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Vesna Radonjic[1], Aleksandra Kostic-Ljubisavljevic[1], Mirjana Stojanovic[1], Branka Dimitrijevic[1], Vladimir Simic[1]

1) Faculty of Transport and Traffic Engineering, University of Belgrade, Serbia {v.radonjic, a.kostic, m.stojanovic, b.dimitrijevic, vsima}@sf.bg.ac.rs

FACTORS AFFECTING SERVICE PROVIDER'S QUALITY OF BUSINESS IN NGN ENVIRONMENT

Abstract: *Quality of business (QoBiz) deals with the financial aspect of service provisioning. It refers specifically to measures such as service price, service provisioning costs, revenue from service provisioning, revenue per transaction, lost transactions etc. Generally, it covers service provider's profitability. For QoBiz evaluation, it is essential to consider service demand, price structures and revenue trends. Main focus of this paper is to explain factors affecting QoBiz operation of a NGN provider such as pricing, market modelling, cost and risk modelling as well as network design.*

Keywords: *Quality of Business, Pricing, Cost models, Next Generation Network*

1. INTRODUCTION

Future telecommunications infrastructure are expected to be built upon the concept of Next Generation Network (NGN) referring to an architecture of telecommunication core and access networks, which assumes transport of all information and services over a common network, typically built around the Internet Protocol (IP). This will create highly competitive environment due to the dynamics of the open market and the close interdependencies of interconnected enterprises.

In NGNs there is a need for simplifying service offerings and infrastructure to deploy new services. With aim to satisfy growing bandwidth requirements and enhanced services, service providers today must evolve not only their networks but also their business models.

Quality of Business (QoBiz) is a new dimension of quality in NGN that is being increasingly used in the pursuit of better business. It encompasses the service provider's profitability and the financial aspect of service provisioning. In general, QoBiz parameters are all those parameters that are expressed in monetary units: service price, service provisioning costs, revenue from service provisioning, revenue per transaction, lost transactions etc.

In this paper we discuss possibilities for a SP to enhance its profitability in evolving NGN market by considering economic and tehnical factors. The paper is organized in the following way. The important quality categories for QoBiz evaluation are explained in Section 2. In Section 3 the main goals for improving business operation of an efficient service provider in NGN environment are given. It covers pricing, forecasting, cost models, risk and network design. Conclusions are presented in Section 4.

2. BUSINESS PERSPECTIVE OF SERVICE QUALITY IN NGN

For an efficient service provider it is extremely important to identify quality categories that affect his QoBiz. Although those categories are related to Quality of Service (QoS) categories, they are not necessarily identical. Several categories stand out: performance, security, usability, regulatory and interoperability and business suitability [1].

Performance refers to the efficiency of support the service provides for the business activities. This category includes:

- response and processing times,
- throughput rates and
- resource utilization.

Security refers to the degree of information protection so that unauthorized persons or systems can't read or modify them and authorized persons or systems are not denied access to them. It encompass:

- confidentiality - the degree of protection from unauthorized disclosure of data;
- integrity - the degree of unauthorized access prevention;
- non-repudiation - the degree to which actions or events can be proven to have taken place, so that the events or actions cannot be repudiated later;
- accountability - the degree to which the actions of an entity can be traced uniquely to the entity;
- authenticity - the degree to which the identity of a subject or resource can be proved to be the one claimed.

Usability indicates the user-friendliness meaning understandability, learnability, ease of use and protection of users against making errors.

Regulatory and interoperability refers to whether the services is able of supporting the existing regulations and to which extent the service is able interoperating with other services that are defined within the same context. Supported standards addresses the issue of to which extent the service takes into account or can support the existing relevant regulations applied in the domain. It also refers to whether the service is open to support other regulations that may be relevant within the domain. Interoperability concerns the question of whether a new service is capable of interoperating with the existing services. This is assessed based on the interoperability of the organizational roles and responsibilities and the interoperability in terms of the information structure.

Business suitability refers to the suitability of the service for conducting the activities in the given business domain (e.g. highly collaborative context). It can be described through business domain adequacy, effect on collaborative practices and reputation within the sector. Business domain adequacy refers to how well the service corresponds to the defined problematic of the domain, in terms of the domain coverage (applicable area of services), and flexibility to major changes that may occur in the collaborative context. Effect on collaborative practices refers to which extent the collaborative practices (for which the service provides support) are supported and to which extent they would have to be aligned if the service would be used. Reputation within the sector refers to how well the service is perceived by others business actors inside the sector or within relevant communities.

3. BUSINESS PERFORMANCES IN NGN

In order to increase profit margins and strenghten bottom lines while continuing to meet users' expectations and overcoming unpredictable global economic environment, service providers have to change their business perspective.

Business operation of a service provider in NGN relies on factors such as pricing, market modelling, cost and risk consideration as well as network design. Suitable business and pricing models need to be designed which is expected to provide appropriate incentives for providers, as well as end-users.

3.1 Pricing issues in NGN

Feasible revenues, *Rev(t)* for a service provider in NGN are modelled based on the forecasted number of users, $N_i(t)$ for each service i and average revenue per user, $ARPU_i(t)$. The total number of users is a direct result of the market modelling, while $ARPU_i(t)$ is obtained by determining relevant market class j for services, $MC_{ij}(t)$, estimating the volume of services per class, $V_{ij}(t)$ and choosing the appropriate pricing model that enables dynamical price changes in time scale, $p_{ij}(t)$ – Figure 1.

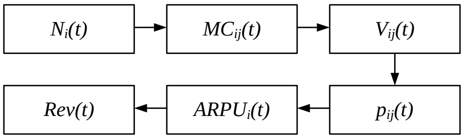

Figure 1. Data flow revenue projections (bottom-up)

The approach shown in Figure 1 basically corresponds to a bottom-up approach and is usually combined with a bottom-down approach, where revenue and number of users' data are used to predict future trends of *ARPU*. Clearly, such a combination is possible only for services that are congruent or similar to existing market-available services. For the purpose of forecasting volume of services per class heavy-tailed distribution are often used. Selection of the appropriate pricing scheme is more demanding. A NGN provider should choose a pricing model that fulfils a trade-off between providing satisfied users' utility and provider's revenue, still preserving efficiency and feasibility. User's utility can be expressed as a function of available network resources offered to a user which indicates a user's sensitivity to changes in QoS. Since users can choose between large number of competing SPs and a wide range of services that they provide, price to performance ratio is significantly improved

A wide range of different pricing schemes is likely to be applied for competitive pricing in NGN (e.g. [2, 3]) and is expected that competition will force providers to rapidly create and deploy different pricing concepts. It is required that pricing in NGN enables both off-line and on-line charging, open mechanisms for charging and billing management, various charging and billing policies (e.g. flat rate, value based, usage based per-session charging and billing etc.). It is also expected that accounting functions support services with multicast functionality and enable all possible types of accounting arrangements, including transfer of billing information between providers and e-commerce arrangements.

For evolution of billing systems from existing networks to NGN three scenarios are considered (Figure 2). In Figure 2, Mediation (MED) is an entity that enables recording and forwarding details about the service usage (for each individual user) from the existing network to NGN billing system or from NGN to the existing billing system. In the first scenario (Figure 2a), it is suggested to use NGN billing system for both the existing and NGN network, in which case changes are needed in all aspects of accounting. The second scenario (Figure 2b) involves simultaneous use of a new billing system for NGN and existing billing system for the existing network. For the realization of this proposal only change of accounting functions within the NGN is required. According to the third scenario (Figure 2c), the existing billing system should be used in both networks and then changes in all aspects of accounting are required. When and which of the scenarios will prevail in the choice depends solely on the network operator.

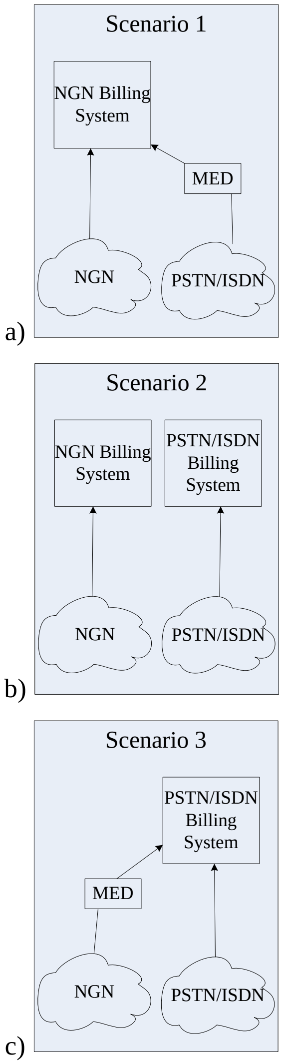

Figure 2. Scenarios for evolution of billing systems

3.2 Forecasting NGN market

For the purpose of forecasting parameters determining telecom market potential of a business model, most often dynamics of particular technology or service acceptance should be considered.

Generally, qualitative and quantitative forecasting methods can be distinguished. Qualitative methods exclusively rely on the intuition of forecasting experts. On the other hand, quantitative methods are based on well-known analytical and statistical models of certain phenomena that are assumed to be applied in the future within a given time series. In NGN market they often rely on models of new technologies diffusion and adoption, whereby diffusion refers to the penetration of new technologies in society, while adoption refers to the acceptance of technology by individual user's choice [4]. The most frequently used models of adoption are Fisher-Pry and Gomperz models, which are based on total number of new technologies or services forecasting using the S-shaped curves. Practical experience has shown that Gomperz model better suites the real cases of increasing user demand for a new technology or a service. The most popular models of new technologies diffusion are Rogers and Bass model. Incremental dynamics of new technology diffusion in both models takes the form of bell curve (i.e. normal distribution), while the differences between these two models are reflected in the number and categories of users (for example, in terms of users' elasticity, QoS demands etc.) considering the time of new technology acceptance ("innovators" and "imitators"). Bass model is more commonly used in practice. There is also Norton-Bass model which is anticipated to provide support for modelling the diffusion of next generation technologies and services.

Forecasting diffusion and acceptance of new technologies in practice is often reduced to the problem of choosing the most appropriate model with corresponding parameters, with the great help of numerical methods.

3.3 Cost modeling in NGN

Transport efficiencies are reflected through transport costs (price/bit) which are continuously decreasing. Process of cost modelling in NGN should include all relevant costs in a business model within an observation period. Structural classification of costs includes capital expenditures - CAPEX and operational expenditures – OPEX [5]. Generally, CAPEX of a telecommunication network can be expressed as:

$$\sum_t \sum_c \left\lceil \frac{d_c(t)}{g_c} \right\rceil p_c(t) \qquad (1)$$

where subscript c denotes the component of network equipment, $d_c(t)$ is a function of network capacity, g_c represents granulation factor for c (i.e. number of users that can share the capacity of the component unit) and $p_c(t)$ is anticipated market price of c in time scale. There is a tendency that market prices of network components are empirically reduced during time, primarily as a result of improving processes, reducing production time and increasing the volume of offers at the market. OPEX cover network running (first-time installation), operation (infrastructural, maintenance, provisioning, billing, marketing costs etc.) and other non specific costs for a telecommunications business model (overhead costs). They often occur in periodic intervals (e.g. monthly, annually). Main objectives related to the requirements of an effective cost model in NGN are:

- increasing bandwidth and optimizing the network to reduce costs,
- equipping the network with intelligence at the optimum cost,
- managing OPEX in challenging economic conditions and
- prioritizing IP transformation, starting with greatest cost reductions.

Reducing the CAPEX and increasing the Average Returns per Unit (ARPU) can be achieved by a scientific planning and designing for NGN, together with introducing new services with high QoS. A suitable model describing the progress of network components cost is called extended learning curve model [6].

3.4 Risk considerations in NGN

Analyses of major economic indicators only roughly indicate the profitability of a business model, without deeper analysis of the impact and interdependence of input parameters on the total profitability. In these analyses the possible changes that affect the values of input parameters in future periods are neglected (e.g. analysis of interactions and changes of other business participants' assumed strategies). Therefore, in order to increase the reliability of the business models analysis and flexibility of business modelling procedures, additional methods have been developed. In practice, all such methods are considered as risk modelling procedures and most commonly used methods are: worst/best case scenario, sensitivity analysis, Monte Carlo simulation and others.

3.5 Requirements for network design in NGN

Network design can significantly affect business operation of a NGN provider. Reducing network complexity is one of the main issues in NGN. All the needed resources, equipments, and the estimation of services usability should be determined prior to implement or deploy any new services. Design or dimensioning is to choose the correct amount of equipments and resources to meet the required grade of service (GOS). Over-design is cost-inefficient and will lead to inefficient use of the resources. Under-design will lead to congestions, delays and network performance degradation. NGN should be deployed to meet high market demands of the new services (especially in terms of bandwidth) and to be compatible with the old services introduced by the legacy networks [7].

The design should be accurate, based on scientific calculation and criteria, as opposed to arbitrary and the traditional one used by operators or that provided from the vendors [8]. It should consider the capacity needed, reliability, scalability, and the stability of the designed network beside the economical and financial factors.

Generally the dimensioning of the network follows the recommended or widely accepted referent network architectures [9]. Based on the input data of spatial distribution and users' density, geometric dimensioning models are applied for the dimensioning of access and core networks components. For the purpose of dimensioning next generation wireless networks Erceg-Greenstein model proved to be appropriate [10].

4. CONCLUSION

In rapidly increasing NGN market service providers and network operators are trying to create new revenue streams, bind current and attract new users and provide new market leading services. Therefore profitability is of the most importance to providers.

In this paper we have considered important service quality categories for QoBiz evaluation as well as factors affecting QoBiz operation of a service provider in NGN.

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