Optimization of the process of customer service with contact center

S. V. Tarkhov
Department of Computer Science and Robotics
Ufa State Aviation Technical University
Ufa, Russia
e-mail: tarkhov@inbox.ru

A. F. Galyamov
Department of Computer Science and Robotics
Ufa State Aviation Technical University
Ufa, Russia
e-mail: galyamov.airat@gmail.com

Abstract[1]

The problem of optimization of customer service process in a typical organization using contact-centre is discussed in the paper. The mathematical model of this process is represented.

1. Introduction

Any commercial or governmental organization is complex socio-economic system, and its activity closely associated with process of client service. The character of this service and clients may be different, but this process can be formal descripted with various methods, such as mathematical apparatus of set theory and queuing systems.

Contact-centre (CC) is an automated technical organizational system, meant for accepting, processing and sending of large amounts of information coming in the form of client requests via various communication channels. Most frequently the correct choice of the CC configuration efficiency and quality of customer service improves. The model of business-processes in a typical organization that implements and uses the CC, has been described in paper [1]. This paper describes the mathematical model of a typical customer service organization with a CC and the formulation of the problem the optimization of this process.

Build a universal model of such complex system is difficult. This problem has a fairly high level of abstraction, but still some of the conclusions of its solutions can be used in practice, or they may form the basis for further applied research.

2. The process model of customer service

For a formal description of a process model of customer service organization has been chosen mathematical apparatus of the theory of sets, as well as object-oriented approach as the development of set-theoretic apparatus.

In the description of a typical organization as a model - the «black box» (Fig. 1) in terms of customer service the whole set of its parameters can be divided into groups:

- Uncontrollable input parameters $N = \{ N_i \}$, $i=1,n$. For example, the intensity of the receipt of customers requests, their attributes, etc.;
- Controllable input parameters $C = \{ C_j \}$, $j=1,m$. For example, the number of operators and their groups, the number of lines, etc.;
- Control parameters $E = \{ Ek \}$, $k=1,p$ – indicators of efficiency of the customer service process in an organization. For example, amount of profit, the share of lost customers, etc.

Fig. 1. The process model of customer service organization as a «black box»

The identification and formal description of efficiency indicators (EI) of customer service is rather compound problem. In general, the EI can be divided into several groups:

- Economical EI, such as amount of profit, maintenance costs per customer, etc.;
- Social EI: customer satisfaction, customer loyalty, ranking the organization in its field, the percentage of lost customers, etc.;
- Technical EI: the average waiting time in queue, the probability of denial of service [2], etc.

It should be noted that the measurement of some efficiency indicators, especially the wearing of social nature, is quite difficult and involve with difficulties. In addition, among the various EI may be explicit or implicit

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link (correlation), and their study requires further research. The division of EI for some groups is conditional, not always possible to clearly identify to which class can be referred one or another efficiency indicators.

3. Description of the model parameters

The next aspect of this research is to formalize the description of the company's customers. Customers who are real world objects have many attributes (properties), which for convenience can be classified into a number of features – divided into several groups. For example, such as:

- Personal data (first name, last name, information about identity documents, etc.);
- Contact details (phone numbers, e-mail addresses and addresses of instant messaging services, accounts in social networks, etc.);
- The importance of customer (it's relevance, priority) for an organization. According to some studies, often 20% of customers generate 80% profit. These customers tend to assign a VIP status;
- Customer preferences, history of previous interactions with him, a list of purchased goods or services, etc.

It is important to note that significant for the solution of the problem are not all the attributes of the customer. A list of these attributes can vary depending on the specific (domain) of organization serving these customers.

It is easy to formalize the description of the personal data of customers and organize their storage. In contrast, customer contact information in the context of the problem is essential information and it requires a more detailed description. For the convenience of processing all client contacts can be divided into classes and types (subclasses). Classes of contacts reflect their physical nature (used technology). Often, for servicing the various classes of requests different hardware and software required [3]. The following classes of contacts can be distinguished:

- Traditional telephony (fixed and mobile);
- IP-telephony (voice over IP network, VoIP);
- E-mail;
- Services for instant messaging (IM-services: ICQ, Jabber, etc.);
- Accounts in social networks (Facebook, Twitter, Vkontakte, etc.);
- On-line web chat and so on.

Types (subclasses) describe the nature of the use of different contacts, their priority (the importance for the customer, how often he uses this contact and respond to messages on it) as well as time of contact availability (at which time you can contact the customer on this address). Each type of contact refers to a specific class and specialize it. For example, in the «Telephone» class it can be types «Work phone» and «Home phone», and in the «E-mail» class it can be personal address or corporate e-mail. In general, contact has type, address, priority and time of availability.

Employees are engaged in servicing client requests, as well as other works. The managers of organization can control their quantity, grouping into divisions as well as scenarios of requests processing, etc. Parameters of the organization related to its employees are controllable parameters of the model. The set of employees may also be classified by different criteria:

- By field of competence, by product (kind of work) in which this employee is competent;
- By qualification (highly skilled employees, managers, etc.). To describe the qualifications it can be used the mathematical apparatus of fuzzy logic.

The organization may have products (goods or services), which it develops, promotes and sells. In the model we can take into account the relations between products and employees as well as between products and customers – what goods and services purchased certain customers.

4. The mathematical model of optimization problem

For definition and formal description of the problem of optimization of the process of customer service with contact center is necessary to describe all the constraints, connected with controllable and uncontrollable input parameters and form an objective function that includes all output efficiency indicators (EI). The mathematical model of this problem can be described as a system of equations and inequalities:

$$\begin{cases} F(C_1, C_2, ..., C_n) > 0 \\ G(N_1, N_2, ..., N_m) > 0 \\ Z(E_1, E_2, ..., E_p) \to opt \end{cases}, \quad (1)$$

where $C_1,\ldots,C_n$ – controllable input parameters of model, $N_1,\ldots,N_m$ – uncontrollable input parameters, $E_1,\ldots,E_p$ – efficiency indicators. Function $F(C_j)$ – constraints, connected with controllable parameters, $G(N_i)$ – constraints, connected with uncontrollable parameters, $Z(E_k)$ – objective function (OF), connected with efficiency indicators. For example, OF can be obtained by linear convolution of indicators E_k with weighting coefficients a_k for each EI:

$$J(x)=\sum_{k=1}^{p}\alpha_k E_k(x)\to\min_{x\in D},\qquad(2)$$
$$\alpha_k>0,\sum_{k=1}^{p}\alpha_k=1$$

where J(x) – final objective function, α_k – normalizing weighting coefficients.

5. The class diagram

The sets of input parameters of the model such as information about customers, their contacts, employees and products can be described by the UML diagram, showed in Fig.2:

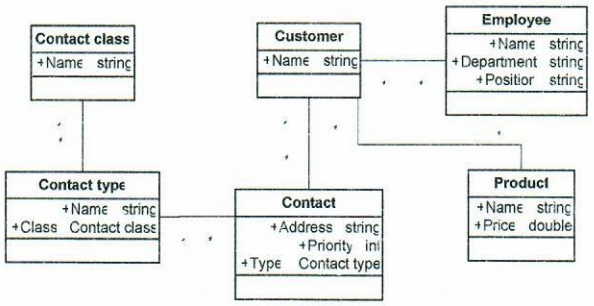

Fig. 2. The class diagram

6. An example of a formal description of the problem

As an example to illustrate the described model, was chosen as the organization that operates in the field of information technology (IT) and engaged in the development, implementation and maintenance of software. Suppose that this organization is developing software applications, sells it to customers and provides paid technical support. Suppose also that the organization provides online access to their web application in a SaaS mode (software as a service), or, in other words, using the "cloud" technologies. Technical support is performed using a contact center.

Uncontrollable input parameters in this case would be the quantity of customer requests in to tech support at a time (the intensity of the receipt of customers requests) N_1. Controllable parameters would be the quantity of operators C_1, capable of servicing requests and the number of telephone lines C_2, connecting the contact center of organization with PSTN. As efficiency indicators can be selected the average waiting time in queue E_1 and the profit from technical support E_2.

7. Conclusion

On the basis of the formal description of the problem of optimizing the process of customer service with contact center can be proposed ways to solve it using the mathematical apparatus of operations research. It should be noted that the methods of optimization of customer service with contact center will form the basis for intelligent decision support system (DSS) for managing this process. This will improve the efficiency of customer service by the selected criteria.

References

1. Galyamov A.F., Tarkhov S. V. Modeling business-processes of a contact-centre for optimizing its characteristics. In: *Proc. of 13th International Workshop on Computer Science and Information Technologies (CSIT'2011)*, Garmisch-Partenkirchen, Germany, pp.124-126.
2. Galyamov A.F. "On designing centres of integrated subscriber service". // The VI All-Russian winter workshop for post-graduates and young scientists: materials for the conference. Ufa: USATU, 2011. Volume 1. Pg. 23–26.
3. Goldshtein B.S. Freinkman V.A. Call-centers and computer telephony.