Quality of Experience (QoE) – An analysis from a market perspective

Applicants

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SUMMARY

This is a project focused on the identification of how advances in mobile technologies, commercial strategies, and current infrastructure deployments are considering QoE/user’s perception, while proposing business models that take advantage of the provision of QoE-differentiated services in mobile infrastructures. In order to reach this goal, the project would bring together a unique consortium, composed by:

- Ericsson Research, and the research area Wireless Access Networks in particular, which works with development and evaluation of radio network features and standards towards the vision of the Networked Society.
- Ericsson Business Development area works with the identification and development of new business opportunities for mobile broadband for operators and consumer.
- Telenor Research is part of Telenor ASA. It helps to drive the transformation of Telenor to a Next Generation Communications and Service Provider by exploring new technology and service opportunities, with the aim to build insight which can be used to improve operations and suggest policy and strategy changes.
- The Swedish Post and Telecom Authority, PTS, is the Swedish telecom regulator. PTS works with consumer and competition issues, efficient utilisation of resources and secure communications.
- Wireless@KTH as an academic partner with strong background and knowledge in the areas of QoE and techno-economic analysis of mobile networks and services.

The main objective is to analyse how the QoE-based differentiation in the provision of mobile services generate new revenue streams for mobile operators.
**Background and scope**

New paradigms in both the wholesale and retail service markets are being formed and accelerated by technological advances (e.g., in networking, virtualization), content delivery, and regulatory changes on access and competition rules\(^1\). This scenario poses ever-increasing demands to mobile infrastructures (according to Ericsson, mobile data traffic is expected to grow at a compound annual growth rate (CAGR) of around 45% between 2013 and 2019) but also enriches the roles of service providers, differentiates traditional pricing schemes, and enables new business models. In this dynamically evolving context, network operators and service providers are struggling to keep their increasingly sophisticated customers satisfied while reducing the “revenue gap” at the same time. To succeed in this competitive landscape, operators are required to choose a more rigorous approach, increase operational efficiency, and roll out new services in a cost effective manner.

The current market evolution presents mobile operators with a challenge and an opportunity: operators that can deliver the best user experience in terms of service choice, availability, speed and quality will gain brand loyalty\(^2\)\(^3\)\(^4\). Operators have the opportunity to lead the market on service differentiation by delivering the appropriate user’s QoE with the speed, capacity, coverage and availability demanded by users of laptops, smartphones and other devices. In this scenario, mobile operators have to develop and implement technical mechanisms and business strategies oriented to strengthen its market presence and generate new revenue streams by selling mobile broadband services at price/performance levels that suit all users’ expectations, delivering a QoE that consistently meets or exceeds expectations while controlling provision costs.

In order to tackle the challenges associated to a QoE-based service provision, operators need to define new strategies and take a holistic, 360° QoE approach, which takes into consideration a number of key aspects. On one hand, an understanding of the technical requirements and implications associated to offering QoE-based differentiated services on the mobile operator’s infrastructure. On the other hand, an identification of the economic impact of the differentiation in the service provision, along with the definition of business, pricing and compensation models that can/should be used in order to incorporate QoE-based types of services to be commercially available. At the same time, this techno-economic approach needs to be supported with a regulatory analysis to reflect on the implications over competition and net-neutrality issues of QoE-based differentiation approach in the mobile services provision. In this context, the main scope of this project is to provide answers to the following question:

*How to implement QoE-based service differentiation in mobile network’s in order to generate new revenue streams for mobile operators?*

**Challenges to address and objectives of the proposed project**

**From Ericsson’s perspective**

Ericsson provides industry-leading network equipment and software, as well as services for network and business operations. For Ericsson this project represents an excellent opportunity to better understand the potential of QoE-based differentiated services. By correlating and analysing existing databases related to network performance and user characteristics insights into the relation between network consumption and network quality can be gained. Strategies for implementation of differentiation may also be developed based on the learning about when, where and to whom network quality matters.

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From Telenor’s perspective

Telenor is an organization that offers a wide range of telecom-related services to consumers and enterprises. It is constantly seeking ways to ensure the best possible user experience whereas maintaining efficient network operations. Telenor Research wants to investigate the effect of taking into account QoE/user experience in the development of its business model and the network deployment strategy.

From the regulatory and PTS perspective

QoE will most likely have an impact on competition and consumer issues. As a regulator PTS sees this as an opportunity to better understand any short and/or long term regulatory implications the adoption of QoE might have, both at the end user market as well as the wholesale level. The project will include to investigate the implications on competition and net-neutrality principles when QoE/user experience is considered telecom services.

From an academic perspective

By offering QoE-based differentiated services, mobile operators can generate new mechanisms to keep their increasingly sophisticated customers satisfied while reducing the revenue gap at the same time. This represents mobile services can be provided in another business setting, with a user centric approach focused on the provision of good levels of user experience adapted to different services. In this context, to identify and assess technical mechanisms to implement QoE-based differentiation in mobile infrastructures is one key objective for KTH. The evaluation of the impact of the proposed differentiation in the traffic management and infrastructure deployments is also important for this study. Another objective is to identify business models, pricing and compensation models that can/should be used in order to incorporate QoE-based types of services to be commercially available.

Specific goals of the project for the involved actors

The main goal is to identify how to implement QoE-based service differentiation in mobile network’s in order to generate new revenue streams for mobile operators. This will require an identification/definition of the business models that take advantage of the new scheme in the service provision. Ericsson wants to understand correlations between people’s behaviour and locations, network types, device type and overall consumption. As well as how network performance affects the volume and types of applications that the users consume. To identify how the incorporation of QoE/user’s experience evaluation will impact its commercial strategy and network deployment is of interest for Telenor. We also want to analyse the impact on the competition and net-neutrality principles of providing good levels of user experience adapted to different services. Questions to be investigated are:
- How to implement QoE-based differentiation services on mobile infrastructures?
- Will QoE play a role in the deployment network decisions/design?
- How to achieve a revenue gap reduction by considering QoE incorporation in the operator business models?
- What are the costs associated to delivering a QoE that consistently exceeds user’s expectations?
A final goal of this project is to form a team and to submit research applications.

Contact persons and staff of the project partners

Sara Landström is manager of the Wireless Access Networks area at Ericsson Research. She has 10-years’ experience from working with services over wireless networks and evaluations of network performance. Bogdan Timus is a senior researcher engineer at Ericsson Research since 1997, working with among other things dimensioning and total cost of ownership for different network solutions.

Greger Blennerud has the global marketing responsibility for the area Mobile Broadband within Ericsson. He has been engaged in Business Development activities within the area of Mobile Broadband since 2007. Greger is heavily involved in the Ericsson studies on how capex investments can improve performance and financial returns.
Min Xie and Andres Gonzalez are researchers at Telenor Research with interest and experience in quality of service, quality of experience and network robustness. Per J. Nesse is a senior advisor in the Telenor Group–Research and Future Studies. His area of expertise includes financial analysis and management of new business development and transformation projects in cooperation with both business and academic partners. He has extensive telecommunications domain experience from working for more than 10 years in the industry.

Fredrik Blomström is an expert adviser within the competition department at PTS. Fredrik has 15 years’ experience from working with regulatory issues in the electronic communications sector, both at wholesale level and end user level. His area of expertise lies in the field of interconnection.

Jan Markendahl and Luis Martinez are researchers at KTH working with technical and business models aspects of mobile networks and QoE. Luis presented his Licentiate Thesis on QoE [1] 2014. Jan Markendahl proposed and investigated user experience metrics in the Ambient networks project [2][3]. Project coordinator is Jan Markendahl.

**The proposed project, organizations and tasks**

1. Analysis of the network performance and user patterns including network requirements in different locations (indoor, outdoor) and on different network types (Wi-Fi, cellular, 3G, 4G, etc) as well as when using different devices. (Ericsson, KTH).
2. Analysis of where and towards which users quality of experience mechanisms may be important. (Ericsson, Telenor, KTH).
3. Identification and analysis of the techno-economic challenges associated to the deployment of user-centric infrastructures. (Ericsson, Telenor, KTH).
4. Study on implications of service design, user and actor involvement and business models on the net-neutrality principles (PTS, KTH).
5. Analysis of different business models for QoE-based service provision/network deployment. (all partners).
6. Preparation of research applications to Vinnova and to Horizon 2020 calls (all partners).

**Resources and budget February 1, 2015 to January 31, 2016**

Ericsson and Telenor will each make an in-kind contribution of 1,5 person month and PTS will contribute with 1,0 person-month, in total an in-kind contribution of 4 person months. The project funding will be used as follows:

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Staff costs for R&amp;D at KTH</td>
<td>400 000 SEK</td>
</tr>
<tr>
<td>Travel expenses at Telenor</td>
<td>30 000 SEK</td>
</tr>
<tr>
<td>Travel expenses at Ericsson</td>
<td>30 000 SEK</td>
</tr>
<tr>
<td>Travel expenses at PTS</td>
<td>10 000 SEK</td>
</tr>
<tr>
<td>Equipment, KTH travel costs and other project costs</td>
<td>30 000 SEK</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>500 000 SEK</strong></td>
</tr>
</tbody>
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**How the project proposal matches the objectives of the research program**

The project aims to establish the impact of deploying services based on QoE differentiation on the mobile operators’ cost/revenue structure. Although there have been major advances in QoE-based services for mobile technologies, much of it has not had significant presence or impact in the market place due to the failure to successfully integrate them into viable services. The project addresses not only technology aspects but also the user experience, service design, and business models.
The project hence highlights the need for mobile infrastructures and platforms, with the capacity to offer QoE-based services. This capacity should be clear both in the technical as well as in the business model domain, integrating a regulatory vision. We believe that the proposed project should be able to illustrate how providing good levels of user experience adapted to different services can be the key to success in mobile services. The project proposal includes three committed industry partners; the mobile operator Telenor (new in Wireless@KTH), the network equipment manufacturer Ericsson and the Swedish regulator PTS.

Involvement in other small projects

Currently Jan Markendahl is leading two Wireless@KTH seed projects: COIN-SWEAT (started Sept 2014) and MUTANT (started 2013 extended until June 2015), http://wireless.kth.se/sweat/, http://wireless.kth.se/mutant/. Previously Markendahl has initiated and run a number of small projects with different partners. Together with PTS Jan initiated and run the small project “The significance of spectrum on operator businesses - Implications on capex and profitability” 2010 http://wireless.kth.se/SoB/. The project has significantly contributed to the ability for KTH to make research contribution in the FP7 projects “Quasar”(spectrum) and METIS (5G access). Markendahl has initiated three other KTH projects in the area of NFC services and mobile payments. The project “TSM MoM” was run 2011-2012 with Giesecke & Devrient (TSM actor, SIM card manufacturer) and Stockholm School of Economics. The project contributed to the funding by Vinnova for the project MBT-MBT and has resulted in one book chapter, several conference and journal papers and master thesis reports, see http://wireless.kth.se/TSM_MoM/. The small project “Mobile P3 “with Payex and KTH center for Bank and Finance has resulted in funding in several projects; the Vinnova project “MBT-MBT”, three year PhD student funding by Handselbanken and another seed project “Mobimer” with KTH Indek, SL, UL and Samtrafiken on mobile payments and ticketing, http://wireless.kth.se/blog/seedprojects/mobile-p3/. The “Mobimer project resulted in very close cooperation with the business development units within UL and SL and currently (November 2014) we are running focus group interviews with users of public transport in order to get a deeper understanding of consumer behavior and attitudes to new technology, http://wireless.kth.se/mpp/projects/mobimer/. These payment projects have all contributed to good relations with public transportation companies and payment providers providing good insights about consumers and mass market services.

Appendix 1: References, publications and relevant activities