

QoE Measurement: Economic and Policy Considerations

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Quality of Experience (QoE) is defined as a “the subjective assessment by a user of the experience of using a specific application,” whereas Quality of Service (QoS) refers to technical “performance metrics such as throughput, delay,” etcetera. To an economist, QoE equates to some notion of a user’s utility function, whereas QoS are the technical characteristics of the good. Goods that provide a higher QoE are more preferred at equivalent prices, and inferences about QoE underlie demand forecasts.¹ In light of this, it is obvious that QoE metrics, measurement methods, and reports or analyses premised on QoE data – and by extension QoS data – are inherently strategic.

Presumptively, information about QoE and how QoS relates to QoE will be useful for ISPs, edge providers and other providers of complementary services to design better and more efficient (cost-minimizing) services, and also will be useful for strategic marketing, including pricing; will help consumers make more informed decisions about what services and complementary goods to purchase and how to use those services; and for regulators to design and enforce policies (e.g., truth in advertising). In the Internet, where control and ownership is decentralized and multiple (partially) independent decision-makers (end-users, edge providers, access ISPs, and other upstream service providers) contribute to the end-to-end QoS that determines a user’s application-specific QoE, there are multiple complex interactions requiring coordination among participants with complex business relationships, and imperfectly aligned interests.

Providing Internet services is an information intensive undertaking. In economic terms, it is a game with significant imperfect, asymmetric information, in which participants confront significant uncertainty. Collecting the information that informs QoS measurements, and ultimately, QoE is costly and the information has strategic implications. In such situations, it is unavoidable that rational market participants (at all levels) will view the entire process of measurement, metrics, and information dissemination/analyses/reporting as strategic: Consumer’s do this when they ask whether they can trust a particular information source;² ISPs do this when they argue in favor of metrics that favor one provider’s technology over another.³

¹ Conceptually, market demand is the aggregation of individual demands, which obviously may be different.

² More generally, consumer’s need to evaluate whether the benefits in improved QoE justify their choice of provider and selection of service tier. Consumer’s often rely on multiple sources of information to infer what the QoE is, including what they hope are independent reviews.

³ This occurred in the discussions over how to measure broadband speeds and over what duration speeds should be measured. Cable providers with Powerboost favored metrics that emphasized the initial speeds; DSL-based providers favored metrics that were averaged over a longer period. See Bauer, S., D. Clark, and W. Lehr (2011) "Powerboost," Proceedings of IEEE HomeNets’11, Toronto, Canada, August 2011.

In designing appropriate measurement frameworks for assessing Internet performance, it is important to consider the strategic incentives of all market participants, and how those may shift as a result of technology, market, or regulatory policies. For the information markets for performance relevant data (QoS, QoE) to have the best chance to work efficiently, it is important to consider the processes and mechanisms (technical, market-based, and regulatory) that collectively will determine how information sharing is managed.

In two recent papers, with my co-authors, I examine these processes and mechanisms from two distinct perspectives: first, from the perspective of the tool set for ensuring adequate Disclosure and Transparency (D&T) for broadband network management relevant information;⁴ and, from the perspective of what the transition to much higher speed access services will mean for reasonable expectations of broadband performance.⁵ In the first, we discuss several examples, including the challenges for measuring and reporting loss metrics. In the second, we consider how Gbps broadband access will require more nuanced speed measurement commitments. It is neither practically possible nor desirable to investigate how QoS metrics may be composited and give rise to QoE without considering such economic and policy issues. Also, translating the technical discussion into terms and frameworks that are accessible by non-technical market participants will involve economic and policy considerations.

From my earlier work and the papers above, it is clear that we need to build better multidisciplinary capabilities to enable edge-based measurements (e.g., such as have been undertaken by a joint MIT-CAIDA project)⁶ and provide for new information sharing channels (e.g., Net.info).⁷ At the same time, we will need to encourage a multiplicity of measurement perspectives to address the strategic challenges, but also endeavor to collate and integrate those diverse measurement platforms/efforts as part of the discourse that will help shape our shared expectations about broadband performance. This workshop, in soliciting participation from academics, industry, and the policy community represents an important bit of process to facilitate this discourse. It is important that the research discussion of the metrics also explicitly consider the economic incentive issues since those are unavoidable.

⁴ Lehr, W., E. Kenneally, S. Bauer (2015), "The Road to an Open Internet is Paved with Pragmatic Disclosure & Transparency Policies," TPRC2015, September, Alexandria, VA, available at available at SSRN: <http://ssrn.com/abstract=2587718> or <http://dx.doi.org/10.2139/ssrn.2587718>.

⁵ Bauer, S., W. Lehr, and S. Hung (2015), "Gigabit Broadband, Interconnection Propositions, and the Challenge of Managing Expectations," TPRC2015, Alexandria VA, September, available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2586805

⁶ Clark, D., S. Bauer, W. Lehr, K. Claffy, A. Dhamdhere, B. Huffaker, and M. Luckie (2014), "Measurement and Analysis of Internet Interconnection and Congestion," 2014 TPRC Conference Paper. Available at SSRN: <http://ssrn.com/abstract=2417573>

⁷ The net.info effort is discussed briefly in Lehr, Kenneally, Bauer (2015), Note 4 *supra*.

My interest is in contributing an economists' perspective to the discourse in order to help design better QoE measurement infrastructure that is policy-aware, and help reflect the technical/practical realities of such measurements to ensure technically-aware policy.