sectors. The number and popularity of these has exploded in recent years, following effective marketing campaigns and internet search engine optimisation. Consumers are now invited to a plethora of sites, the majority are based around saving the consumer money by finding the cheapest deal – although many also contain information on service levels and others will find the most appropriate and cost effective level of service for a consumer based on a series of basic questions profiling the consumers' usage patterns and individual needs.

Put 'compare telecom services' into Google and you are presented with a plethora of sites. It is impossible to review all here but for the purposes of this report a selection are discussed here.
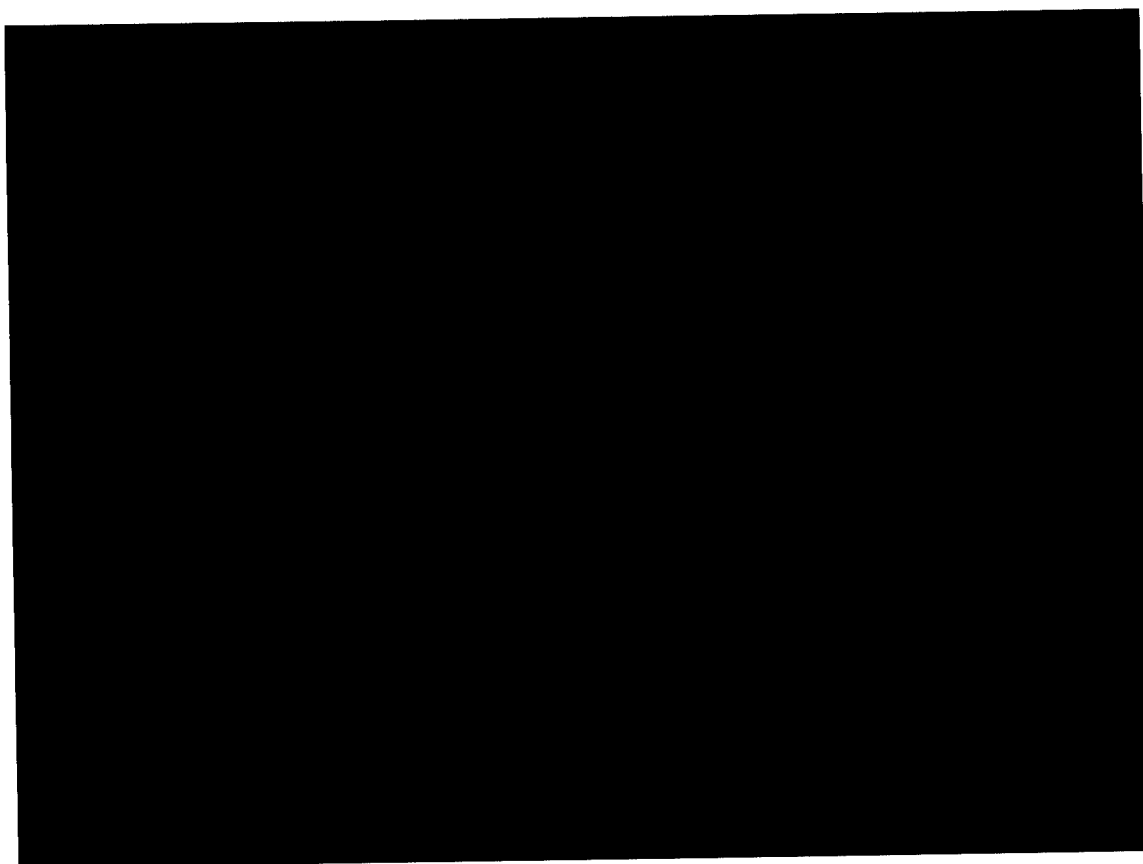
www.uswitch.co.uk

Uswitch is one of the most well-known price comparison websites, led largely by a high profile media campaign and search engine optimization.

The site is mainly known for comparing utility service providers on price. In fact uswitch's advertising hinges around its claims to save the consumer money. However, uswitch has expanded its remit in recent years to cover other products including telecoms and also reports Customer Satisfaction results, which are compiled by YouGov. The YouGov survey is conducted on a six-monthly basis, but is not evenly spread across the various service providers. The results could show a well known service provider, such as BT, with thousands of reviews, and a lesser known provider, say Toucan with less than 50 reviews. The site does acknowledge that a score cannot be provided with less than 200 reviews, and this is probably why the site does not allow the results to be sorted by the customer satisfaction results – although the consumer can sort by brand name, or cost etc.


www.reviewcentre.com

The services covered by reviewcentre.com includes fixed line telephony (although limited in the number of service providers), mobile, and broadband.


This site is essentially a portal for consumers to log their feedback about service providers. Consumer messages include a service provider rating (1-10) and "respect" value which is usually between -1 and +2. These scores appear to be based from the review ratings components:

> Signal Coverage
> Value for Money
> Overall Rating
> Recommend to a friend


As with any consumer feedback, scores and ratings are mixed and entirely subjective, but the website does summarise the overall score per service provider. However, this appears to be based upon all feedback, regardless of when it was provided and does not necessarily offer an up-to-date reflection of the service. Unfortunately, the consumer will need to review each individual feedback to get a balanced view on the good and bad performance areas.

www.lspreview.co.uk

The site offers a good assortment of information to consumers, which includes details of different internet connection technologies, i.e. ADSL, Dial Up, Wireless...and more. Also the site displays the output of reviews and surveys, common complaints about ISPs, and based upon consumer feedback onto the site, a top 10 list of ISPs. The top 10 listing is formulated from a scoring mechanism, based upon the following key points.

> Services
> Support
> Speed
> Cost


Although some feedback is very recent, the scoring appears to be averaged upon all of the historical feedback, going back to at least 2005. Therefore, if an ISP has changed there actual performance recently, their current results may be affected by previous scoring. This also depends upon individual consumer expectation, and what might be an appropriate service level for one, may not be the same for another.

www.ciao.co.uk

This site requires the consumer to enter a post code, and then outputs a list of known service providers for that geographic area. The output also includes information such as cost and broadband speed availability. There are no actual hard performance results to support the speed availability.

J.D. Power undertakes an annual customer satisfaction survey of UK Broadband internet Service Providers with companies ranked against a 1000 point scale, on the following factors:
- ➢ Performance and Reliability
- ➢ Customer Service / Technical Support
- ➢ Cost
- ➢ Image
- ➢ Billing
- ➢ E-mail services
- ➢ Offerings and promotions

Other search engines include www.broadband.co.uk, www.broadbandchoices.co.uk, www.simplyswitch.co.uk. All of these compare service providers based upon cost, speed and package, for a postcode area. These sites do not enable the consumer to make a decision based on actual Quality of Service performance and no indications of service levels are offered. However, the output does indicate useful information such as speed; download restrictions and contract terms, which may all be useful to different consumers.

Although useful in identifying potential service providers, the websites with consumer feedback are all based upon subjective evidence from individuals who have experienced indifferent levels of quality from their service providers. It is impossible to gauge whether the experiences logged are an indication of the overall quality of service given by the service provider. It may also be that the methods of supplying the services are different between service providers, and therefore it is difficult to judge the feedback on any comparable basis.

# Review of other regulated industries

## Office of Rail Regulation

The rail industry also has a regulatory requirement to publish results on quality, performance and perceptions (i.e. do consumers believe that the trains run on time). Although the rail network measurements concentrate on track renewals, safety, pollution and expenditure, two measures can be related to customer service.

> Train Performance

> This measures the percentage of trains arriving on time at their specified destination, allowing for a lateness margin of 5 and 10 minutes.

> Delay (Minutes)

> This measures the actual delay in (thousands\millions) minutes as a year to date cumulative, for train arrivals to their specified destination.

It is useful to note that the two measures are measuring the same issue, but the output is represented in two ways, a %age on time, and an actual time of delay. This is similar to some of the ETSI measures which require the service provider to measure the %age of events meeting a target and the actual error. Outputs like this are useful in gauging both the frequency of success\failures and the extent of any error. For example, a consumer may see two results where, Provider A misses the target on 20% of occasions but only by a small margin each time and Provider B misses the target on 10% of occasions but always by a large margin. The consumer will then be able to choose a provider based upon the criterion that suits them.

## OFWAT

OFWAT publish regular performance reports on the water industry covering:
> water and sewerage services

> drinking water quality

> environmental outputs

> sewerage service

> serviceability to customers

Clearly many of these measures are specific to the water industry but the following section reviews the metrics which could be used for the communications sector.

Serviceability to customers looks at the reliability of the network by identifying the actual number of sewer collapses per 1000Km, and includes accidental failures of network elements except where damage may be caused by a third party. The metrics also identify the main sewage leakages in the network. However these metrics are not necessarily customer related, as issues may occur which do not affect the customer directly, or the customer may not be aware of the problems.

However, there is a number of more customer focused measures, such as:
- %age of properties affected by low water pressure
- Number of properties affected by supply interruptions
- % population affected by hosepipe restrictions
- % billing contacts dealt with within 5 working days
- % written complaints dealt with within 10 working days

- % of calls abandoned

- % of calls receiving engaged tone

In total there are 55 measures which each water supplier needs to submit to OFWAT, although it must be noted that this is on an annual basis. Most of these measures are related to the supply and reliability of the network, which may not always be noticed by the consumer, but some measures are customer focused, i.e. bill contacts, complaints and contact centre experiences – abandons and engaged tones.

## OFGEM

OFGEM is the regulator for Britain's energy suppliers and states its primary objective is to protect consumers. This is achieved by:

1. promoting effective competition, wherever appropriate, and
2. regulating effectively the monopoly companies which run the gas pipes and the electricity wires

OFGEM provides Quality of Service comparisons on its own website as well as identifying how to switch between service providers. QoS Measures include:

Electricity

- Customer Interruptions and Customer Minutes Lost – which identifies the number of outages experienced per 100 customers, and the average outage duration, i.e. out of 100 customers 76 experienced an interruption with an average duration of 71 minutes.

- Telephony – There is a measure on telephony performance, although this is not defined and the results only show the overall score, ranking and reward/penalty per supplier.

Gas

- Customer Interruptions and durations

- Overall satisfaction on the communication of the supplier

- Satisfaction with the skill, professionalism and quality of work of the supplier

Each gas distributor is required to send questionnaires to their customers, via a research agency, to ascertain customer feedback on performance. Unfortunately, the output of the QoS reports for the gas suppliers was found to be non-comparable by Ofgem and hence no actual performance results could be identified to confirm the measurements.

**National Audit Office**

The National Audit Office studied and published the most frequently used performance measures for call centres.

**a. Time taken to answer calls**

1)      % calls answered within 20 seconds

2)      % calls answered within 30 seconds

3)      % of calls not answered (abandoned)

**b. How calls are dealt with**

4)      % of calls resolved by the first agent

5)      % of calls resolved by automated service

6)      % of calls that cannot be resolved

**c. Whether calls are referred to another organisation**

7)      % of calls referred to other organisations2

8)      % of calls redirected to other organisations3

9)      % calls where the language requested could not be met

**d. Length of calls**

10)     Average length of completed calls

11)     % of agent time spent taking calls

The time taken to answer calls is a common measurement throughout contact centres but target times vary across different industries and organisations. However, 20 seconds appears to be the most common target and one that could potentially be used for QoS. Although a result for the % meeting the target is offered as a metric, there is no measure identifying the actual time to connect a call to an agent.

The abandoned call measurement target also varies across the call centre industry, as customers may have many different reasons for abandoning calls, including:

➤   comparison to the ease in which a call was previously answered,

➤   cost of the call (if its free the caller may wish to wait)

➤   ease of accessing the required information through alternative means, i.e. internet websites

Some call centres measure the % of calls handled first time, but there are potentially different definitions which could be used to identify a repeat call, i.e. repeat only if the caller's subject matter was the same, repeat if the same CLI was captured, or repeat if the same account was log-noted. It might be useful to identify the % calls resolved by automated service as this may give an indication of the ease in which the customer queries are handled. For example, it may be just as quick to dial up and complete a payment transaction through an IVR as opposed to waiting to connect to an agent and talk them through your requirement. Unfortunately, the definition of a resolved call may be impossible to determine unless the IVR's also had a built in function where consumers could confirm that the requirement has been successfully dealt with.

Transfers and language issues are rarely key performance indicators as these are usually monitored through agent call monitoring and agent call handling time statistics. As products vary, with some call centres managing singular products and others managing quad play products, it may not be applicable to use this as a service comparison. For example a broadband technical call may take 5 times longer to handle than a request to add a telephony feature, or upgrade a TV package.

## ICMI – International Customer Management Institute

The ICMI a global leader in call centre consulting, training, publications and membership services and has been included into the review due to the information and recommendations on the potential quality of service measurements which can be obtained through analysing the effectiveness of the call centre.

Membership to this institute enables call centre representatives, leaders, managers, and designers to discuss openly their issues and successes in call centre management.

A range of discussions for quality of service measurement parameters was reviewed and concluded the following:

Call Abandons – Although it is easy to set a measurement standard or objective for an individual call centre on abandoned calls, this type of measure may not be comparable across different organisations. There are an unlimited number of reasons that influence caller's behaviour, but most can be categorised into "seven factors of caller tolerance" that include:

- ➢ Degree of motivation-how important the call/contact is to the customer
- ➢ Availability of substitutes --can they get the answer somewhere else (i.e., your Web site, or FAQs, etc.)
- ➢ Competition's service level
- ➢ Level of expectations -- do they have to wait a long time every time they call or did they get right through the last time they contacted you?
- ➢ Time available
- ➢ Who is paying for the call --callers may not wait as long if they are paying the phone charges
- ➢ Human behaviour

Therefore, this standard of measurement is not suitable for comparing different service providers.

First Call Resolution – This measure is frequently used within customer service centres to provide an indication of how successful calls are being handled completely on the first attempt. There are many different ways in which this metric can be measured, from either analysing call "log" codes, assessing the frequency in which customers accounts are accessed, or normally by counting the number of times caller's CLI's have repeatedly called the call centre. A window of either 5 or 7 days is used to calculate whether the 1st and subsequent calls are related.

The method preferred is to pull ALL (not just a random sample of) calls made into the call centre for a specific monthly period, noting the date of the call. The data is then correlated by CLI. Any CLI calling back within the seven day window is assigned as a repeated call. The

number of repeat calls is divided by the total population of calls to give a First Time Resolution performance figure.

## The Global Report on Call Centre Practices: March 2007

A report by the President of ICMI concludes the following points, which are useful in identifying why call centres play a significant role in shaping customer's perceptions.

There are now 1.6 billion internet users and an astonishing 2.7 billion mobile phone subscriptions worldwide (sources: Internet World Stats and Wireless Intelligence, respectively).

The sheer number of connections is creating a powerful dynamic in delivering customer services.

Zeroing in on customer expectations is not the hit-or-miss proposition it may seem. ICMI has followed this issue for almost two decades, and found 10 customer expectations that consistently emerge from customer feedback and surveys

- ➢ *Be accessible*
- ➢ Treat me courteously
- ➢ Be responsive to what I need and want
- ➢ Do what I ask promptly
- ➢ Provide well-trained and informed employees
- ➢ Tell me what to expect
- ➢ *Meet your commitments and keep your promises*
- ➢ *Do it right the first time*
- ➢ Follow up
- ➢ Be socially responsible and ethical

Accessibility is considered to be one of the main functions of the call centre, and every responsible organisation will measure how successfully they are at capturing every consumer call attempt.

By meeting your commitments, keeping promises and doing it right first time will result in fewer repeated calls into the call centre. Not only will this enhance the consumer experience of the service provider, but it will also serve to reduce the service provider's operational costs due to the lesser demand in answering calls.

# Review of quality standards

## ETSI Measures

## ETSI Standards

The TopComm scheme uses measurements which are loosely based upon the Speech and Transmission QoS guidelines from ETSI – the European Telecommunications Standards Institute.

The following is an extract from the ETSI 202 057 guide on Speech Processing, Transmission and Quality Aspects (STQ); User Related QoS parameter definitions and measurements.

*"The present document has been written to provide a balanced approach taking into account as far as practicable the following seven principles:*

1) *QoS parameters should be easily understood by the public, and be useful and important to them.*
2) *All network related parameters are applicable at the network termination point (where appropriate).*
3) *To be as realistic as possible, real traffic rather than test calls should be used as a basis of the measurements, wherever possible.*
4) *Parameters should be capable of verification by independent organizations. This verification might be made by direct measurements or by audit of service provider's measurements.*
5) *The accuracy of QoS values should be set to a level consistent with measurement methods being as simple as possible with costs as low as possible.*
6) *The parameters are designed for both statistical and individual application. The statistical values should be derived by the application of a simple statistical function to the individual values. The statistical function should be specified in the standard. The standard should also contain guidelines on how statistically significant samples should be selected.*
7) *The statistical functions should be designed so QoS figures from different service providers can be compared easily by users and in particular consumers."*

There are a number of ETSI guidelines which could be used for processing and measuring QoS in the communications industry, but the two used for this study are ETSI 201 769 *(Parameters for voice telephony service required under the ONP Voice Telephony Directive 98/10/EC)* and ETSI 202 057 *(Parts 1-4, General; Voice Telephony; Public Land Mobile Networks; and Internet Access).*

### Reporting for Directly and Indirectly connected customers

One important note which the current TopComm Scheme has had difficulty in understanding and implementing is the reporting based upon the type of service offered. Some service providers provide both direct and indirect services. Where there are likely to be significantly different levels of performance for these two service types, separate reporting should be adopted for each service type. If service levels are similar only a single combined statistic need be reported.

### Data Processing Methodology

Several parameters require a statistic of the form:

> "the time by which the fastest X % of <relevant event>".
The measurements give a list of times recorded for the events, for example a list of supply times. This list of times should be counted and sorted into ascending order.

X % of the total number of measurements counted should be calculated giving a number, say "n" which would be rounded down to the nearest integer.

The "n"th time in the sorted ascending list will then be "the time by which the fastest X % of relevant event>" occurred and is the statistic to be reported

Using this statistical method will remove those rare events which could distort the (mean) averages significantly away from the other average types (mode\medium – which may not be suitable for these measurements due to the high variation in results).

## ETSI 201 769

The following list summarises the measurements proposed to Fixed Telephony providers from ETSI 201 769

> Supply time for initial connection
> Faults rate:
    Faults/access line/year All actual Direct and indirect with separate reporting
> Fault repair time
    Time to repair 80 % and 95 %, and %age on target date for faults on access lines
> Unsuccessful call ratio
    % for national and international calls (separately)
> Call set-up time
    Time for mean and 95 % for national and international calls (separately)
> Response times for operator services
> Response time for directory enquiry services
> Public pay-telephones in working order
> Bill correctness complaints

Clearly, not all of the measurements are relevant to all service providers, and certainly not relevant to all communications sectors. However, the majority of measurements could be used over different services, not just the communications industry.

## The value of each measure

*Supply time for initial connection*

The level of success with which the service provider connects the service to a customer. The ETSI guide proposes that the measure be split into 2 parts:
    (a) measure the time for connected services, but excluding orders which have been delayed by the customer, and
    (b) percent of orders connected by the time agreed with the customer.

As each service provider will have their own method and Service Level Agreements, the second part of this measure is not naturally comparable between different service providers. Therefore, it would be sensible to concentrate on the "time" for connection as opposed to "% connected". The time element also is more customer friendly and easy to identify and compare.

*Faults rate Faults/access line/year All actual Direct and indirect with separate reporting*

This measure is to identify the reliability of the service provider's network, and is measured by comparing the number of fault reports to the average number of connections over the same period. It is recommended for the measure to be differentiated and reported separately for Direct and Indirect providers. This is due to the non-comparability in the actual service offering.

*Fault repair time - Time to repair 80 % and 95 %, and %age on target date for faults on access lines*

Similar to the Supply measure, this measure identifies the timescale from the instant a fault has been notified to the instant when the service has been restored to normal working order. The measurement is based on actual clock hours as opposed to working days or SLA's, as this provides a more meaningful perspective to a customer and is more easily comparable between service providers.

The measure is split into 3 parts:
- (a) for Network providers,
- (b) for carrier providers (although SP's who provide both should include both results in this measure), and
- (c) the % repaired to the providers objective\target time.

Exclusions may contain cases where the customer has delayed the repair time.

*Unsuccessful call ratio % for national and international calls (separately)*

This measure identifies the ratio of calls which do not connect to the required destination. Industry experience for the Fixed Line providers is that this is not a useful customer metric due to the very few instances where this may occur.

*Call set-up time - Time for mean and 95 % for national and international calls (separately)*

This measure identifies the time it takes for a carrier\network provider to connect the caller to the required destination. Similar to the previous measure, this is not one that causes a common problem within the industry.

*Response times for operator services*

This measure is to indicate the time taken for a caller to connect to a human customer service agent or operator. It includes the time taken for an IVR to process and pass the call to an ACD, waiting time in the ACD until connected to the agent\operator. Calls answered wholly by the IVR are excluded. The measure is split into 2 parts (a) mean time to connect which will give an indication of the expected connection time in seconds, and (b) % calls answered in 20 seconds, as the mean time may be affected by a small portion of extreme delays, which could skew the result. This is considered to be a non-product specific measurement.

*Response time for directory enquiry services* – This is the same definition to the previous measure, except it is for DE services only.

*Public pay-telephones in working order* – This is a measure to identify the %age of publicly available pay-phone services which are in good working order. As the provision of these services is minor in comparison to the number of service providers, it is not seen to be a comparable metric.

*Bill correctness complaints* – To identify the proportion of bills issued where the customer contacts the service provider to complain about the accuracy or correctness of the information on the bill. The TopComm scheme has adjusted this measure slightly to only measure the complaints which are justified. However, this is a subjective measure on whether the agent handling the customer interaction considers the customer's response to be of a complaining nature, as opposed to enquiry. The number \ percentage of billing contacts may be more appropriate and comparable.

## ETSI 201 057

This ESTI guide is split into 4 different sections, General overview, Voice, Data and Fax services accessed via the PSTN and SMS, Mobile Telephony, and Internet Access

The following list summarises the measurements proposed to Fixed Telephony providers from ETSI 201 057 (Part 1)

> Supply time for fixed network access
> Supply time for Internet access
> Proportion of problems with number portability procedures
> Fault report rate per fixed access lines
> Fault repair time for fixed access lines
> Response time for operator services
> Response time for directory enquiry services
> Response time for admin/billing enquiries
> Bill correctness complaints
> Prepaid account credit correctness complaints
> Bill presentation quality
> Frequency of customer complaints
> Customer complaints resolution time
> Customer relations - MOS value survey
> Professionalism of help line - MOS value survey

It can be seen that these measures follow a very similar line to the ETSI 201 769 guide, with a few extra measurements which appear to identify some of the specific issues, such as Number Portability and bill presentation, to name just two. One different aspect to the ETSI 201 769 guide is the introduction of surveys, which are aimed to identify the quality of the operator \ customer service agent. However, as with all surveyed results, these are perhaps more likely to be open to subjectiveness as opposed to hard, data supported events.

One further point to note at this stage is the scoring used for the survey result, which are as follows:

| Quality | Score |
| --- | --- |
| Excellent | 5 |
| Good | 4 |
| Fair | 3 |
| Poor | 2 |
| Bad | 1 |

## Voice, Data and Fax services accessed via the PSTN and SMS

The following list summarises the measurements proposed to Fixed Telephony providers from ETSI 201 057 (Part 2)

> Unsuccessful call ratio - the percentage of unsuccessful calls for national calls / international calls (Would likely to be included within Faults metric if customer thought to be impairing service)

> Call set up time – the mean time for national and international call set up (Would likely to be included within Faults metric if customer thought to be impairing service)

> Speech connection quality - quality category according to ITU-T Recommendation G.109 [14] (Would likely to be included within Faults metric if customer thought to be impairing service)

> Fax connection quality - % successful fax transactions (Would likely to be included within Faults metric if customer thought to be impairing service)

> Data rate of Dial-up access to the Internet - transmission rate of modem data – Dial up access products are not as popular as the faster and more widely used broadband service

> Successful SMS Ratio - % of successfully sent short messages

> Completion Rate for SMS - ratio of successfully sent and received short messages

> End-to-End delivery time for SMS - the mean value in seconds for sending and receiving short messages

NOTE re SMS: Concerning the mobile environment the parameter is meant to measure the combination of the network accessibility in the claimed area of coverage and congestion in the signalling channels and SMS system, i.e. the ability of a user to send an SMS when in a claimed area of coverage. Whilst operators may wish to distinguish the effects of coverage and access congestion, it is not necessary to distinguish them from the perspective of the user.

## Public Land Mobile Networks

The following list summarises the measurements proposed to Fixed Telephony providers from ETSI 201 057 (Part 3)

Unsuccessful call ratio for telephony – ratio of unsuccessful call attempts in a specified period

Dropped call ratio – ratio of calls (incoming and outgoing), once successfully connected are dropped or interrupted prior to normal completion by the user

Voice Quality – an indication of problems with the radio signal

Note: Measurements of voice quality on a PLMN will be influenced by both the transmission capabilities of the network and the state of the radio access. A network with a higher access threshold will support better speech quality but poorer network accessibility in an area of weak coverage.

<u>Internet Access</u>

The following list summarises the measurements proposed to Fixed Telephony providers from ETSI 201 057 (Part 4)

> Login time – The average time taken for a user to connect to the Internet

> Data transmission speed achieved - The maximum/minimum/average data transmission rate in Kbit/s achieved when transferring (uploading and downloading) files between a user and the Internet

> Unsuccessful data transmissions ratio - % unsuccessful data transmission, where test data (upload and download) has not been successfully completed within 60 seconds

> Successful log-in ratio - % Successful log-ins when attempting to access the Internet

> Delay (one way transmission time) – The average delay in seconds for a Ping to a valid IP address.

**Performance consideration of delay, jitter and packet loss using different applications**

| Application | | Performance Consideration |
|---|---|---|
| Audio | Conversational voice | Conversational voice is heavily influenced by one-way delay. In fact, there are two distinct effects of delay. The first is the creation of echo in conjunction with two-wire to 4-wire conversions or even acoustic coupling in a terminal. This begins to cause increasing degradation to voice quality for delays of the order of tens of milliseconds, and echo control measures must be taken at this point. The second effect occurs when the delay increases to a point where it begins to impact conversational dynamics, i.e. the delay in the other party responding becomes noticeable. This occurs for delays of the order of several hundred milliseconds. However, the human ear is highly intolerant of short-term delay variation (jitter). As a practical matter, for all voice services, delay variation due to variability in incoming packet arrival times must be removed with a de-jitterizing buffer. Effects of packet loss are influenced by the fact that the human ear is tolerant to a certain amount of distortion of a speech signal. In IP-based transmission systems a prime source of voice quality degradation is due to the use of low bit-rate speech compression codecs and their performance under conditions of packet loss. |
| | Voice messaging | Requirements for information loss are essentially the same as for conversational voice (i.e. dependent on the speech coder), but a key difference here is that there is more tolerance for delay since there is no direct conversation involved. The main issue therefore becomes one of how much delay can be tolerated between the user issuing a command to replay a voice message and the actual start of the audio. There is no precise data on this, but based on studies related to the acceptability of stimulus-response delay for ttelecommunications services, a delay of the order of a few seconds seems reasonable for this application. In fact, a distinction is possible between recording and playback, in that user reaction to playback is likely to be the more stringent requirement. |
| | Streaming audio | Streaming audio is expected to provide better quality than conventional telephony, and requirements for information loss in terms of packet loss will be correspondingly tighter. However, as with voice messaging, there is no conversational element involved and delay requirements for the audio stream itself can be relaxed, even more so than for voice-messaging, although control commands must be dealt with appropriately. |
| Video | Videophone | Videophone as used here implies a full-duplex system, carrying both |

| | | video and audio and intended for use in a conversational environment. As such, in principle the same delay requirements as for conversational voice will apply, i.e. no echo and minimal effect on conversational dynamics, with the added requirement that the audio and video must be synchronized within certain limits to provide "lip-synch". The human eye is tolerant to some loss of information, so that some degree of packet loss is acceptable depending on the specific video coder and amount of error protection used. It is expected that the latest MPEG-4 video codecs will provide acceptable video quality with frame erasure rates up to about 1 %. |
|------|------|------|
| | One-way video | The main distinguishing feature of one-way video is that there is no conversational element involved, meaning that the delay requirement will not be so stringent, and can follow that of streaming audio. |
| Data | Web-browsing | In this category we refer to retrieving and viewing the HTML component of a Web page, other components e.g. images, audio/video clips are dealt with under their separate categories. From the user point of view, the main performance factor is how quickly a page appears after it has been requested. Delays of several seconds are acceptable, but not more than about 10 seconds. |
| | Bulk data | This category includes file transfers, and is clearly influenced by the size of the file. As long as there is an indication that the file transfer is proceeding, it is reasonable to assume somewhat longer tolerance to delay than for a single Web-page. |
| | High priority transaction services | The main performance requirement here is to provide a sense of immediacy to the user that the transaction is proceeding smoothly, and a delay of no more than a few seconds is desirable. |
| | Command/cont rol | Clearly, command/control implies very tight limits on allowable delay, much less than a second. Note that a key differentiator from conversational voice and video services with similar low delay requirements is the zero tolerance for information loss |
| | Still image | This category includes a variety of encoding formats, some of which may be tolerant to information loss since they will be viewed by a human eye. However, given that even single bit errors can cause large disturbances in other still image formats, it is argued that this category should in general have zero information loss. However, delay requirements for still image transfer are not stringent and may be comparable to that for bulk data transfer, given that the image tends to be built up as it is being received, which provides an indication that data transfer is proceeding. |
| | Interactive games | Requirements for interactive games are obviously very dependent on the specific game, but it is clear that demanding applications will require very short delays of the order of a fraction of a second, consistent with demanding interactive applications. |
| | Telnet | Telnet is included here with a requirement for a short delay of a fraction of a second in order to provide essentially instantaneous character echo-back. |
| | E-mail (server access) | E-mail is generally thought to be a store and forward service which, in principle, can tolerate delays of several minutes or even hours. However, it is important to differentiate between communications between the user and the local email server and server, to server transfer. When the user communicates with the local mail server, there is an expectation that the mail will be transferred within a few seconds. |
| | Instant messaging | Instant messaging primarily relates to text, but can also include audio, video and image. In any case, despite the name, it is not a real-time communication in the sense of conversational voice, and delays of several seconds are acceptable. |
| | Background applications | In principle, the only requirement for applications in this category is that information should be delivered to the user essentially error free. However, there is still a delay constraint, since data is effectively useless if it is received too late for any practical purpose. |
| | Fax | Fax is included in this category since it is not normally intended to be an |

| | | accompaniment to highly interactive real-time communication. Nevertheless, for so-called "real-time" fax there is an expectation in most business scenarios that a fax will be received within about 30 seconds. Delay for store and forward fax can be much higher. Note that fax does not require zero information loss. |
|---|---|---|
| | Low priority transaction services | An example in this category is Short Message Service (SMS). 10s of seconds are an acceptable delivery delay value. |
| | Email (server-to-server) | This category is included for completeness, since as mentioned earlier, the prime interest in email is in the access time. |
| | Usenet | Usenet is a world-wide distributed discussion system. It consists of a set of "newsgroups" with names that are classified hierarchically by subject. "Articles" or "messages" are "posted" to these newsgroups by people on computers with the appropriate software. These articles are then broadcast to other interconnected computer systems via a wide variety of networks. This is a very low priority service, with corresponding relaxed delay requirements. However, it is desirable that messages are received by the user in the order that they are posted, to avoid seeing a reply prior to the original message. |

# Ofcom Notes

What do Broadband consumers need to know? Based upon the OCC data and disputes to ADR over the past twelve months, the main areas of dissatisfaction are:

➢ Problems with switching provider

➢ No Service delivery / availability

➢ No connection / loss of service

➢ Speed of service

➢ Difficult to contact / ignored or /inadequate response to enquiry/complaint.

How could these areas of dissatisfaction be incorporated into performance measurements?

➢ Problems with switching provider – It is not unusual for a service provider to "stall" a customer from leaving their service, in an attempt to "save" the customer. However, there is an agreed industry where if requested, the service provider must issue a Migration Authorization Code "MAC" within 5 working days. The MAC code is valid for a period of 30 days from the date that it is issued.
  o A potential metric could be to measure the average time to provide a MAC code or % of MAC codes issued within 5 working days.
  o In effect, this is a measure of how quickly the Service Provider assists the customer in leaving their service, and therefore is doubtful that this is a selling point for persuading a consumer to switch to that provider. When a consumer selects a service provider, it is not naturally based upon how quickly they can then leave that service, but should be about the performance of the supplier when providing the service.

➢ No Service delivery / availability – If this is a question of availability, then it must be unfair to penalize a service provider for not having full UK coverage. Financially, it is common for the service providers to build an infrastructure in an area which will reap the most return. For a consumer, it is better to receive information on the service provider's performance in the local geographic area, as opposed to nationally. However in practice, the main service providers are national and are unlikely to be able to focus performance measurements on small geographical areas. The important factor for service delivery, to a consumer, is to know how long it will take to receive the service. Many complaints (including public feedback on utility based websites) are about the length of time taken for the service to be provided. The issue could be made more acceptable if the consumer was aware of the service delivery timescales prior to ordering the service. A measure of the average time to provide\install the service would give the consumer an indication of the expectation.

➢ No connection / loss of service – This measure is currently provided in the fixed-line QoS scheme, and similar to the Service Delivery indicator (above) should give the consumer an expectation of how often the service is likely to be unavailable. The current QoS measure gives the fault rate in xx per 100 lines scenario, which is thought unlikely to be meaningful to a consumer when the results are at a small scale. The measure more likely to have meaning would be the average time between faults, i.e. expect to have a fault once every five years.

➢ Speed of service – This is a Broadband measure which has resulted from Service Providers giving an expectation of speeds up to xx Mbps, where in practice the delivered performance is usually far less. Many factors can contribute to the final delivered speed, including number of other users on the network, website being viewed, PC specification, router and Providers network restrictions during certain busy times. Possible solutions have been presented where each Service Provider

offers potential discounts for a sample base of customers to run tests through agreed periods and send the results through to the Provider's to collate and compare. Usually, the tests will involve equipment to be attached to the customer's network, which will process the measurements in the background without the customer's knowledge. An alternative would be to follow the Mobile TopNetUK's approach and contract an outsourced agency to perform tests across all networks on comparable, controlled environments. Speed of service is not the only measure for broadband and in itself is not a true measure. For instance, upload speeds will normally be far lower than the download speeds, which for web-designers (owners) who continually add or change their website will certainly have an interest in the upload speeds. As more and more internet users are creating their own personalized websites, the measure of upload speed may be important in the very near future. Alongside speed comparisons, then other Broadband user types may be interested in other measures, such as Latency (for gamers) and Jitter\packet loss (for VoIP users).

➢ Difficult to contact / ignored or /inadequate response to enquiry/complaint – There are a bundle of potential measurements which covers these issues. Some may be targeting the contact centre responses in answering incoming calls, such as Percent Calls Answered (PCA) or Abandonment Rate, or Average Delay. Others may target repeated attempts to contact the provider, which again could be measured by the number of Accounts which have been accessed following customer calls. Time to process complaints or respond to written correspondence would also cater for some of the customer dissatisfaction reasons.

# Summary of Industry Feedback and Recommendations (see appendices for full details)

**Mobile Review**

**Introduction**

The Mobile service providers were invited to discuss the potential consumer issues and contribute suggestions towards any potential quality of service measurements.  Initially no feedback was received so a conference call with ███████████████████ again invited comments and proposals for any areas where consumers would benefit from understanding the potential differences in quality of service provided in the mobile industry.  Comments were invited to ██████████████ for the following potential measurements:

- ➢ Provisioning
- ➢ Faults & restoration
- ➢ Complaints
- ➢ Billing issues
- ➢ Customer Service Measures
    - a.  average speed of answer
    - b.  % calls abandoned
    - c.  average "on hold" time
    - d.  average call handling time – excluding wrap (maybe not as important as the customer may feel that at least their issue is being worked on)
    - e.  % of callers receiving $1^{st}$ time resolution to their call (if the customer does not call back about the same problem for a certain period of time, it is considered a successful resolution or FCR - First Call Resolution).
    - f.  % of callers being transferred

Overall, ████████████████ appeared to be skeptical as to the consumer benefit as it was perceived all relevant information on mobile providers are already in the public domain.

Fortunately, this was not the opinion of all mobile providers. ████████████████████████████████████████

Feedback from ████████████████ were less conclusive as to consumer requirements, but did confirm that from any prospective measurement, complaint data was available and could be used comparably if a suitable definition could be agreed████████ confirmed that the mobile provision and repair issues are not comparable with the fixed-line telephony product, as services are connected almost instantly and fault reports are less frequent.

In summary, there was very little confirmation from the Mobile telephony service providers on the types of quality of service measurements which may be of benefit to consumers.

Epitiro are linked to the communications industry by monitoring network performance of fixed line and wireless broadband providers. Their business concept is to track the network performance through simulated end user tasks and measure the results. These results are then compiled and sold back to the network providers which can then be used to improve customer related performance issues.

Test calls to the ISPs are typically made from the following locations:

Test calls are typically performed on a 365x24x7 basis, with calls made every 15 minutes,

Once connected, the systems perform a series of simulated end user tasks and records the following data:

- ➢ Modem Answer
- ➢ Negotiation Time
- ➢ Authentication Time
- ➢ Address Assignment
- ➢ Connection Failures
- ➢ HTTP Throughput by region (Cached and Non-cached)
- ➢ FTP Download Speed/FTP Upload Speed
- ➢ Ping Time
- ➢ DNS Performance
- ➢ Packet Loss
- ➢ E-Mail statistics
    - o E-mail round trip
    - o SMTP Failures
    - o Pop3 Failures

Although this may sound very technical to most ordinary broadband users, the results can be easily translated into event types which the average consumer would understand. For example, when a user initiates the connection to the broadband network a series of events occurs which include the modem answering; negotiation and authentication, and address assignment. These would be recognized as a "time to connect" style of measurement and can be quite varied between different service providers.

Connection failures are also measured and could be displayed as a %age of connection successes, but this may not result in a significant measure to differentiate between service providers, therefore the actual time to connect would be more applicable.

HTTP Throughput measures the time taken to perform web page downloads of text from a list of commonly used URL's, including BBC and Yahoo. These tests can be performed on cached (if this feature is supported by the ISP) and non-cached. The results could be described to the consumer as the "Average Broadband Speed" and measured as:

$$\text{HTTP Speed (bytes/sec)} = \frac{\text{Downloaded Data (bytes)}}{\text{Download Time (seconds)}}$$

However, to make the consumer understand the measurement, the result of this test should be compared to the "alleged" broadband speed offering by the service provider. For example, if a service provider marketed that their broadband speed is up to 8Meg, this measure would identify the actual %age which is observed by the consumer. Typically this result would be around 30-40% for most ADSL style providers. If a service provider regularly "throttled" the network, i.e. placed restrictions on the download speed capability, then the results would be worse.

Most broadband service providers offer the consumer to have their own web space. In the environment where more people are willing to tell the world of their experiences through the use of their own websites, a measure on the FTP speed (i.e. to transfer data to and from their website) would identify the end user experience. The diagnostics records the number of bytes transferred, and the amount of time to actually upload and download the complete file.

These two values are used to calculate the actual Transfer Speed for this particular file.

FTP Speed (bytes/sec)　=　$\dfrac{\text{Downloaded/Uploaded Data (bytes)}}{\text{Download/Upload Time (seconds)}}$

A ping (network latency) test is also performed which measures the time taken for a packet of information to be sent by a user to a website and back again. This measure would be applicable for gamers, but results between service providers are so minimal that there would be no noticeable comparison between them.

A measure on packet loss would identify the service providers where video and speech content may differ in performance. However, these are content specific style of measures, and may also be related to any fault performance measure, already under consideration. Content performance is also subjective. Where some consumers may consider the performance to be poor, others may consider it to be acceptable.

E-mail is a tool which virtually everyone with a broadband account should be familiar. If so, they would also recognize the frustration in waiting for a mail to be sent or delivered. Therefore, a measure of the round trip time to send and receive a standard sized e-mail would be recognizable to the end user. The measure would be calculated as follows:

Email round-trip Time (secs)　=　SMTP send time - POP3 retrieval time

In summary, the end user related measurements which could be provided would be:

➤ Average time to connect

➤ Percentage broadband speed (offered versus experienced)

➤ Average FTP Speed

➤ E-mail speed
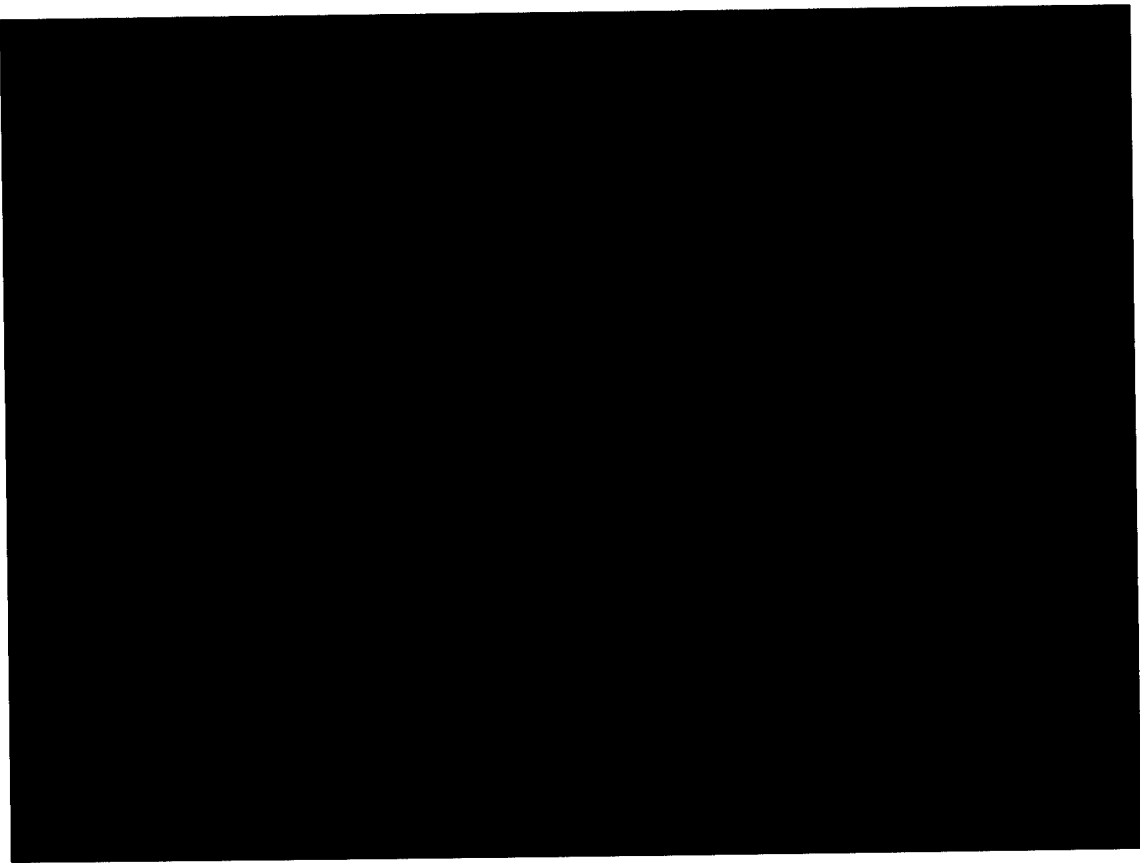
# Communication and presentation
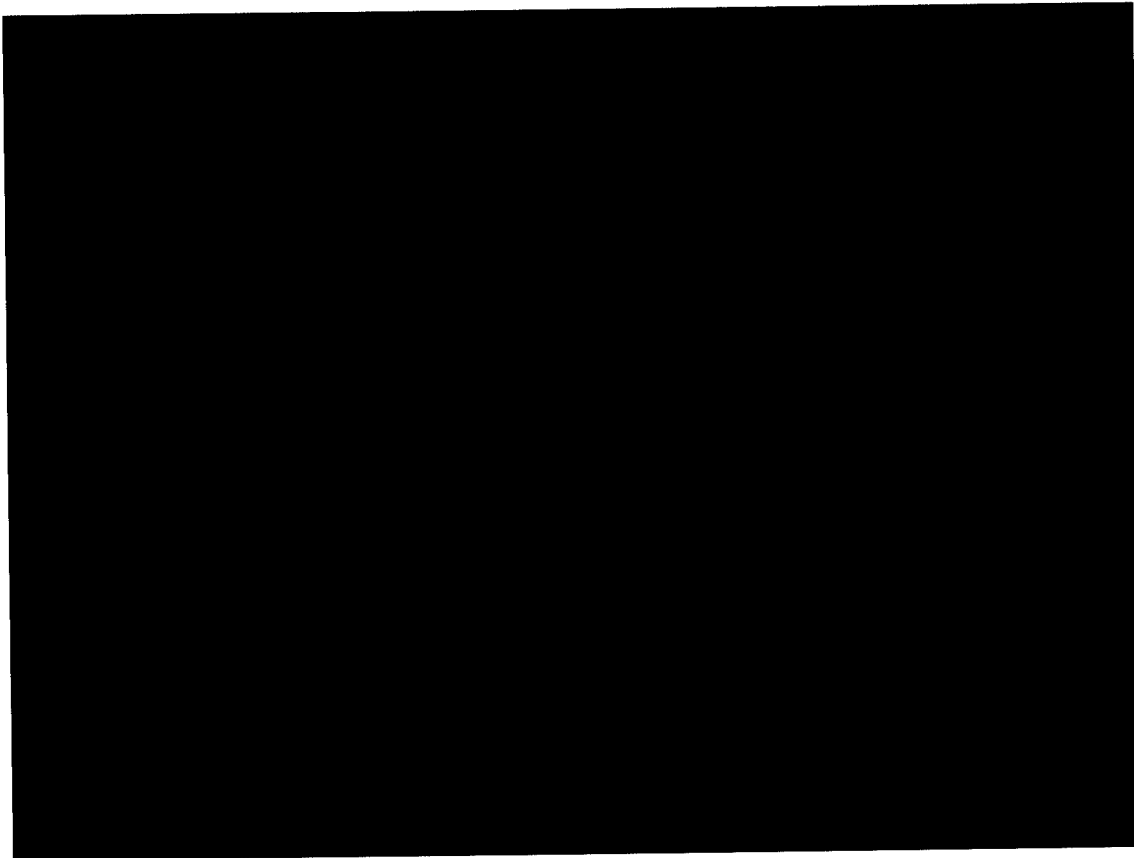


The TopComm website allows the consumer to view all of the main UK fixed line telecoms provider's performances for five key measures. The output is graphical using line bar charts, but only shows the performance of one key measure at a time. If the consumer wanted to obtain a balanced view on the overall performance of the service providers, they must select the five metrics individually and either memorise the results, print the graphs or download the detail to MS Excel and create their own matrix for comparison.

The site overall is easy to navigate but difficult to read and use as a comparison tool.

The TopNetUK website allows the consumer to view a geographical area and identify the output of tests made for any of the four Mobile Network Providers who comply with this scheme. The results are shown in green or red dots for successful and unsuccessful calls and quality. It is not clear what radius each dot represents, and as a consumer if the place of particular interest, say a driving route from home to work, does not have any dots, then the results are uninformative. Unless there is obvious distinction between service providers, it is not clear how a consumer would use this to influence a selection.

The site overall is easy to navigate and use as a comparison tool but difficult to read and interpret how the results meet the consumers requirements.

The uswitch website allows the consumer to input the parameters that are of interest, i.e. product, payment style etc and then outputs the list of providers which meet the consumers needs. The output is already sorted into order, normally based upon the price, but gives the user the options to re-sort to a different order for different subject headings. In this example, if Speed is more important to the consumer than $1^{st}$ year cost, then the consumer could re-order the results. The downside is that the user will not see all of the available alternatives unless they scroll through the screen – obviously the more service providers, the longer the scrolling option. However, if the consumer wants the best, why would they scroll to a service provider who does not perform as well?

The site overall is easy to navigate, read and use as a comparison tool. However, if the consumer considers changing their requirements, i.e. paying method, then the input and selection process has to be completely restarted.

Based upon the 3 options reviewed, we would recommend any future quality of service results to be output in a style similar to that offered by uswitch for the following reasons:

➢ Selection criteria is easy to complete

➢ The user will obtain a full view of the service provider's performances across all measurements, and

➢ Results can be sorted into order depending upon the users preference

However, we also recommend that any future forum or Ofcom undertake suitable research in identifying the consumer's presentation needs. This is to be supported by a marketing campaign to increase consumer awareness once the Quality of Service results are placed into the public domain.

**Appendix 3 -** ███████████████████

**Appendix 4 -** ██████████████████

**Appendix 5 -** ██████████