# Vodafone's response to BEREC's regulatory assessment to support National Regulatory Agencies with the implementation of the net neutrality provisions of the Regulation 2015/2120, concerning monitoring systems[1]

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[1] Vodafone welcomes comments or questions on the views expressed in this document. They should be directed to Lisa Felton, Head of Services Regulation at lisa.felton@vodafone.com

# Introduction

Vodafone welcomes the opportunity to respond to BEREC's regulatory assessment to support National Regulatory Agencies with the implementation of the net neutrality provisions of the Regulation 2015/2120, concerning monitoring systems.

The management of our networks is evolving and adapting at a rapid pace, which is needed to address the rapid growth in internet traffic (especially mobile). At the same time, we are seeing innovation both at the network layer, with 5G network slicing, network function virtualisation and software defined networks and at the service layer, with new business models emerging that will be reliant on specific levels of quality. These changes will both continue to improve network performance and at the same time enable new business models to emerge.

Transparency and monitoring will be essential both to ensure the principles of an open internet and also to enable the industry to develop and successfully provide these new quality differentiated services, which is dependent on customers being able to observe the quality benefits. As traffic management evolves and quality requirements change, communicating quality to end users becomes ever more challenging. Speed will become only one element of the overall quality experience but at the same time, many of the characteristics which engineers use to define services, such as latency or jitter are not well understood by users. In addition, many factors affecting the quality of the service the end user experiences will be impacted by factors outside of the control of the operator.

In order to make quality information future proof and relevant for our customers we encourage BEREC to work as closely as possible with the operator community. Our comments set out in this response should be seen as a contribution of our operational and commercial experiences aiming to help with fine-tuning BEREC's work. Vodafone is keen to work with BEREC and local regulators to empower users with tools and information that allow them to understand and measure the service they have purchased in a simple and effective way. The outcome should be to ensure transparency requirements and monitoring techniques and tools are future proof and provide robust and real results for consumers.

# General points

- We agree with BEREC's assessment that different measurement tools can serve different objectives. Customers value the ability to measure and compare their experience but this is not usually an accurate measurement of the performance of

an operator. In addition, customers may benefit from a more consumer centric presentation of information which is mapped to services rather than just speeds (e.g. showing the data speeds/quality needed for specific types of services).

- We also welcome BEREC's acknowledgement that monitoring tools, in particular those assessing individual applications, cannot exclude factors outside the control of the ISP and that these factors can have a significant impact on the accuracy of such tools and how they are used.
- Care should be taken to ensure that the interpretation of the Open Internet Regulation and the implementation of monitoring tools do not have the perverse effect of causing more congestion through the increased measurement requirements being required or reducing the optimal use of the network by preventing efficient and dynamic sharing of network resources.
- The interpretation of the Regulation should also not restrict consumer's ability to choose what services and applications they want to use, in accordance with Article 3(1), such as parental controls or spam filters.
- The BEREC methodology should not be mandatory but should be useful guidance only. In many member states effective IAS speed measurement methodologies have already been implemented by all operators, following discussions between the industry and the national regulator and it would be disproportionate to require these to be replaced if they achieve the same or a similar result.

## Use of measurement applications

We would agree with BEREC's assessment that crowdsourcing applications can introduce an element of inaccuracy as it is impossible to have full control over all of the factors impacting the end user or their environment. However, we do believe crowdsourcing applications can be a useful and trusted tool for end users to supplement other monitoring controls and operators should be free to offer these on a free (zero rated) basis to their customers. Any zero rating of these services should not be limited when the end users' data cap is reached.

## Measuring Internet Access Service Quality

We would agree with the proposal that the fundamental precondition is that measurements are performed at the edge of the network which provides the IAS (i.e. end user premises for fixed access or via the radio access for Mobile IAS).

BEREC suggests two options to measure speed (TCP payload/IP packet payload). Both

methods are meaningful, but may deliver different results. This must be reflected when evaluating the results.

The speed measurement technique described in section 3.1 is available in network benchmarking CPE used by several ISPs and regulators already. This raises the issue that in order to avoid additional costs to industry it is presumably sufficient for an ISP or regulator to use any equipment that meets the functionality required, as opposed to forcing all operators to align on a single vendor solution. However, if different operators use different types of vendor measurement equipment, the NRA to compare results in a way that ensures comparisons are accurate and fair.

Section 3.2 suggests a minimum of 10 measurements for delay & delay variation measurement. This should be evidenced to show this is sufficient for measuring jitter accurately.

Section 3.3 on packet loss states that at least 1000 packets are sent. It could be noted that this limits measurement accuracy to 0.1% accuracy (which is sufficient). With regard to the comments on longer measurements, these will only give an indication of the stability of a connection if the statistical distribution (including standard deviation) of latency etc. are captured and the network performance exhibits statistical stationarity.

In terms of the objective of the speed measurements, it should be noted that speed tests have a diurnal variation due to the difference in throughput between the evening "busy hour" (when shared access media, backhaul and internet transit can become congested) versus the night time quiet hours. It is important to factor in the timing of any measurements before making comparisons.

When measuring IAS performance, the quality of the Local loop should be also taken into account. For copper lines, in order to have comparable results, all end users of different IASs in an area should have LLUs of the same quality type (distance and copper characteristics).

As we evolve to the Gigabit access era, other key parameters will have a more profound impact on quality (including latency, consistency, stability, reliability etc.). It is important that any measurement regime is forward looking and recognises this trend. For example, state of the art techniques like "ΔQ"[2] are evolving which are capable of giving much greater insight than simple speed tests. Whilst these may not be necessary today, it is important that the overall conceptual approach to quality measurement becomes more rounded than simple bandwidth quantification.

[2] https://docs.google.com/document/d/1yH5R59fNDgZJKs24caFCWMy2QCoGKiFwqVAcj5JPByw/edit

## Detecting Traffic Management Practises that Impact Individual Applications

One concern is that only a small fraction of services can be tested, which would not be representative. Even for a test of a single service may show significant discrepancy, because the content is distributed all around the world and different content management techniques may be used by the content provider.

It should be noted that there can be valid reasons for blocking IP addresses for security purposes e.g. virus checks and by authority enforcement (blacklisting of certain sites etc. including cases of violation of IPR). In addition, blocking may have been requested by the end-user customer. For example, where the end-user has opted in to Parental Controls which blocks sites with pornography or violent content etc. Where the customer has chosen not to access specific content., they have a right to do so under Article 3(1) of the Open Internet Regulation, whether using network or app tools, and monitoring techniques should not restrict this.

Section 4.2 on detecting practises that impact QoS needs further consideration. Packet networks delay or drop packets subject to load. Such degradation does not only occur during the busy hour due to diurnal patterns of network load. It can happen due to peaks occurring at a ms or even µs level. How can the normal statistical distribution of sub-second network loading be distinguished from more nefarious practises? An Ofcom report from 2015[3] undertook a very thorough technical analysis of the potential for various tools to detect traffic management. It identified many limitations to the available techniques. For example, most techniques operate at layer 3 so would not detect traffic management at layer 2 (e.g. Ethernet VLANs level). Several of the technical approaches used were also not scalable. Only the NANO and Chkdif tools were deemed suitable to overcome some of these limitations. There is no coverage of such approaches in the BEREC document.

From the mobile perspective, detection of traffic management using techniques at the basic network level will potentially confuse "normal" mobile network behaviour subject to restrictions deriving from sharing of a common media in a cell (so each customer be affected by what other ones in the cell do) to mechanisms to enforce traffic management.

[3] "A study of traffic management detection methods & tools", Predictable Network Solutions, June 2015.

## End-user Dependent Factors that may Affect the Measurement Results

It is important that the impact of WiFi (and potentially other home networking/LAN technologies) is not under estimated. If the objective is to measure the ISP's network connectivity (including potentially the Broadband router, often supplied by the ISP) then measurements should be made directly from the Broadband router or a device plugged into a wired Ethernet port on the router (preferably a 1 Gbit/s port, not 100 Mbit/s for NGA-based broadband access). However, if the objective is to measure the end to end user experience of their applications then the WiFi connection to the end-user device (e.g. laptop, tablet, set-top box, smart TV etc.) should be included. Any NRA regime that compares/contrasts performance should be clear on what it is attempting to measure and ensure consistency of approach across the ISP and end-user base.

In relation to mobile, there are a number of end user factors which may affect the measurement results, which could be impacted by the reached server (which one the customer is routed among the typical pool used by a web service providers; routing could be dynamically done), the non-Vodafone network connectivity, the user handset type and settings (and connection mode, e.g. directly on mobile or using a mobile handset as wifi router and connecting to it over wifi), etc. While measurement methods can be rigorously defined the variety of factors influencing can generate deltas which are much greater than the traffic management itself.

Section 5.3 cites Broadband Forum TR-064 – which covers LAN-side CPE configuration. This is incorrect as the correct Broadband Forum technical report that covers the remote management protocol is TR-069. However, note that the ability to retrieve data from CPEs through TR-069 is valid only for CPEs provided from the IAS provider

## Measurement Results Assessment

Section 6.2.2 states that "it is important to compare the maximum speed value against a measurement result and not individual samples within the measurement task or within multiple measurement tasks". The intent is not clear.

Section 6.2.3 regarding normally available speed: This requirement could require a continuous/periodic measurement approach to track speed minute by minute, hour by hour. It could load the network and ironically cause congestion/slow-down for other users at aggregation points. This may need to be better clarified since it could be overly onerous.

Section 6.3.2 regarding the effect of specialised services on IAS: It has to be recognised that the specialist services are usually IP based so are not a separate leased line network overlay. They use the same shared packet network as IAS, using QoS, logical VLANS/pseudo-wires etc. to segregate different service flows. Capacity is communal in shared networks - forecasting leads to dimensioning to meet demand. The suggested approach of measuring neighbour's networks with and without a specialised service like IPTV in play is potentially flawed. Results will depend on the time of day and traffic load on the network when the measurements are made.

Finally, on video measurement, 20 seconds of video duration is not enough for the end points to reach the final bitrate on the negotiation. We would recommend using longer videos like 45 seconds. In addition, live video streaming measurements are more dependent on service provider and player (device settings) than static videos. If possible the measurements should be performed on static videos with KPIs measuring the real customer experience.