Body of European Regulators for Electronic Communications

BEREC

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Summary report on the joint OECD and BEREC's Webinars on Improving customer experience of electronic communication services through QoS and QoE

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Executive Summary

In its Strategy 2018-2020, the Body of European Regulators for Electronic Communications (BEREC) set out a clear objective to empower and protect end-users. In the BEREC 2020 Work Programme BoR (19) 253 a key focus was on exploring new ways to boost consumer empowerment and an External Workshop in collaboration with the OECD (Organisation for Economic Cooperation and Development) on Quality of Service (QoS) and Quality of Experience (QoE) was proposed.

The workshop was scheduled to be held on 23rd and 24th of June 2020 in the beautiful city of Stockholm however, due to the Covid-19 crisis, a decision was taken by the BEREC Board of Regulators to instead hold two webinars on two consecutive Tuesdays 23rd and 30th June 2020 at which different views and perspectives on QoS and QoE were presented and discussed.

The differentiation between QoS from QoE can be simply stated as QoS concerns the network and terminal equipment up to the user interface whilst QoE focuses on the entire service experience and includes the whole path from user to user including the end-user expectation, perception and context of use. QoS also includes the assistive equipment and the specific services provided to end-users with disabilities where equipment is provided by the interpersonal communication service Provider. QoS measurements provide transparency on the QoS for end users and help them to compare retail offers in order to strengthen market demand and to force operators to improve QoS.

In addition to this report that provides a summary of the webinar discussions the agenda, presentations and recording of the webinars are available at https://berec.europa.eu/eng/events/berec_events_2020/244-berec-and-oecd-webinar-on-qos-and-qoe

1. Introduction and aim of the Webinars

Therese Hourigan and Paolo Lupi Co Chairs of the BEREC End Users Expert Working Group moderated the first of the two webinars (Part 1). Part 1 of the webinar offered an introduction to QoS, its role in communication markets from both a BEREC and OECD perspective, how QoS could contribute to an enhanced connectivity experience with country experiences being shared by National Information Society Agency (NIA), Korea and the French National Regulatory Authority ARCEP.

Verena Weber, Head of the unit for Communication Infrastructure and Service Policy (CISP) at the OECD moderated the second webinar (Part 2) that focused on QoS and QoE in relation to accessibility, e-health, video communication and how to capture quality of experience through standardisation in order to improve the quality on online collaboration.

2. Part 1: Webinar 23 June 2020

Dan Sjöblom, Director General PTS, Sweden, Chair BEREC together with Verena Weber, Head of Digital Economy Policy Division, OECD opened the webinars, thanked all those who joined (288 viewers joining through the BEREC live YouTubechannel). Mr. Sjöblom recognised the strong collaboration between BEREC and OECD during the last decade in the aim of bringing the expertise of both organisations together to improve policy design and regulation. He also referred to the fact that there are four BEREC working groups that are all involved in work on QoS and welcomed the insight being brought by the variety of speakers.

Ms. Weber welcomed everyone to the joint webinar and noted that the advantage of an online format allowed a broader reach to colleagues worldwide. She communicated that typically one topic is chosen for joint workshops with BEREC and the OECD to facilitate a deep dive which in this case concerned QoS and QoE. Acknowledging that the Covid-19 crisis has likely pushed the digital transformation two years ahead, with for example medical consultations in France and more people working from home on a regular basis resulting in demand for high quality internet connection. The discussions today will help our understanding of what are the right tools that we need and how can we measure the QoS and how those measurements can contribute to better policy making.

i. BEREC Work accomplished to Date

Paolo Lupi AGCOM and Co Chair End Users Expert Working Group presented the "*BEREC Guidelines detailing QoS Parameters*", pointing out the legal basis and the policy principle underlying the work done by BEREC and illustrating the results of the activity.

In the ever-connected, globalized, digital environment that is developing faster and faster, electronic communication services play a key role in citizens' everyday activities. The QoS is a crucial factor for both customers and service providers and it is becoming increasingly more complex to manage, measure and regulate it: quality can be impacted by many factors at the network level and along the value chain, including the device, hardware, infrastructure, service and applications. Regulatory development in the European electronic communications sector is intended to help improve the end-user experience, to lead to greater competition and investment, and to benefit all the different players in the digital ecosystem.

In accordance with Article 104(2) of the European Electronic Communications Code (EECC), in order to contribute to a consistent and harmonized application of the EECC, BEREC, after having consulted stakeholders and in close cooperation with the EC, has adopted Guidelines defining QoS parameters and measurement methods for interpersonal communications service (ICS) and internet access service (IAS), including those for end-users with disabilities, the content and format of publication of information, and quality certification mechanisms.

A benchmark has been carried out in order to get useful insights into the QoS measures in place in EU. A wide range of QoS measures are listed in the responses for both ICS and IAS. For fixed ICS, network performance measures stand out as the key measures in place, i.e., supply time for connection, fault rate per access line and fault repair times. A number of QoS measures are also in place for mobile networks such as network coverage, drop call rate, bit

rate error, packet loss, delay and jitter. QoS measures are also in place for IAS, including minimum guaranteed IAS speed values for fixed and mobile networks.

Taking into account the results of the above benchmark, the Guidelines provide definitions and measurement methods (ETSI, ITU, IETF, 3GPP) for ICS and IAS QoS parameters as set out in Annex X of EECC and for two additional parameters (response time for operator services, customer complaints resolution time).

Moreover, Paolo Lupi clarified that the Guidelines provide further guidance on the publication of information and quality certification mechanisms. NRAs may require service providers (SPs) to publish comprehensive, comparable, reliable, user-friendly and up-to-date information on QoS, that should be accessible for the broadest possible group of users (with disabilities, elderly, with special social needs, etc.). NRAs could oblige SPs to publish information directly via their own communication channels or through third parties, and to provide information to NRAs to be published simultaneously on NRAs websites. NRAs should determine what factors are to be taken into account when choosing a quality certification mechanism; the certification shall ensure that the quality monitoring fulfils requirements (accurate, enables comparison, open, safe, future proof, accessible).

Klaus Nieminen,co-chair for BEREC's Open Internet WG (OI WG), presented a quick overview of the work done by the WG. OI WG has been studying QoS, QoE and network performance for the past 10 years. He illustrated the difference between these concepts and told that OI WG focus is on measuring internet access service quality as the regulatory tasks are related to it. He clarified that basically this means the network performance of ISP's own network + the interconnection.

Mr. Nieminen told that QoS is much more than the quality of the best effort internet. ISPs can also offer differentiated QoS levels and the quality required by the categories of traffic and specialised services. These all are allowed under the Open Internet Regulation. OI WG has published many QoS related studies and reports and Mr. Nieminen described the BEREC Net Neutrality Regulatory Assessment Methodology briefly. It contains guidance on a harmonised QoS measurement methodology, detecting traffic management practices that impact individual applications, factors to be taken into account when assessing the measurement results, validation of the collected measurement results and measurement system certification. He also noted that this might be revised in the near future.

ii. QoS within OECD

Alexia Gonzalez Fanfalone and Frederic Bourassa, from the OECD provided an overview on activities within the OECD related to QoS underscoring that connectivity is essential for the digital transformation facilitating interactions between people, organisations and machines and is the underlying link between the Internet of Things (IoT) and Artificial Intelligence (AI), which means that the performance of the networks is of utmost importance. It is therefore essential to measure actual broadband performance. The actual performance of broadband is an important source for policy making and regulation, as well as empowering consumer and business users. However, measurement requires definitions: what shall be measured and how shall it be done?

The OECD has worked systematically with these issues and laid the foundation for a harmonised measurement approach in 2012 for one dimension of broadband quality: download speeds. It has since then published a number of reports related to this work. The OECD Broadband Portal provides a range of key parameters related to connectivity, like for example links to national broadband maps, data on broadband speeds, and broadband coverage. The OECD monitors the development regarding QoS in the member states and highlights in the Digital Economy Outlook 2020 two countries examples of data driven regulation with France and Korea.

The OECD underscores that indicators, like resilience and robustness, latency and reliability are becoming increasingly important with the next evolution of broadband networks (i.e. 5G and high-capacity fixed networks). One clear trend of 5G is the need to bring cells closer to the user (network densification) to reduce latency and keep up with the pace of data transmission requirements. In order to meet increasing customer demands on communication infrastructure, more fibre backhaul needs to be deployed. Therefore, according to OECD, it is important to measure underlying wholesale inputs directly influencing broadband performance, such as backhaul availability. The OECD appreciates the productive collaboration with BEREC throughout the years on several policy issues, including QoS. Going forward, the OECD sees itself as having an important role to play for harmonising measurement and definitions and looks forward to continuing the work on QoS indicators.

iii. QoS used as a Policy tool in France

Audrey Goffi, ARCEP, France shared key insights from Arcep's advanced work in the area of QoS. QoS has been used as a policy tool by Arcep in France for many years. It is part of a data driven regulation policy based on data from multiple sources, feeding into an analytical process in which this data is presented and made visible aiming to inform users, stimulate operators' investments and steer the public debate.

Arcep conducts two types of QoS campaigns: the first one is an "accessibility" annual measurement campaign meant to verify operators' simulated coverage maps by checking end users' ability to effectively access the network. This campaign measures voice and data services with around 0.2 million measurement points, using light accessibility tests. This enables Arcep to examine if they meet the defined reliability threshold of the coverage maps in the interest of consumers and business users in France. Arcep sees this as an effective policy tool, as it can not only compel operators to rectify their maps, but also better inform end-users and eventually foster competition. Arcep has recently sharpened the reliability threshold, which requires that the operators will have to be more precise on what they promise to deliver regarding mobile coverage.

Moreover, Arcep conducts annual QoS campaigns with approximately 1.5 million measurement points, with demanding tests covering mobile voice, data speed and other tests

representative of end users' experience, such as video streaming or webpages browsing. This enables Arcep to publish rankings of the different mobile operators according to these various indicators, as well as different type of zones (high density, medium density and rural areas). Arcep's QoS campaign is an effective policy tool as it is closely looked upon by all players who advertise its results.

Arcep has consistently worked with third parties to establish a harmonised approach to measuring broadband speed on fixed networks. On the mobile side, Arcep has published the Regulator's Kit, a guide to Arcep's protocols and technical specifications for measurements in a controlled environment. Arcep has recently published the results of measurement campaigns carried out by third parties (companies, local authorities) in compliance with the Kit. Moreover, Arcep has established a Code of conduct for QoS measurement tools on fixed and mobile networks in order to enhance consumer information and to provide comparable results on service quality. Arcep has also worked with the ecosystem on an API developed by operators to better characterize the user environment in fixed internet services. This API could be assessed by QoS measurement tools that comply with the Code of conduct and will be deployed gradually over time.

By expanding the toolbox available to regulators, this data driven regulation policy eventually contributes to their core missions while approaching the issues at stake with a new angle.

iv. Korea showing the way with QoS

Dr Lee Yeongro, Vice President, National Information Society Agency (NIA), Korea shared details of the work done in Korea during the last 20 years, work that has consistently focused on QoS with a special focus each year. This year, focus has been on 5G as it is a new service, which was launched in early 2019 in Korea, now with over 5 million subscribers. The work on quality evaluation done by NIA is driven by the aim to stimulate competition, network investment and thereby intend to improve quality for end users. Although the Korean consumers have access to good networks there are substantial quality differences between urban and rural areas, as users do not have access to sufficient quality information and coverage information.

NIA evaluates the quality of both wired networks and wireless access with the different technologies and different speed tiers. It is a systematic approach based on long experience, consulted with stakeholders and transparently reported. Measurements are done on different network levels as well on terminals. A new metric that NIA has added this year is the rate of switching on to 4G network while using 5G networks as 5G coverage is still sketchy with 5G island around Korea. NIA applies different measurement approaches to capture the quality of the networks in all kind of places. The collected measurement data are analysed in order to examine if it can be validated and be representative for the networks in Korea.

The outcomes of the QoS measurement done by NIA are published and publically available. The results show that the download speed has continuously improved and the national average for 2019 was 158.5 Mbps for 4G, 333.5 Mbps for WiFi, and fixed broadband marketed as 100 Mbps delivered in average 99.3 Mbps, and 1 Gbps connection delivered in reality 951.7

Mbps. The 4G speed in rural areas was 128.5 Mbps, with a compounded annual growth rate of 13.6 percent since 2017, indicating a positive development. However, there is a significant gap to urban areas which NIA will continue to address. Altogether, NIA prioritise the work on QoS as it is for the benefit of the Korean consumer and business users and appreciate the possibility to share our experiences with BEREC and the OECD.

v. Conclusion

Dan Sjöblom, Director General PTS, Sweden, Chair BEREC thanked the participants from OECD Alexia and Frederic who provided an overview on the road so far since 2012 and the road ahead, where measurement of other QoS parameters may become increasingly important with the next evolution of broadband networks. He also thanked both France and Korea for sharing their country experiences and noted how releasing this information to the market actually has changed operators' behaviour to stride to improve network quality.
The purpose was to share experiences and get a better understanding and ways we can work with QoS and hope that all the attendants to the webinar benefited.

Finally, Mr. Sjöblom invited all to return to further deepen the experience and understanding in the second part of the QoS QoE webinar on 30th June 2020.

3. Part 11: Webinar 30 June 2020

Verena Weber, Head of the Unit for Communication Infrastructure and Service Policy (CISP) at the OECD moderated the second webinar that focused on QoS and QoE in relation to accessibility, e-health, video communication and how capture quality of experience through standardisation in order to improve the quality on online collaboration. All those who had joined the webinar were thanked for joining and welcomed active participation by raising questions throughout the session.

i. Introduction

Michel Van Bellinghen, Chairman of the Council of BIPT (Belgium), Chair BEREC 2021 and Audrey Plonk, Head of Digital Economy Policy Division, OECD opened the second webinar.

Mr. Van Bellinghen welcomed both the speakers and those joining the second part of the QoS and QoE webinar. Whilst referring to the previous week's webinar the update provided in respect to the BEREC work done on QoS, the co-operation between BEREC and OECD is really topical addressing this key topic. He confirmed that due to the current Covid situation the workshop that was planned is now in the form of webinars and unfortunately BEREC technology did not facilitate live captioning. On behalf of BEREC he apologised for this limitation that resulted in the webinars being restricted but confirmed that work is underway and a solution is due to be in place later in the year. He focused on the importance of high QoS for all society.

Ms. Plonk then introduced the webinar, thanked BEREC for the fruitful collaboration over the years and noted the importance of availability of broadband in the current environment when most attendees are working from home. She then provided a summary of the key points discussed at part 1 of the webinar on 23rd June 2020 and in particular, the focus on broadband performance and how OECD has started to measure one component of broadband QoS, which is the download speeds, where Alexia and Frederic provided an overview on the road so far since 2012. They also provided an outlook of the road ahead, where other QoS measures may become increasingly important with the next evolution of broadband networks.

In addition, insight into the recent and ongoing BEREC work in the area of broadband performance measurement was heard from harmonising definition and parameters, as well as exploring the links with the Open Internet principles. We further learned from two OECD countries (France and Korea), leading in terms of data driven regulation, who shared with us their innovative approaches on how to measure the actual performance of broadband (as opposed to the commercially advertised speeds), and how releasing this information to the market actually has changed operators behaviour to stride to improve network quality.

ii. Accessibility and how to harness communication technologies for people with disabilities with appropriate QoS levels

Inmaculada Placencia-Porrero, EU Commission presented at the BEREC – OECD webinar on QoS and QoE in respect to accessibility. The presentation highlighted that access for persons with disabilities should be on an equal basis with others and is a right according to the UN Convention on the rights of persons with disabilities (CRPD). This means that accessibility is a precondition for an open and inclusive society and requires that obstacles that pose problems for persons with disabilities in using products, services and infrastructures should be prevented and eliminated.

Member states of the CRPD should undertake appropriate measures to ensure equal access for persons with disabilities inter alia to information and communications technologies and systems & internet regardless of geographical locations. Providers of electronic communication services are urged to make their services accessible and usable for persons with disabilities.

The European Union has a firm legal basis that stipulates that providers of electronic communication services should make access to electronic communications services by end-users with disabilities equivalent to that enjoyed by the majority of end-users. This is set in the European Electronic Communications Code. The European Accessibility Act sets accessibility requirements to products and services, including electronic communications services.

The European Electronic Communications Code stipulates a number of obligations for Member States and providers to facilitate equivalent access. The European Accessibility Act has a wide reach covering many sectors of society in relation to interaction with digital media

and services. This includes emergency communication and how it should be possible for everyone to reach the single European emergency number 112. It also stipulates that consumer terminal equipment with interactive computing capability, used for electronic communication services and audio-visual media services must be accessible following the obligations in the EAA.

Economic operators have a number of obligations including accessibility obligations that they have to comply with for putting the CE marking on their products. They also have to declare compliance within the terms and conditions for services. The EAA allows the use of standards and technical specifications to provide presumption of conformity.

In Public procurement is already compulsory to offer accessible services. This means that the technical specifications of tenders should include provisions on accessibility. Procured products and services in the scope of the EAA should meet the obligations in the European Accessibility Act. Others get presumption of compliance with the obligation to buy accessible under certain conditions when they meet the accessibility requirements of the EAA.

The European Accessibility Act provides a process with different mechanism for enforcement starting with the lightest form that is self-declaration of conformity, complemented with market surveillance of products by the authority responsible for supervision of compliance of services. Consumers are able to take action before the competent Court as well as public bodies or private associations with a legitimate interest. Legal provisions should be in place for Courts to decide on effective penalties, proportionate and dissuasive in order to incentivise compliance with the established legal framework.

The European Accessibility Act should be transposed by member states by 2022, and it enters into force by 2025. This implies that a lot needs to be done during the next couple of years in order to provide equal access to everyone and realise the full potential of accessibility.

iii. E-Health and the significance of QoS,

Tonko Wedda , chairman of the board of WDTM, sector organisation in the Netherlands for healthcare presented how trends underline the importance of e-health solutions as well as the importance of network reliability to encourage the adoption of digital health solutions. The situation in the Netherlands is the starting point. Many other European countries face the same problems though, to a greater or lesser degree.

For many reasons the need for, and use of, e-health solutions at home is growing exponentially. The main drivers on the demand-side are: the aging of the population; an increase in governments' wish for elderly people to continue living independently.

At the moment, a very large part of the installed base of e-health solutions still uses analogue technology while in many countries providers are switching to IP-networks. It is crucial that all players become aware of the vast amount of equipment that is not yet suitable for IP networks.

For important services like e-health services, a reliable carrier is of the utmost importance. Disruptions in the working of the carrier can have a big impact on the service.

Parties that offer e-health have no formal point of contact with the provider to address problems. The subscriptions/contracts for the lines themselves belong to the consumers who depend on the e-health-service. Considering the size of the group of users and their dependence on reliable connections for their health, you would expect providers to take their (social) responsibility. If they do, solutions can be found for the lack of:

- communication between involved stakeholders (care-response-centers) and providers;
- protection and guarantees for lines that are used to offer e-health solutions;
- absence of escalation windows at providers in case of outages;
- testing options for equipment;
- smooth and fast provider switching for users of e-health.

The conclusion called on:

- telecoms providers to take their (social) responsibility in the context of the migration to IP-networks;
- telecoms providers to take responsibility to assure high availability of IP networks with active monitoring to solve malfunctioning within acceptable timeframes;
- telecoms providers to take their (social) responsibility in the context of communication with suppliers of e-health solutions regarding issues, escalations and provision and usage of test facilities;
- to establish independent institutes where problems can be reported and which would be involved in investigating problems;
- for national working groups to be set up to deal with migration from analog to IP networks; and
- for national working groups and a pan-European working group to be set up to develop a future roadmap for e-health and connectivity, as well as a plan for its implementation. Part of the plan should be a program of requirements for reliability and availability of connections. Members must include representatives from government, telecoms authorities, providers, medtech companies, healthcare providers and industry bodies (including Afrata-France, TSA-UK and WDTM-Netherlands).

iv. Improving the Quality and Efficiency of Video Relay Service

Debra Patkin and Michael Scott of the Federal Communications Commission (FCC) provided an overview of the United States' video relay service (VRS) program. Acting on its goal to provide access to telecommunications for all Americans including those with disabilities and pursuant to federal statute, the FCC implements and regulates various types of telecommunication relay service programs, including VRS. VRS involves the use of video equipment that allows deaf and hard of hearing users and CAs, who are qualified and trained sign language interpreters, to sign to each other.

The FCC has regulations in place to ensure that VRS calls are functional equivalent to telephone calls, or in other words, that VRS calls mirror telephone calls to the extent possible. The regulations also seek to promote competition to ensure quality of service.

Additionally, the FCC has issued a notice of inquiry on service performance goals and quality metrics. In addition to seeking public comment, the FCC has several other methods of stakeholder engagement in which it receives input on how to maintain the quality of VRS, including an advisory committee on disability issues.

v. Complementing QoS with QoE

Gunilla Berndtsson from Ericsson, and rapporteur for ITU-T Study Group 12 shared users view on QoS and QoE and the way to establish standards and recommendations that capture the parameters that determine our experience of online collaboration.

The interpretation of each measure was initially discussed with QoS concerning the network and terminal equipment up to the user interface, whilst QoE is how users perceive the service. QoE is complex and influenced by many factors which frequently interrelate. They can be characteristics of the human user (expectations, goal, personality), the system (technical aspects), and the context of use.

The lead study group on QoS and QoE in ITU-T is Study Group 12. It coordinates QoS and QoE activities within ITU-T and collaborates with other organizations such as ETSI and 3GPP. The work in ITU-T SG12 is divided into separate questions and “Conferencing and telemeeting assessment” is dealt with in ITU-T SG12/Question 10. This work has become more in focus as we are now more dependent on virtual meetings due to the COVID-19 situation.

To understand what leads to a good QoE, tests where human subjects evaluate the quality of various testing conditions are needed. Subjective test results are then used to develop objective quality models that can estimate QoE based on objective QoS parameters.

There is ongoing work to make digital meetings more immersive. At Ericsson we are investigating what kind of meetings in virtual reality (VR), augmented reality (AR), and mixed reality (MR) that will be possible using 5G, and what network requirements that are needed to achieve a good QoE.

In ITU-T SG12/Q10 we are currently drafting recommendations about how to assess these new types of immersive meetings and how to characterize all types of virtual meetings. If we understand how different factors influence QoE for different types of virtual meetings, we can optimize the network and system resources according to the preference of the users and improve the quality of online collaboration for all.

4. Conclusion

In drawing the 2nd of the two webinars to a close Audrey Plonk, Head of Division, STI, OECD highlighted the incredible collaboration that they have had with BEREC throughout the years and suggested going forward, the role of the OECD and BEREC to include the following:

- OECD and BEREC should strive to work together to achieve common ground on measurement through their role of “harmonisers”. Beyond QoS measures explored so far, such as speeds, going forward also thinking about those measures that will become increasingly important with the evolution of broadband networks impacting all sectors of the economy.

- New QoS measures include reliability and resilience of networks, digital security, as well as underlying factors influencing broadband performance. This is important as the notion of the end user is shifting, i.e. higher focus on the end-user being in the B2B chain, instead of just B2C.

- OECD work currently underway that involves a revision of the 2004 Recommendation of the Council on Broadband Development.

- The need to take a holistic approach, linking both QoS measures on the access layer, to the end user experience via applications and services.

The concluding remark highlighted that connectivity is a pillar of the digital transformation and that measures of broadband performance are essential. OECD thanked BEREC for the collaboration on this timely topic and in particular the BEREC team responsible for the organizational side.