



**Vodafone response to BEREC's public consultation on the draft Guidelines on
Net Neutrality and Transparency: Best Practices and Recommended
Approaches**

Introduction

1. Vodafone welcomes the BEREC consultation on the Draft BEREC Guidelines on Net Neutrality and Transparency. The debate is now correctly focusing on how to ensure the required level of transparency in relation to broadband offers and provision. Transparency is an essential condition of choice for consumers and pricing freedom for operators, both of which are central to Vodafone's view of net neutrality.
2. The BEREC document provides a comprehensive analysis of many of the most effective tools and approaches. Operators already have in place a number of transparency initiatives but more can be done.

Net Neutrality, transparency, and barriers to switching

3. Transparency and low barriers to switching are key components of any pro-consumer view of net neutrality. Transparency allows consumers to make informed choices between competing services, and low barriers to switching allow them to act on those choices. Taken together, this enables consumers, rather than operators or regulators, to determine how the industry should allocate scarce resources between competing demands and thereby to perform the function of properly competitive markets. The allocation of scarce resources between competing demands is at the heart of the net neutrality debate.
4. Vodafone therefore agrees that high barriers to switch might undermine the benefits brought by transparency (page 9). There is not much evidence of barriers to switching in the European mobile market today, where churn rates consistently exceed 25% p.a. (annualised churn in the fiscal year ending in March 2011 for Vodafone Germany was 29.1%, Vodafone Italy 27.8%, Vodafone Spain 38.7% and Vodafone UK 37.6%¹). In addition to inter-operator churn, a high number of customers choose new tariffs or renew commitment every year while remaining with the same operator. For example, in Ireland, Spain and the UK the number is above 35%².
5. The implementation of new regulatory framework over the coming months, supplemented by specific initiatives in individual Member States, will further reduce any remaining barriers to switching in the mobile sector. For example:
 - number portability will be subject to stricter time limits and subject to pro-consumer conditions (in terms of porting costs, processes, ease of use, penalties for delays, etc.)

¹ Vodafone results announcement for the year ended 31 March 2011:
http://www.vodafone.com/content/dam/vodafone/investors/financial_results_feeds/preliminary_results_31_march2011/dl_prelim2011.pdf

² Calculation made for postpaid customers that move to different tariffs or actively renew commitment to specific plan.

- rules on contract duration are intended to reduce barriers (max 24 months and need for the availability of at least one offer of max 12 months)
 - availability of prepaid and postpaid offers without minimum contract duration
 - new rights for users to withdraw from contracts without penalties if any of the contract conditions (price, functionalities, characteristics) is modified to the disadvantage of the user (i.e. material detriment)
 - pro-user national rules on the application of penalties in case of early cancellation of contracts
 - rules and commercial practices on SIM-locking to reduce barriers to switching
6. In short, the mobile market is already highly responsive to customer demands as we witness rapid shifts in products and services (e.g. customers switching between prepay and post-pay options, the rise and fall of the 'netbook', or the rapid adoption of smartphones) and intense competition between firms. The collapse of the 'walled garden' mobile internet model favoured by many operators (including Vodafone) showed that consumers, not operators, would determine how access to the internet would be governed. The rapid growth of new mobile messaging applications, such as WhatsApp (and the consequential decline in SMS service revenues in some Europe markets), confirm that consumers remain firmly in the driving seat in determining which services and applications will prevail.
7. Vodafone accepts that there is always more that might be done to safeguard competition, particularly as mobile internet services become more complex. Operators will need to engage in greater differentiation and segmentation of consumer needs if they are to create a sustainable economic platform for mobile internet. But greater differentiation, and more choice, also carries the risk of more confusion for consumers. Vodafone has always argued that operators themselves have an interest in avoiding this: if consumers are unsure or confused about the merits of a more expensive service then they are unlikely to select it and the operators' investment will have been wasted. We believe that BEREC's objectives and those of the operators should be viewed as closely aligned rather than being in opposition on this topic. Regulation may have a role in 'nudging' the market to do more, but in this area it should be seeking to harness existing competitive incentives rather than work against them.

Vodafone key principles for effective transparency policies

8. Vodafone believes that any policy in this area should be subject to the following principles:
- Full industry involvement

- Proportionality
 - Graduated approaches
9. In Vodafone's experience the most effective transparency initiatives are those that have seen the involvement of the broadband providers in all stages of the policy making process and are clear about distinctions between 'ends' (which might best be defined by the regulator, in conjunction with the industry, and which will be common to both) and 'means' (which are generally better defined by the industry, and might differ significantly between operators).
10. This could take a number of forms. For example, the regulator could set general transparency objectives that will be implemented:
- by each operator on a unilateral basis in a way which accords with their existing business practices, internal processes, branding and tone of voice with customers. This approach has the advantage of providing operators with enough flexibility to retain differentiation (and hence innovation) in delivery of common objectives. It should also help to reduce implementation costs and/or speed up delivery. Usage monitoring tools and management of data caps are examples that are best tackled through this approach. The regulator should monitor the effectiveness of implementation, but not specify how it is to be done.
 - via self-regulatory initiatives by the industry. The operators will agree among themselves the best implementation of the general regulatory objectives. This approach is particularly effective for areas where individual operators will not act to avoid being put in a competitive disadvantage compared to other industry players (e.g. communicating actual speed vs. headline speed) or where a common approach is required to avoid customer confusion (e.g. the development of visual representation of broadband characteristics and limitations) . The main disadvantage is that self-regulation can take time to agree (or may be limited to very generic agreement). Again, the regulator will monitor the effectiveness of the measures³.
 - via co-regulation where industry and the regulator determine together the best approach to solve a specific transparency issue. This approach will be required where the regulator itself is needed to provide authority or credibility to the process in the minds of consumers (for example, by serving as an independent source of information) or where competitive considerations make industry agreement unrealistic.

³³ A first example of this approach is the UK mobile networks' code of practice on the sales and marketing of mobile broadband signed in 2009:
<http://www.vodafone.co.uk/consumer/groups/public/documents/webcontent/vftst062577.pdf>

11. A traditional top-down approach on transparency should be avoided because it will not be flexible enough to take into account the constant market and technological development in the sector. It is also likely to limit innovation in an area where competition between operators will result in more creativity and a healthy degree of ‘trial and error’, even if the industry is eventually required to standardise around best practice.
12. The second principle to be followed is proportionality. Vodafone agrees with BEREC on the application of the principle from recital 41 of the Framework Directive and 51 of the Universal Service Directive to the definition of transparency measures (page 17).
13. Transparency requirements have implementation costs and operational burden that can be substantial, whilst benefits are often hard to measure. There are also opportunity costs that should be taken into account (e.g. the delay in the introduction of new products and services due to the need to implement a specific transparency feature). The costs do not fall only on operators. There are costs for users too in terms of time and attention resources to be dedicated, or from counter-productive ‘information overload’. Opt-out mechanisms could reduce these costs.⁴
14. The third principle is the graduation of the response which has been also proposed by BEREC (page 18). It is better to start with less costly and simple measures based on general principles and increase the level of detail and effort if, and only if, they do not achieve the necessary results in terms of transparency. It is also important to be clear about and to distinguish between activities can be expected to emerge from the competitive process over time, and which may require a stronger ‘nudge’ from the regulatory process.

Need for transparency in all stages of the customer relationship

15. Vodafone believes a comprehensive transparency policy will require initiatives in all three stages of relations with users⁵. These include :
 - Educating non-users, prospective users and current users on broadband in general
 - Informing prospective users on the characteristics and limitations of different broadband offers
 - Allowing existing users to monitor the level of service they are actually getting

⁴ This measure which has been implemented in some EU countries is not part of the BEREC proposals

⁵ In this case the term “user” is referred to prospective users too

16. The three stages will require different tools and measures to be provided by operators, regulators and other stakeholders

Educating non-users, prospective users and current users

17. This stage is important to increase general awareness about what services are available and what prospective users should look after when buying a broadband product. In Vodafone's view, the best and least expensive way to achieve this aim is to develop a comprehensive and easy to use 'Guide to Broadband Selection'⁶. This initiative should be a joint effort of the industry and, possibly, NRAs and consumers associations⁷. This guide should include the following:

- A general idea of the performance requirements for each category of application (e.g. online gaming requires low latency; video streaming requires download throughput over x Mbps; etc.)
- Easy to understand technical jargon glossary (this could be connected to the requirement to agree to a common terminology analyses further on in this paper)
- Explanation of key traffic management techniques
- Summary boxes of how much data is required to download a music file, to stream a 10 min low quality video, etc. to help decide the size of the data bundle
- Description of the visual representation of broadband characteristics and limitations described later in this document
- Reference to any QoS measurement exercise by NRA
- References to NRA website containing additional information about broadband

These guides could have the following benefits:

- Reduce the amount of information/explanation to be provided for each offer (a reference to the guide will be included in the description of the tariff)
- Advertising and promotion material will tend to converge to the terminology used in the guide
- Customers will have a reliable source of information enhancing their confidence in new technologies
- Operators and content providers could increase demand for their services

⁶ Ofcom has attempted to work in this area with its guide to mobile broadband "What to look for when choosing mobile broadband" and the guide for students "Keep connected at college – a student guide". However, a more comprehensive approach is needed.

<http://consumers.ofcom.org.uk/2009/08/what-to-look-for-when-choosing-mobile-broadband/>
<http://consumers.ofcom.org.uk/2011/09/keep-connected-at-college-%E2%80%93-a-student-guide/>

⁷ An alternative approach might be to have NRAs to develop such guides. However, operators should be involved in the process. This will give them the confidence to use them as much as possible.

18. Operators, NRAs, consumer associations and other stakeholders will then make it available electronic copies on their websites. Paper copies could also be distributed at the point of sales of operators.

Informing prospective users on the characteristics and limitations of different broadband offers

19. This stage is critical as it will influence the customer's choice of operator and service. Prospective customers can be divided in to two main categories⁸:

- Prospective customers that will first gather information about operators and different packages on the internet and then go to the point of sale with a decision broadly already made
- Prospective customers that go directly to the point of sale and choose there the pricing offer that best suits their needs

20. This means that sufficient information should be provided both on the web and at the point of sale. The key information provider will be the operator itself. NRAs and third parties websites will play a complementary role potentially in the explaining and comparing the various offers.

21. The general categories of information will be the same for both the web and the marketing material available at the point of sale. However, as BEREC note, the level of detail will have to be higher on the web (the customer has more time available) than at the point of sale where a summary of key characteristics and limitations should be provided. On the web too, the operator should make available the information in two steps. A summary box first with key characteristics and further link to additional details that the customer could choose if more information are needed. The figure below is an example of such summary boxes provided by Vodafone Spain on its website.

⁸ There are other information sources such as operators' customer service centres and direct sales (e.g. telesales), but their importance is decreasing. As a general point, the telephone mean is not the best transparency tool for complex broadband packages. However, it fulfils a key role in answering and clarifying specific questions.

		Smartphones				Smartphones BlackBerry	
		Tarifa Diaria 2,90€	Tarifa Plana 15€	Tarifa Plana 19,90€	Tarifa Plana 39€	Tarifa Ilimitada BlackBerry 15€	Tarifa BlackBerry 6€
	Navegación	Ilimitada	Ilimitada	Ilimitada	Ilimitada		
	Velocidad máxima de descarga hasta	7,2 Mbps	7,2 Mbps	7,2 Mbps	7,2 Mbps	7,2 Mbps	3,6 Mbps
Throttling	Reducción de la velocidad a partir de	20 MB	300 MB	500 MB	1 GB		
	Navegación en Roaming		50 MB	150 MB	250 MB		
	SMS a todos			350 SMS	350 SMS		
Tethering	Uso del teléfono como Módem			Incluido	Incluido		
Voice over IP allowed?	Voz sobre IP				Incluido		

22. The key information to be provided should include the following categories (each one will be analysed in the following paragraphs):

- Prices, minimum duration, other services included (if part of a bundle)
- Fair usage policies and data caps
- Information on speed/throughput and other QoS metrics
- Traffic management techniques applied and traffic types limitations (e.g. VoIP, P2P, etc.)

23. Broadband prices are relatively straightforward. They usually include a monthly (or a daily/weekly for mobile) fee and possibly a subscription fee. Minimum durations are more common on fixed packages and should be clearly stated. Most of the complexity is likely to come from bundling with other services (for example, voice or IP-TV for fixed) or the inclusion of terminals (mainly for mobile). Transparency policy in this area is already highly developed thanks to general consumer law and rules on misleading advertising.

24. Prospective customers should be clearly informed about any fair usage policy, the criteria applied to determine the breach of the policy and the implications for the user that breaches them. Fair usage policies are being progressively abandoned by mobile operators in favour of the more transparent data caps.

25. Information about the size of any relevant data cap (possibly both in terms of data size, but also practical examples such as number of pictures, minutes of video, etc.), the billing period, consequences of exceeding the cap, procedures to buy higher caps, any notifications mechanism, any data usage monitoring tools, etc.
26. A key evaluation parameter in the choice of operator/offer is the speed of the connection. However, it is also the most difficult to define and to communicate to the user. Vodafone agrees with BEREC (page 29) that there are three different types of information that may be useful to users in this area, but would add a fourth one:
- a) **Headline speed** which is the maximum speed that the connection could reach. This is the one usually advertised by operators. For mobile networks, this value is the result of the network capability in a specific area and the speed that the terminal equipment supports (i.e. the lower of the two). However, this information is not sufficient to potential users as it might rarely be reached by the network.
 - b) **Actual speed.** This could be considered the average speed that the typical user within the same category/technology should expect to get. This information can be difficult to gather for mobile networks, and very sensitive to interpretation. It is important this information is meaningful to the end-user (an average actual speed is not per se meaningful for a mobile end-user, who would be more interested in the actual speeds in the areas he frequents). The values could be derived from internal measurement or from independent testing. Operators could publish this information periodically, but it should not be part of the contracts with customers. This is an area that needs further analysis by the stakeholders involved. Vodafone understands that BEREC will investigate it in detail in 2012. Further details on Vodafone views on QoS measurement can be found in the specific policy paper attached to this response as Annex 1.
 - c) **Minimum broadband QoS/speed.** The new EU framework foresees that NRAs might specify the minimum QoS information to be included in customers' contracts. This value would be a floor that the operators will commit to. If this approach will be implemented, for mobile, the definition of such floor must be flexible enough to take into account the variation in the level of service which is intrinsic to the technology. In principle, absolute service guarantees are not possible on mobile networks. Also in this case, BEREC will provide additional analysis in 2012 and Vodafone is currently undertaking further additional work on it.
 - d) **Applicability of prioritised services:** this is a feature mainly of mobile broadband. Customers can buy a prioritised broadband service that guarantees in most circumstances a better performance compared to other users in the same situation. The characteristics and potential limitations of this functionality should

be clearly explained to the customer buying the prioritised service although, as explained at the outset, this is likely to be necessary anyway if the customer is to be persuaded to buy it.

27. Transparency regarding traffic management techniques are a pre-condition to ensure customers can make informed choices about the different service providers and tariff plans. Vodafone agrees with BEREC about the policy of giving priority, in the information to the customer, on those traffic management techniques that have a substantial impact on the service offered to the user (the ones that BEREC paper refers as “problematic”). The list of techniques that should be communicated could be agreed by the broadband providers together with the NRA. Information on other techniques that are used by the broadband providers to enhance the service to the user (a typical example is video optimisation techniques) may be available to the prospective or current user, but not in detail at the point of sale. This should guarantee that the typical user is not overloaded with information, but that the more advanced user will still be able to get all the information (this is consistent with the tiered approach suggested by BEREC)⁹.
28. Vodafone supports BEREC’s proposal to provide explanations on why specific traffic management techniques are applied. It is in the operators’ interest to reassure customers that the techniques are applied to provide a better service to users, guarantee a lower priced offer, ensure network integrity, etc.
29. For some tariff packages, traffic management techniques are used to prevent types of traffic not included in the specific tariff plan (e.g. VoIP or Peer to Peer traffic). In these cases, it is more useful and transparent for the customer to get the information that those services are not included rather than providing technical details about the underlying traffic management technique used.
30. A key aspect to increase transparency for prospective customers is comparability of the information. This can be reached in two ways:
 - Making sure that the operators provide information that can be easily compared by users (e.g. common references, similar terminology and provision of common visual representation of offers)
 - Provide tariff packages comparisons (compiled by NRAs or independent trusted third parties on their behalf)
31. Vodafone agrees with the aim of using common references to increase transparency and comparability (page 23). This will work best if done through a self or co-

⁹ A good example is the one adopted by Vodafone UK that provides a summary of the applied traffic management techniques in a specific summary page on its website:
http://www.vodafone.co.uk/consumer/groups/public/documents/webcontent/pdf_trafficmanagement.pdf

regulatory approach rather than leaving the task to the NRA. This approach has been adopted by UK fixed broadband providers in the development of their “Voluntary industry code of practice on traffic management transparency for broadband services” signed in March 2011¹⁰. Any agreement on common references within the industry must not involve any pricing issues or any other discussion that will restrict the marketing freedom of operators.

32. A good approach to the issue is the one foreseen in Spain. The Spanish Ministry of Industry is working with the industry to develop a common website where all operators will publish main characteristics of their broadband services (fixed and mobile) based on a common framework and a common terminology.
33. The presentation of information would be key in making broadband offers transparent to customers. Vodafone believes that a visual representation of the characteristics and limitations of broadband offers similar to the one provided in the Tecnologia research reported by BEREC (Figure 1 on p. 39) is the right direction to follow. However, as stated by BEREC, the approach should be common to the whole industry (potentially at European level, but at least at national level) and agreed by the market players with a monitoring role for the NRA. This could then be complemented with additional detailed information (i.e. the tiered approach mentioned by BEREC) to be provided in the website of the operator. This information would be key for more technologically savvy users and for third parties providing advice and comparison tools. The visual tool should be seen as complementary to what operators otherwise do to promote their services. It should also be updated regularly to take into account technological developments.
34. The direct comparison of tariff packages characteristics may provide useful information to users. However, such initiatives require careful planning and substantial effort in the setting up and maintenance of the information. The variety of tariff packages and additional options available will require such comparisons to be web based. While they should be set-up and run by NRAs or other independent trusted third parties, operators will have to be fully involved in the initial design and in the on-going development. In addition, operators will provide the raw tariff information.
35. Current experience with such initiatives is mixed. The Portuguese website set-up by Anacom with the involvement of operators is an example of good implementation with relatively low investment and operational burden.¹¹ However, there are examples of similar initiatives in other countries that have failed to provide useful information.

Allowing existing users to monitor the level of service they are getting

¹⁰ www.broadbanduk.org/component/option,com_docman/task,doc_download/gid,1335/Itemid,63/

¹¹ <http://www.anacom.pt/tarifarios/Paginalnicial.do>

28. The third stage is to allow existing broadband subscribers to monitor the service that they are getting. The best way to do this is to give users monitoring tools such as software clients or web interfaces that can be used directly by customers. These tools can be divided in two categories:

- Tools to monitor traffic management techniques and the level of Quality of Service
- Tools to monitor data usage

29. A number of independent software companies have developed software that can detect whether operators apply traffic management techniques to a specific access line¹². However, the efficacy of these tools still needs to be fully confirmed. Vodafone encourages BEREC to perform a technical analysis of these tools within the work planned for 2012. In addition, there are other tools that can be used by customers to verify the performance of their broadband connection¹³. Vodafone supports these self-test means as customer empowerment tools and already makes them available in some markets (e.g. Italy and Germany). However, it is important that regulators provide users with all the necessary information on the advantages and limitations of these tools as they have limited scientific validity, particularly if used for Quality of Service benchmarking.

30. Vodafone views real-time or near real-time tools to assess their data usage as essential to allow users to make the most of their data bundles and avoid bill shocks. All Vodafone operating companies provide such tools to users in the form of specific web interfaces, IVRs, software packages, SMS alerts or more recently smartphone push applications. This latter application called Vodafone Discover provides information about usage, tariffs and other characteristics of the service directly on the smartphone with an easily accessible interface. It has been launched by eight Vodafone operating companies. More details about Vodafone initiatives in this area are contained in Annex 2 to this document.

31. The best combination of usage information tools should be defined by the operators themselves with a monitoring and verification role for the NRA. This is necessary because the cost and operational complexity of implementing the different solutions vary from operator to operator, and this is an area where there will be significant opportunities for innovation and differentiation.

Vodafone comments on other topics raised in the BEREC document

36. Vodafone agrees with the five criteria (page 13) for an effective transparency policy (accessibility, understandability, meaningfulness, comparability and accuracy) and

¹² For example, M-Lab is making available a number of applications developed by independent researchers to detect the application by operators of different traffic management techniques. See: <http://measurementlab.net/measurement-lab-tools>

¹³ For example Speed test by Ookla - <http://www.speedtest.net/>, M-Lab (see above) and Radio-Opt

with the fact that they should not be applied to all transparency communications, but they should all be present in the overall policy framework.

37. Vodafone share the view of BEREC on the necessity to provide both general (i.e. information on the network as a whole) and individual information (i.e. information on the level of service to the specific user). In relation to QoS and traffic management, Vodafone acknowledges that, as a general rule, the two approaches satisfy different needs. However, it is important to note that given the characteristics of the mobile network (e.g. the level of QoS depends on the number of customers using the same cell and the broadband use in mobility), a general information approach is usually more suited to mobile networks. There are exceptions to this such as mobile coverage information which could be relatively more individual to users (e.g. on-line coverage information tools based on “pixels”).
38. As a general rule, the high variance of mobile broadband performance (due to number of customers using the same cells, indoor coverage issues due to building material and obstacles, distance from the antenna, meteorological factors, factors related to the terminal design and software, etc.) provides huge challenges in terms of information accuracy and meaningfulness to the user. However, this should not refrain the industry and regulators involved to seek the best transparency tools possible such as interactive coverage maps available on the web and smartphone based applications¹⁴.
39. The direct approach is the one that has been traditionally used by operators and imposed/encouraged by regulators (page 15). In addition to this, a whole industry of “third party” information providers has flourished to provide summary information and comparison of the offers available (indirect approach). Even though we believe that this approach is fulfilling a useful role in guiding users, the quality and accuracy of the information provided varies considerably. Third parties can provide an educational role by explaining the technical jargon and highlighting the key advantages and disadvantages of certain offers. They will be able to tailor the information to the needs of the specific category of users and will be regarded as independent of any particular operator. For example, a magazine (or website) on on-line gaming will focus on the characteristics of ISPs offers suited to its readers.
40. However, as BEREC points out, the indirect approach can be complementary to direct information requirements for operators. No formal role should be given to third parties as they cannot substitute operators in the legal role to guarantee transparency towards the customer.
41. NRAs should also monitor the quality and accuracy of the information provided by the third parties or review notifications from operators signalling misleading or

¹⁴ Vodafone Italy has recently launched a smartphone application that can be used by customers to monitor coverage and to send location tagged complaints about lack of coverage or other network issues.

incorrect information contained in third parties websites. Some NRAs, for example Ofcom and Agcom, have in place accreditation processes for tariff comparison websites. However, the accreditation would need some kind of periodic monitoring by the NRA and 'notice and correct' process to eliminate inaccuracies.

42. It is important that reliance by regulators on third parties does not result in the need to disclose confidential information about the network topology, traffic distribution or customer data. As a general rule, the provision of raw data to third parties should be limited to information accessible to the general public and customers.
43. Vodafone agrees with the approach proposed by BEREC that transparency principles and practices should be the same for fixed and mobile broadband (page 20). Traffic management techniques (and the frequency of use) might differ from fixed and mobile, but this does not mean that the general transparency principles should not be the same. QoS metrics for broadband are also the same, albeit with different end results in terms of performance. However, as BEREC recognizes, mobile networks have more variance in terms of performance due to service availability (customer moving to areas without 3G coverage and, in the future LTE), impossibility to predict exactly the number of users per cell (e.g. mobile operators know that some streets in urban areas have higher traffic than other, but they cannot take into account all external events that might cause an unexpected number of people gathering in some areas) and metrological factors (e.g. heavy rain affects radio signals of base stations and microwave links). Operators should be transparent about these factors.
44. Moreover, as BEREC correctly underlines, terminals and software applications play a much bigger role in the characteristics of the mobile offering (page 21)¹⁵. In many cases, these are outside of the operators' control. The onus of transparency is in these cases on the manufacturers and software developers that, however, are not subject to any sector specific transparency regulation. This may result in less transparency for users. Even though there is no legal basis in the current EU regulatory framework, BEREC and single NRAs should use their 'moral suasion' powers to involve terminal manufacturers in the process of improving transparency.

Summary recommendations

45. Vodafone proposes the following key policy recommendations to ensure transparency in the provision of broadband services:
 - Self and co-regulatory approaches to transparency should be preferred to traditional top-down detailed regulation, allowing existing competitive incentives to communicate effectively with customers to be 'nudged' in a positive direction where necessary

¹⁵ It should also be noted that terminals design and antennas can affect substantially the radio signal reception. Internal Vodafone research revealed that radio signal reception of some widely diffused smartphones is 30% lower. This affects performance.

- Common references (terminology, service definitions and key examples) should be agreed and used as much as possible by industry via self-regulation
- Customers should get synthetic (at point of sale) and detailed (on website) information about characteristics of service (headline/actual speed and other metrics), traffic management techniques, fair usage policies and data caps
- A common 'Guide to Broadband Selection' should be defined by operators together with consumer associations and NRAs to help customers
- Common visual representation of characteristics and limitations of broadband should be agreed among operators (with NRA supervision)
- QoS monitoring tools (software clients and web interfaces) are good customer empowerment means, but their limitations should also be made clear to users
- More work is required on broadband QoS measurement (e.g. information on actual speed). Planned activities by BEREC for 2012 will help fill the gap
- Operators should make available the most effective combination of data usage monitoring tools
- Fixed and mobile broadband should be subject to the same transparency principles, but the implementing measures should be differentiated
- BEREC and NRAs should involve terminals manufacturers and key application providers in the process to improve transparency of the features under their control. BEREC has more reason to be concerned about high switching costs in other parts of the internet value than in the mobile network sector, and should focus accordingly.

Measuring mobile broadband quality of service: a paper by Vodafone

Introduction

1. The growth of mobile broadband services (and the associated debate on net neutrality in Europe) means increasing focus on level of actual broadband Quality of Service (QoS) provided to customers and on the different methods used to measure it¹⁶. This paper provides Vodafone's views on how this should be undertaken.
2. There is widespread agreement between industry and regulators that transparency is a primary means of ensuring an open internet, allowing customers to choose the operator with the service that most suits their needs in term of pricing, features and quality offered. The traditional way of presenting information to users based on the theoretical maximum speed (i.e. "up to x Mbit per second") is clearly insufficient for these purposes.
3. Moving from theoretical to actual performance is not, however, straightforward. Many different variables affect the actual QoS provided by a specific operator: the time of day, geographic location of the user, the destination servers used, terminal equipment, how the terminal is held, operating system used, type of application used, etc.. This suggests that a common methodology and a neutral testing environment will be required to ensure any kind of comparability.
4. Customers, operators and regulators will be interested in different aspects of the user experience. This suggests that a variety of different test scenarios and KPIs will need to be analysed.
5. ETSI has been working on QoS testing and standardisation for a long time. It has produced a number of documents which Vodafone believes should be the basis for any activity on QoS undertaken by the industry. This paper reflects extensive QoS testing undertaken by Vodafone across all its networks over the past 5 years.

¹⁶ Vodafone has provided its views on net neutrality at http://www.vodafone.com/content/dam/vodafone/about/public_policy/position_papers/Vodafone%20response%20to%20European%20Commission%20Questionnaire%20on%20the%20Open%20Internet%20and%20Net%20Neutrality%20in%20Europe.pdf

Summary recommendations

6. Current QoS testing methodologies can measure both network performance (under the control of the operator) and actual customer experience (which is influenced by external variables beyond the control of the operator). Results can differ. Vodafone believes that any testing methodology should measure both network performance and end-user experience.
7. Vodafone believes that a robust QoS measurement approach should include as a minimum the following Key Performance Indicators:
 - Download speed or throughput: (measured in bits per second (bps) or multiples of that such as Kbps or Mbps)
 - Upload speed or throughput: (in bits per second (bps) or multiples of that such as Kbps or Mbps)
 - Latency: (normally expressed in milliseconds (ms))
 - Web browsing session time: (measured in seconds on a reference ETSI page)
8. A large number of different methodologies and tools have now been developed to measure the performance of a mobile broadband connection. Vodafone believes that, for the foreseeable future, measurements should be undertaken using specialised QoS testing tools. New technologies such as device-based tools (i.e. campaigns via testing software downloaded onto terminals) and public domain tools (e.g. speedtest websites / tools) offer some benefits (lower costs, customer empowerment, continuous testing, etc.), but are not (yet) sufficiently robust to substitute for more established techniques.
9. Testing itself should be undertaken either by the operators themselves or by an independent agency. Vodafone currently uses both approaches – self-managed benchmark measurements as well as commissioning of external/independent benchmarking¹⁷.
10. Operators should adopt a common methodology with testing methodology, tools, timing of measurements and all other technical and operational details the same for all operators in a specific national market (with the possibility of a common EU-wide QoS benchmarking exercise in the longer term). This should be based on ETSI reference papers that address QoS measurements, with Technical Specification 102

¹⁷ Currently undertaken by P3 Communications for Vodafone

250 as the main reference document. Vodafone's approach is already based on these standards.

11. Regulators should review and endorse the methodology proposed by operators to ensure that both end-users and regulators regard the QoS results as reliable and trustworthy. Regulators could publish the results. Results could be made available on a regular basis and at least annually.

12. **In addition, regulators should provide guidance to customers on the advantages and limitations of web-based self-testing tools.** The web-based self-test tools already available (e.g. speedtest.net by Ookla, MLab, CNLAB, etc) are strong customer empowerment tools that allow the testing of the actual end user line in a specific environment and for a specific server destination. However, they have limited scientific validity and the results do not provide reliable information for benchmarking. It is, therefore, important that regulators provide users with all the necessary information and characteristics of these tools. Vodafone is in close contact with suppliers like Ookla to improve the measurement methodology especially to the characteristics of mobile networks and their latest evolution towards LTE speeds.¹⁸

13. The next section provides a detailed proposed methodology for QoS testing

¹⁸ A number of NRAs (e.g. in Denmark, Greece, Italy, Latvia and Lithuania) have developed or plan to develop their own web-based tools, mainly for fixed broadband measurement..

Proposed detailed QoS methodology

Vodafone has undertaken an extensive QoS testing campaign across all operating companies in Europe and the rest of the world. The measurements covered 16 countries with almost 50,000 data test samples over 315 measurement days of testing from September 2010 until January 2011. This has allowed Vodafone to gain valuable experience on the best tools available and the relevant testing methodologies.

On the basis of such work and the reference ETSI work, the following approach is proposed.

1 Services and Technologies

The following services should be audited:

- HTTP download (3MB)
- FTP upload (1MB)
- Web browsing (using ETSI reference web page)
- 15-30s download stress test (fixed download time) via FTP
- ICMP PING and TCP Socket Establishment RTT

The tests should be done with commercial devices (preferring USB stick) in dual-mode.

2 Measurement Methodology

2.1 Packet Switched Data Measurement Sequence

Figure 1 to Figure 3 show the measurement sequences for different use cases.

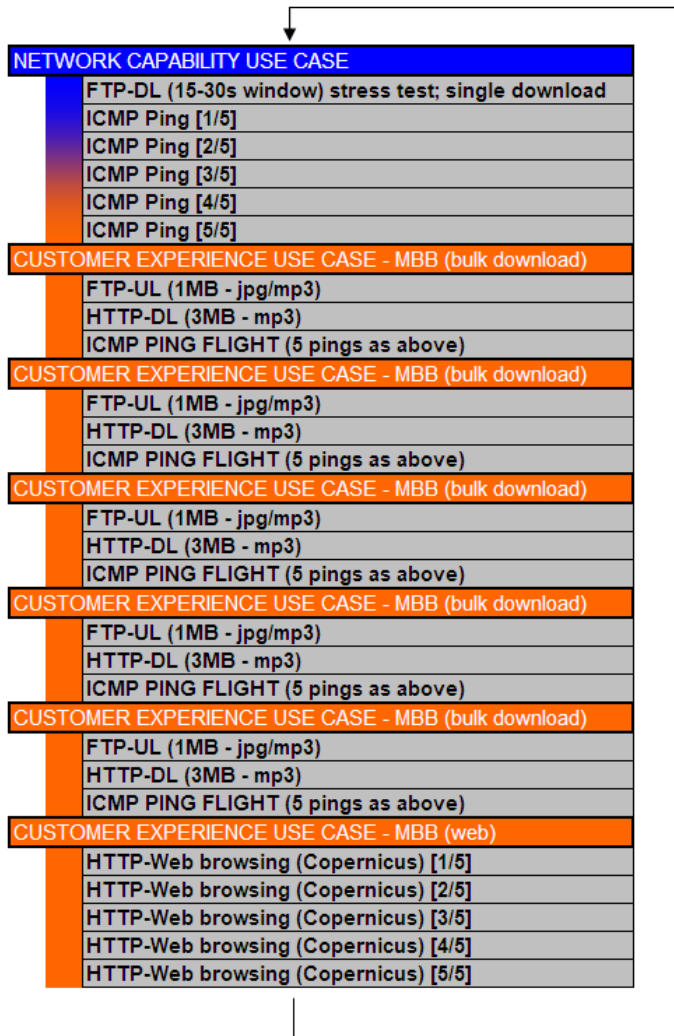


Figure 1 Simplified Measurement Use Case

NETWORK CAPABILITY USE CASE	
	30s re-selection pause
	PDP Context Activation
	3s pause
	FTP-DL (15-30s window) stress test; single download
	<i>only statemachine delay - no physical pause</i>
	ICMP Ping [1/5]
	1s pause
	ICMP Ping [2/5]
	1s pause
	ICMP Ping [3/5]
	1s pause
	ICMP Ping [4/5]
	1s pause
	ICMP Ping [5/5]
	PDP Context De-activation

Figure 2 Network Capability Use Case

CUSTOMER EXPERIENCE USE CASE - MBB (bulk download)	
	30s re-selection pause
	PDP Context Activation
	3s pause
	FTP-UL (1MB - jpg/mp3)
	3s pause
	HTTP-DL (3MB - mp3)
	<i>only statemachine delay - no physical pause</i>
	ICMP PING FLIGHT (5 pings as above)
	PDP Context De-activation
CUSTOMER EXPERIENCE USE CASE - MBB (web)	
	PDP Context Activation
	65s pause
	HTTP-Web browsing (Copernicus) [1/5]
	30s pause
	HTTP-Web browsing (Copernicus) [2/5]
	20s pause
	HTTP-Web browsing (Copernicus) [3/5]
	10s pause
	HTTP-Web browsing (Copernicus) [4/5]
	5s pause
	HTTP-Web browsing (Copernicus) [5/5]
	PDP Context De-activation

Figure 3 Customer Experience Use Cases – Mobile Broadband bulk download and web-browsing

The estimated number of measurement samples and the measurement time given in section 4 are based on the sequences as specified in figures 1-3.

2.2 Measurement Devices and Attenuation

2.2.1 Data

Packet switched measurements should be executed with widely used testing equipment agreed among the operators involved in the campaign. The USB data sticks should be placed inside the vehicle without external antennas or additional attenuation.

Operator-specific dashboard settings and/or optimiser clients may be used if applicable and possible for all competitors in a market and subject to tool capabilities. This is to be agreed on a per-country basis among operators.¹⁹

2.3 Nomadic Measurements for Data

In general, all measurements should be executed as nomadic in main city centres. Indoor measurements could be the subject of further testing campaigns to be defined among operators at national level.

The measurement campaign should focus on top cities (typically 4-16) depending on the size and population of the country. The exact list of cities should be defined by operators at national level. Further scenarios related to wider area coverage (e.g. highways) could be added.

The criteria

- Within cities so-called “areas of interest” could be selected covering areas such as train stations, airports, business districts, shopping centres, tourist areas etc. Those are again to be specified by operators at national level.
- Inside the areas of interest a nomadic approach is applied. Single spots will be measured for around 20 minutes. All measurements (drivetest + stationary) inside of areas of interest are aggregated into one result. The measurements performed along routes connecting the areas of interest are aggregated into another result.
- The number of individual locations shall be maximized across areas of interest (at least 10-20 static locations per city depending on size).

2.4 Measurement Tools

The measurements should be executed with the appropriate communications testing equipment available in the market from the various vendors. The supplier of the equipment is to be agreed at national level among the involved local operators. The pre-requisite is a proven compliance of KPIs against the ETSI standard.

¹⁹ The testing should be fair, without providing advantages to a specific operator in relation of the testing tool used.

3 Performance Indicators to be measured

Service independent KPIs:

- PDP Context Activation Failure Ratio [%]
- PDP Context Activation Time [s]
- PDP Context Cut-off Ratio [%]

For FTP file upload:

- FTP IP-Service Access Failure Ratio [%]
- IP-Service Access Time [s]
- FTP Data Transfer Cut-off Ratio [%]
- FTP Mean User Data Rate [kbit/s]
- FTP Data Transfer Time [s]
- FTP Session Failure Ratio [%]
- FTP Session Time [s]
- FTP Roundtrip Time other (3-way handshake of FTP data socket) [ms]

For HTTP browsing and HTTP bulk download:

- HTTP IP-Service Access Failure Ratio [%]
- IP-Service Access Time [s]
- HTTP Data Transfer Cut-off Ratio [%]
- HTTP Mean User Data Rate [kbit/s]
- HTTP Data Transfer Time [s]
- HTTP Session Failure Ratio [%]
- HTTP Session Time [s]

FTP download (fixed time window stress test):

- FTP IP-Service Access Failure Ratio [%]
- IP-Service Access Time [s]
- FTP Data Transfer Cut-off Ratio [%]
- FTP Data Rate [kbit/s]
- FTP Session Failure Ratio [%]
- FTP Roundtrip Time other (3-way handshake of FTP data socket), [ms]

For Ping:

- Ping Duration, [ms]

4 Test Volume

4.1 Test Volume

The test volume and the minimum number of measurements to be executed in a specific market will depend on the particular country requirements. Larger countries in terms of population/geographic extension will need higher volumes of tests. Table 1 shows the volume of test performed for Vodafone within a recent testing campaign.

The measurements are spread over the different cities per country. As the measurement time per city depends on the respective city size, the number of locations for stationary measurements per city also depends on this size.

Tier	1a	1b	2	3
PSD (http, web, FTP UL, PING)	≥3,050	≥2,440	≥1,830	≥1,220
PSD (FDTT, eg 30s)	≥610	≥490	≥360	≥250
Measurement days	25	20	15	10
Country	ES, DE, UK, IT, TR	GR, RO, SA, NZ	PT, NL, IE, HU, CZ, EG, IN (per circle)	MT, AL, GH, QA

Table 1 Required number of samples per country type

5 Reporting

The results of the measurements should include the following deliverables:

1. Radio and IP traces from all measurement clients
2. Call detail records, i.e. KPI tables in Excel format containing the results of every single measurement sequence
3. KPI statistics report in Excel format
4. Summary results presentation

5.1 KPI Statistics Report in Excel

The KPI statistics report should contain all measured KPIs in different aggregation levels. Measurement samples should be aggregated by

- Measured Service
- City (if statistically reliable)
- Country

The statistics report should also contain a summary page showing the basic meta information about the considered set of data, i.e. time period, routes, polygons, etc.

The statistics report should also contain the ratio or mean value for each KPI as well as the 5- or 95- percentile for data rates and times, respectively.

ANNEX 2: Vodafone Discover and other data usage monitoring tools

Additional information about Vodafone Discover in the two slides below



Vodafone Discover

Why are we doing it?

- **Customers:**
 - One easy-to-use place to get my usage information plus the best of my local Vodafone's services
- **Vodafone:**
 - Handset customisation can now be market-specific and deliver a differentiated customer proposition best suited to local needs.

Where does a customer discover it?

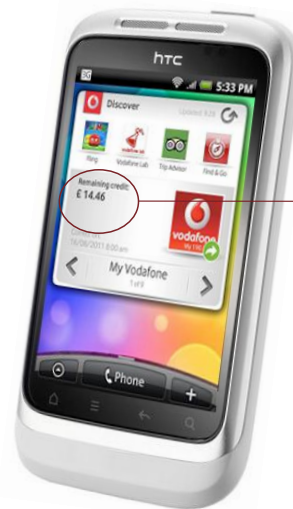
- The application is pre-installed on new devices customised by Vodafone.
- The illustration (right) shows the 'widget' view of the service
- The widget is one gesture away from the device 'homescreen'

What does it include, feature wise?

- Customer-specific 'windows' (called Dashboards) display account usage, customer value management, loyalty programs and Vodafone services.
- Dashboards can be 'tapped' and launch IVR, web sites, videos and applications
- High value discovery and usage of third party applications

Which markets are launching it?

- **All EU8.** Lead markets: IT, DE, PT. Additional launch markets: ES, UK, GR, NL, IE.
- Begins with Android customisation of new devices and will extend to in-market 'vanilla' devices.



Features customer-specific tariff balance

Department on title master

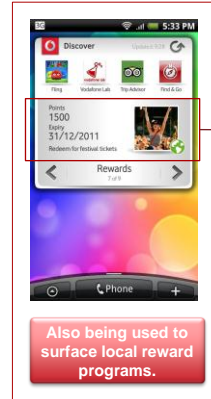
Confidentiality level on title master
Version number on title master



Tariff information - detail

What is tariff information?

- Vodafone Discover displays – where available – a summary of the customer's tariff usage and status
 - Text, Data and Minutes
 - Contract and Prepay balances
- When a customer 'taps' on the information in the Dashboard, Vodafone Discover launches the local market tariff application (or installs it if not on the handset).
 - Local applications contain 'rich' details including tariff name, details on non-tariff extras (long distance calls, for example) and more.
- Vodafone Discover is an entry point for local tariff applications.
- By delivering high visibility plus assisting in the installation of local applications, Vodafone is providing transparency to customers on their usage and charges



Also being used to surface local reward programs.

Dashboards are 'tap' able and launch applications or websites

	DE	PT	IT	UK	NL	ES	IE	GR
"Dashboard"	Y	Y	Y	Y	Y	Y	N	N
Local Application	Mein Vodafone	mCare	My190	My Vodafone	Power to You	MI Vodafone	TBC	TBC

Department on title master

Confidentiality level on title master
Version number on title master



Screenshot of the mobile broadband software application to monitor data usage. It also allows to set monthly limit and it contains a link to the on-line bill:

Vodafone Mobile Connect Lite

File View Settings Tools Help

Mobile Connect

- Main View
- Manage Connections
- View Usage
- Manage Devices

Other Programs

- Vodafone SMS
- WLAN

Mobile Usage
01 November 11 - 01 November 11

Volume-based Time-based Display current month

	3G	GPRS
Usage	0 KB	0 KB
Limit	50MB	50MB
Portion in Roaming networks	25MB	25MB

Approximate figures only.
Please refer to your bill for final amounts and charges.

Vodafone Malta
 Portion in Roaming networks

[Set Limit](#) [View Online Bill](#)