Features of Tariffs Determination for Telecommunications Services on The Basis of the Simulation the Cost of Their Providing

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Abstract — **The proposed approach to determination of tariffs for telecommunication services allows to take into account nature and specific characteristics of each services and conditions of providing, in contrast to existing. The core of the proposed approach is the model of services providing process (conceptual model) that takes into account only elements of the existing network, that involved in realization of provided services, and simulation model which determines operational costs through modeling work of a similar scale hypothetical subsystem using the original data corresponding to the current state of the market and the current legislation, and taking into account particular qualities of the operator (provider).**

It allows to refuse of using the separate accounting system, as well as to eliminate the disadvantages of the "historical" costs method and Long-Run Average Cost method, which can significantly reduce the complexity of the tariffs determination procedure and increase their validity. Its usage gives the greatest effect in the case of tariffs determination for telecommunication services, in conditions when the operator provides a wide range of services, as well as in calculation of tariffs for new services. The proposed approach of determination of tariffs for telecommunication services are successfully implemented in practice activities of some telecommunications operators.

Key Words — **telecommunication services, tariffs, method, simulation modeling.**

I. INTRODUCTION

Impetuous, even unprecedented, development of techniques and technologies, principles of telecommunication networks building and, as a consequence, innovations in the field of offered services packages, leads to the appearance of new participants, creates new business processes. In these conditions, application of effective methods of tariffs determination is becoming increasingly important. This application is ensuring maximum satisfaction of consumer demand for telecommunication services, creating favorable conditions for attracting investments, maximization of operators and providers revenue and profit, implementation of effective long-term policy of state regulation in telecommunication sector. At the same time, as practice shows, occurring changes give rise to certain scientific and methodical difficulties in development and implementation of economically feasible methods for determination of tariffs for telecommunication services require special researches to solve appearing problems.

Analysis of researches and publications on the problem of tariffs determination for telecommunication services and methods of its formation [1-5] allows to conclude that current theoretical and methodological approaches, in most cases, are general and do not take into account the nature and characteristics of the specific services and conditions of providing. This circumstance leads to the reduction of the validity of tariffs and efficiency of their usage in practice. As known, costs of providing for every particular service are significantly differ among different operators, and they depend on the range of services provided by the operator and the quantities of each service, and the specific conditions of providing – nature and state of technical means, indicators of usage, organization of technological process and so on.

It should be noted that in the contribution of O.S. Popov ONAT to the International Telecommunication Union "Determination of tariff to provide Internet access services based on ROI accounting method" (Document 957, Question - 12-3/1, Study Period 2010-2014) the method, that takes into account the nature and specific characteristics of access to the Internet services , was proposed by us. At the same time, as practice has shown, the area of effective usage of this method is a particular case, when the operator (provider) provides only Internet access service, or, along with it, a narrow range of services. In the general case, when the operator provides a wide range of services, features of providing and consumption lead to appearance of difficulties in process of tariffs determination for telecommunication services, the solution of which requires the development and application of special methods. First of all, we are talking about the methodical difficulties connected with the necessity to use the separate accounting system, since, as known, indirect costs are overwhelming in the cost price structure of telecommunication services.

The goal of this work is to present the proposed method of determination of tariffs for telecommunication services, for the general case, when the operator (provider) provides a wide range of services and taking into account the particular conditions of providing and consumption.

II. PRESENTATION OF THE MAIN MATERIAL OF THE RESEARCH

The solution of this problem can be proposed approach to determination of tariffs for telecommunication services based on the simulation modeling of providing costs. Building of the simulation model and determination of tariffs for providing of services are based on the current (operational) costs, which are determined in accordance with planned amount of services and economically justified planned providing costs, taking into account investment costs for development of networks and/or services for the planning period and profit. Justification of the choice of the tariffs determination method taking into account profitability of the investment is given by us in [6].

In our opinion, for understanding the essence of the approach, it is necessary to consider some assumptions and preconditions that were used during solving problems and reflect characteristics of telecommunication services, the conditions of providing and consumption.

First of all, we are talking about the key factors that it is necessity to consider before constructing a tariff for a particular service, and the division of each service on two key components: component of traffic transportation and component of direct services implementation.

The key factors that affect the magnitude of the tariff, should include:

– distance between the point of the subscriber connection and the communication node or the distance between two points of subscribers connections;

– bandwidth, which is necessary and sufficient for providing of services;

– type of communication channels (lines) and terminal equipment, which are used to provide services;

– range of services, the nature of the terrain (urban, rural and so on);

– tariffication mode (time-based or depending on volume of services).

Under the component of the traffic transportation here and will continue to understand the process of communication traffic through a set of transmission systems, communication lines or whole network segments which are used to enable providing of services.

In its turn, as a component of direct services implementation we will understand the process of providing a particular service between two end devices or between the end device and the device that performs the functions of the "central node" for this service.

As an example, the division can be considered as a classical telephone communication. In this case, the component of implementation is provided in sections "Telephone Subscriber 1 – Subscriber Line – Private Branch Exchange (PBX)" and "PBX - Subscriber Line – Telephone Subscriber 2". Component of transportation is provided in the area of "PBX-PBX" in the transmission of voice traffic over the transport network. Thus one and the same transport network can be used for transmission of traffic generated by different services. Obviously, if the service does not involve the transmission of traffic over the transport network, the component of transportation traffic of such services is missing.

The formula for calculation of tariffs for telecommunication services (in proposed approach) has the following view:

$$T = T^{trans} + T^{imp}, \qquad (1)$$

where
T^{trans} – component of transportation of the traffic over the transport network of definite type, in the amount which is sufficient to provide the service with the specified level of quality; T^{imp} – component of direct services implementation

Component of transportation of the traffic over the transport network of definite type can be defined using the formula:

$$T^{trans} = C^{t.dr} \, Z^{t.dr}, \qquad (2)$$

where
$C^{t.dr}$ –minimum number of consumption units of telecommunications traffic in the range of the transport network, sufficient to ensure providing of services with a given level of quality; $Z^{t.dr}$ – reduced costs (including investments required for development of the transport network for the period of tariff determination) on providing of minimum telecommunication traffic consumption unit in the transport network, "monetary units per time unit".

A typical example of the telecommunication traffic consumption unit can be a virtual connection, characterized by a definite nominal speed of information transmission (in bits/s). Thus, the most striking example of minimum consumption unit can be channel tone frequency (TF) or digital channel bandwidth of 64 Kbit/s. In the context of the proposed approach the minimal telecommunication traffic consumption unit is the costs driver of the transport network.

Component of the tariff for implementation of services can be defined using the formula:

$$T^{imp} = \sum_{k=1..N} (C_k^{dr} Z_k^{dr}), \qquad (3)$$

where
where N – number of types of costs drivers that determine the providing of services; C_k^{dr} – number of costs drivers of the k-th type, providing of services implementation; Z_k^{dr} – reduced costs for one driver of the k-th type (taking into account the investment required for development of an appropriate subsystem for the tariff determination period) for the tariff calculation period, "monetary units per time unit".

As it can be seen from formulas (2) and (3) the initial data for calculation of both tariff components are information about involved cost drivers for providing services as well as the data

about reduced costs on each of drivers, taking into account the investment required for development of an appropriate subsystem (for example, transport network). Thus, one driver costs can be defined by the formula:

$$Z = (E+I)/D, \qquad (4)$$

where

where, E – modeled amount of operational costs for the tariff calculation period, necessary to ensure the uninterrupted functioning of all elements of the network infrastructure, providing for transportation traffic or implementation of services respectively, "monetary units per time unit"; I – setting of norms of amount of investment costs required for development of the transport network or corresponding subsystem, for the tariff calculation period , "monetary units per time unit"; D – total amount of driver costs that determine capabilities of the transport network or telecommunication subsystem.

The core of the proposed approach is the model of services providing process (conceptual model) that takes into account only elements of the existing network, that involved in implementation of provided services. In the process of its construction the scheme of connection and traffic transmission between two subscribers or end devices (in the context of each specific services) is formed.

In general, the telecommunication network is a set of connection schemes and traffic transmission between two end devices in the context of each specific service. Each such scheme reflects the model of organization of communication, consisting of transmission equipment (seals) and connecting lines. The characteristic that defines its ability to provide services, are the distance between two end devices and bandwidth (for example, number of communication channels) that it provides. The unit of measurement 1 channel-kilometer is used to quantify this possibility. Thus, the total capacity of this scheme of communication channels organization is calculated as the product of distances by the number of channels that it provides. The total capacity of the telecommunication network to provide specific services is measured as the sum of capacities of all involved schemes of the organization which provides it.

In conditions of large number of various schemes of the specific service providing that vary in length and number of channels, for building the model of the process of the specific service providing and further determining costs of providing it, it is enough to use basic elements of the network, which will reflect average the amount of involved resources. Examples of such elements in telecommunications can be "PBX port", "conditional subscriber line", "conditional connecting line", "conditional trunk connecting line" and so on. Thus, for example, conditional connecting line represents one channel, which provides a scheme for providing of services.

For situation when a connecting line passes through several transmission systems (seals) for providing connection, it can be denoted as a trunk connecting line. In the modeling process is also determined by the average length of a conditional trunk connecting line. Standard telecommunication parameter "average distance between network nodes" is used to determine this length.

The end result of this stage is the allotment of base elements of the network for each service and determination of the numerical equivalent of the each element consumption in the context of each service.

The generalized algorithm of determination of tariffs for telecommunication services using the proposed approach consists in the following:

1. At the first stage should carried out the investment plan, which should include all costs connected with purchasing, installing and setting of new telecommunication equipment, as well as organization of new communication channels (including costs for the construction of new canalization system and antenna-mast structures, cable laying, design costs, licensing and so on) which are used for the transport of telecommunication traffic over the transport network or for the providing continuous functioning of segments, which provide implementation of one or other services. An important step in this stage is also the setting of investment costs amount norms .

2. In the second stage of the algorithm carried out the development of corresponding conceptual models of the transport network and implementation of services (for the second block). The main purpose of indicated models is the allotment of separate cost drivers that characterize the work of the transport network or a separate subsystem, which provides implementation of certain services, as well as determining total number of costs drivers.

3. In the third stage of the algorithm carried out the building of the simulation model of operational costs amount determination for the maintenance of the transport network or each of services implementation subsystems. The elaboration of simulation models have to determine total costs for the tariff calculation period the necessary to provide continuous functioning of segments of all network infrastructure elements that provide the traffic transportation or the implementation of the corresponding subsystem. Thus, the key characteristic of these models is that costs are not defined for an existing subsystem, and by means of modeling work of a similar scale hypothetical subsystem using the original data corresponding to the current state of the market and the current legislation, and taking into account particular qualities of the operator (provider). So, for example, for determination of total amount of costs to operate subscriber lines subsystem carried out an estimation of the number of staff which is required for the operation of this subsystem in amount which is similar to the current (or forecasted for new or developing systems), number of required materials and so on. The indicated values are the basis for modeling the corresponding components of total costs by usage such indicators as average salary of the staff, current (forecasted) market costs of materials and so on.

4. In the last stage of the algorithm two basic components of the tariff (for the traffic transportation and implementation of corresponding services) are determined. Determination of the tariff for each service is carried out according to the results of addition of the two basic components of the tariff.

CONCLUSIONS

The proposed approach to the tariffs determination for telecommunication services allows to take into account the nature and specific characteristics of each specific services and conditions of providing, in contrast to presently existing. It allows to refuse of using the separate accounting system, as well as to eliminate the disadvantages of the "historical" costs method and Long-Run Average Cost method, which can significantly reduce the complexity of the tariffs determination procedure and increase their validity. Its usage gives the greatest effect in the case of tariffs determination for telecommunication services, in conditions when the operator provides a wide range of services, as well as in calculation of tariffs for new services. The proposed method of tariffs determination for telecommunication services are successfully implemented in practice activities of some telecommunications operators. The proposed approach can also be used for the determination of prices and tariffs for products and services in other industries, if indirect costs constitute a significant proportion in the cost structure.

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