Use of Simulation in a Service Desk of an Oilfield Services Company

Luisa Carabalí-Sánchez[1(✉)], Germán Andrés Méndez-Giraldo[1], and Carlos Franco[2]

[1] Universidad Distrital Francisco José de Caldas, Bogotá, D.C., Colombia
lmcarabalis@correo.udistrital.edu.co, gmendez@udistrital.edu.co
[2] Universidad del Rosario, Bogotá, D.C., Colombia
carlosa.franco@urosario.edu.co

Abstract. Service desks over the years have become an integral part of most businesses, whether telecommunications, industrial, banking, health, etc. That is why today the management of these companies face major challenges such as the proper planning of the agents, skills, processing times, breaks etc. For those major challenges, simulation is suitable for modeling the service desk.

This paper presents an application of simulation for the service desk of the oilfield services company in order to achieve better system performance and improve the customer service process. The name of the company will be anonymous due to security policies.

Keywords: Simulation · Service desk · Workforce · Process improvement

1 Introduction

In today's business environment, people and the companies they work for depend on complex technology. This is the result of a huge challenge: supporting the growing number of technology users when they need help. The service desk is the single point of contact (SPOC) within a company for managing customer incidents and service requests as well as resolving incidents by using various knowledge repositories, the service desk can handle service requests, license issues, change requests etc. [1].

The number of requests made to the service desks within companies is estimated to be larger because some of these factors [2]:

- The Internet-based applications and rising number of mobile devices.
- Questions and problems from infrastructure and computing practices.
- The installation and updating of security and compliance-related systems such as antivirus, firewall, and data protection systems.
- Upgrades to existing systems, operating systems, collaboration systems, and messaging systems.
- Problems with outdated equipment and legacy systems.
- Others including presentation tools, photo-editing tools, tax software, money-management systems.

J.C. Figueroa-García et al. (Eds.): WEA 2016, CCIS 657, pp. 153–164, 2016.
DOI: 10.1007/978-3-319-50880-1_14

The Bogotá Service Desk in its 10 years of operation, has grown and has become one of the four service desks of the anonymous Oilfield Service Company, leading world-wide; providing the first line IT supports more than 100,000 employees and contractors.

This service desk handles an approximate number of 2,500 daily interactions, and communicates with the user through four different media: web chats, calls, voicemails and emails. They are the first point of contact for users who have problems related to IT.

Due to the large number of users who are given support, forecasting methods and management of resources for solving the problems have been insufficient. Different situations such as loss of calls, service times and longer wait than desired, are presented likewise the complexity of each incident is different user depending, these features extend the customer service process, generating more expected interactions on queue and a point of high stress by analysts feeling overloaded with work. We see interesting and important opportunities not only with call arrivals patterns and handling times, but also overall call volumes, using techniques from risk analysis and experimental design along with simulation models to quantify system capacity and delivery risks [3].

By the above conditions in this paper, and because of the provisioning of IT services increasingly being based on the modularization of whole service processes, it offers certain potential for reducing costs and enhancing service quality at the same time [4]. We present the management decision to employ new techniques such as simulation that allows them to counter the problems and improve customer services, making a balance between the qualities of service provided.

The paper is organized amongst Sects. 2, 3, 4 and 5. A review and related works about simulation in call centers are presented in Sect. 2. We summarize a company overview in Sect. 3. Following next, descriptions of the system, data collections, model designs, and results are the bases of Sect. 4. In Sect. 5, we evaluated different alternatives based on the necessities of the company, the paper concludes with this section.

2 Literature Review and Related Work

Several studies in the field of process simulation have been proposed already. However, studies related with service desk simulations was difficult to find, but there are plenty of jobs related to call centers.

The distinction between the two is pretty fluid. As a matter of fact, just a simple search reveals equal numbers of people who do and don't believe there's a difference [5]. The difference between call centers and service desks are the mutual points [6]. If a call center is customer service oriented, the focus may be more toward improved responsiveness to customer inquiries. In a service desk setting, the main objective may be improving the overall performance of problem identification [7].

The approaches in [8] defines the value of simulation in call center design, planning, and management by examining key weaknesses and strengths of traditional approaches and industry trends. It discusses how call centers can maximize their investment in simulation. The authors of [9] shows how simulation can be of use to generate data that can be used to evaluate incoming call forecasting algorithms. The work in [10], introduce key notions and describe the decision problems commonly encountered in call center management also formulated some common decision problems and point to recently developed simulation-based solution techniques. The paper [11] describes the modeling of a skill-based routing call center using two distinct simulation-programming methods: the C language and the Arena software package.

3 Company Overview

The anonymous oilfield services company is the world's leading provider of technology for reservoir characterization, drilling, production, and processing to the oil and gas industry.

The Bogotá Service Desk, began operations in 2001, dedicated to providing IT support for the anonymous oilfield services company employees since its inception has grown significantly to become the unique single point of contact for the company. The area aims to be the central interface between enterprise applications and users, providing high-quality business services worldwide through a combination of proactive and reactive support. This objective promotes the best practices in the business processes of everyday life, and helps with business objectives, and quality of services amongst others.

The main objective of the service desk is to achieve customer satisfaction and offers a response team 14×7 dedicated to timely technical support. The service desk is given assistance in: hardware, software developed for the company, connectivity. Administrative services such as access to servers, creates accounts for different applications segments of the business, cellphones configurations, internet channel monitoring, remote management of routers and servers, etc.

3.1 Bogotá Service Desk Statistics

Interactions loaded throughout the year are variable and there is no uniformity of incoming interactions. Last year the average amount of incoming interactions was 34,136 emails, 9,768 calls, and web chats 3,459, and 32 voice messages.

Making a comparison with the amount of incoming interactions of 2015 and 2014 are among the range of variations given by the standard deviation. This is disturbing because the standard deviation of each type of interaction and high variability, was confirmed on arrival system interactions.

4 The Current System

4.1 Steps for the Simulation Study

The methodology followed to construct the simulation is proposed by Kelton & Law [12]. First, the problem was formulated and the plan to followed.

The aim of the situation model is to provide a model that will give support for management decision making, given that such decisions are taken under a high level of uncertainty.

The model aims to find solutions to questions such as:

- Is the number the analysts have suitable for the volume of incoming incidents?
- How can the system be sized to an unexpected volume of interactions?
- What changes can be made to improve system performance?

Performance measures used to evaluate the efficiency of different system configurations are:

- Number of users served.
- Number of analysts required.
- Percentage of analysts' occupation.
- Time to resolve.
- Interactions Queue.

The simulation develops a model dimensioning of resources that fits the reality of Bogotá Service Desk. As with most simulations, you have the freedom to relocate resources, reorganize activities or modify procedures, without the constraints of cost, time, and difficulty of implementation that would usually have to be tested in real conditions.

4.2 System Description

The Bogotá Service Desk acts as a single point of contact for the oilfield services company; records, and manages IT questions and/or problems.

Specific service desk responsibilities include:

- Record of incidents and response to problems.
- Management lifecycle of incidents and requests.
- Keep users informed about the status of services, incidents and requests.

The service desk works for 14 h a day, 7 days a week throughout the year. It has a staff of 51 analysts where 41 analysts are Level 1 (L1) and 10 analysts are Level 2 (L2). Analysts are cross-trained e.g. Have the ability to multitask in this case would resolve any incident regardless of category.

Analysts on level 1 and level 2 have different functions, level 1 are those that provide the most service desk support and level 2 provide support but have additional tasks to improve the overall objectives e.g. Tutoring for level 1 analysts, help with questions, problems they may have, etc.

There are 3 shifts of 8 h each. The first shift starts at 6 AM, the second shift at 9 AM and the third shift at 12 PM. Besides that, analysts have a break of 10 min in the morning and afternoon, 50 min for lunch.

There is a software package used called Apropos[1] to automatically distribute calls, mails, web chats and voice-mail, among the analysts; additionally the other software

[1] Apropos Interaction Management is the platform for managing interactions and analysts in the Service Desk.

package used is Remedy[2], where the tickets are generated to track the requirements incidents for the users.

Figure 1 shows the flowchart of the system modeled. It consists of a queue where interactions are routed to Bogotá or other service desk depending on working hours, hence pass Apropos which is the platform for managing interactions; being here a part escalates to the other service desk or the onsite support according to the requirement and the other party is to be processed by analysts. The interactions are passed through Remedy. It is the management platform where tickets are created and can be followed up to user requests.

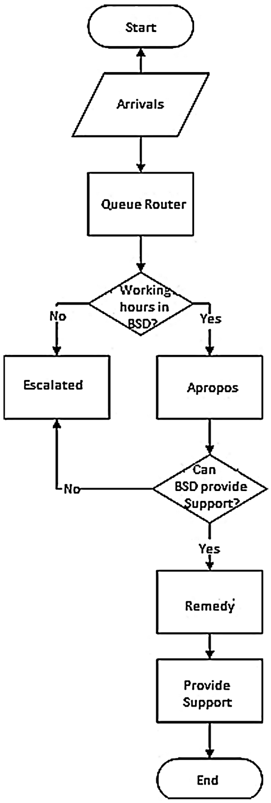

Fig. 1. Model flow chart

4.3 Data Collection

The data collection is drawn from information provided by the company, considering the random behavior of the events the tool used was Stat-fit, which is available in the

[2] Remedy is a Management Software that streamlines and automates the processes around IT service desk, asset management, and change management operations.

professional version of ProModel. It was used for testing goodness fit and the determination of the probability distributions.

The arrival rate represents the average arrival time between each entity entering the system, which in this case is an interaction.

After analysis and statistical adjustments, it is concluded that the time between arrivals is based on an exponential distribution. The Arrivals times are were classified by Day of the week and hour, Fig. 2 presents the results.

<table>
<tr><th rowspan="2">HOUR</th><th>Monday</th><th>Tuesday</th><th>Wednesday</th><th>Thursday</th><th>Friday</th><th>Saturday</th><th>Sunday</th></tr>
<tr><th>Average</th><th>Average</th><th>Average</th><th>Average</th><th>Average</th><th>Average</th><th>Average</th></tr>
<tr><td>6-7.</td><td rowspan="5">Group 1</td><td rowspan="5">Group 2</td><td rowspan="5">Group 3</td><td rowspan="5">Group 4</td><td rowspan="5">Group 5</td><td rowspan="7">Group 13</td><td rowspan="5">Group 15</td></tr>
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<tr><td>11-12.</td><td colspan="5">Group 6</td><td rowspan="3">Group 16</td></tr>
<tr><td>12-13.</td><td colspan="5">Group 7</td></tr>
<tr><td>13-14.</td><td rowspan="7">Group 8</td><td rowspan="7">Group 9</td><td rowspan="7">Group 10</td><td rowspan="7">Group 11</td><td rowspan="7">Group 12</td><td rowspan="7">Group 14</td></tr>
<tr><td>14-15.</td><td rowspan="6">Group 17</td></tr>
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	λ
Group1	2,53
Group2	3,00
Group3	2,97
Group4	2,94
Group5	3,47
Group6	1,23
Group7	0,68
Group8	0,26
Group9	0,24
Group10	0,29
Group11	0,29
Group12	0,31
Group13	2,61
Group14	1,47
Group15	9,29
Group16	4,78
Group17	2,45

Fig. 2. Arrival times BSD

The service times were the most difficult variable to collect due to the Bogotá Service Desk not having any reports on how much time an analyst spend solving an incident; all the statistics in the BSD are measurement by quantities. To solve this problem the total of incidents taken by analysts was divided by the amount of working net time, giving as a result an average of time spent for interaction.

The BSD monthly handles about 400 or more types of products. An initial analysis made showed that amount of product depends on the type to of the product; for this reason was decided to perform an ABC Model classification for the products where main products are in category A than represents 73.8% of all products, other fairly important in category B than represents 17.2% and the last ones in category C that represent the 9%.

For the analysts of level 2 were unable to find probability distributions as some cases not had enough information. As specified, initially analysts level 2 spent most of their time on other tasks such as mentoring than taking interactions, so for these analysts the times are average times. After this classification, the service times for the analyst level 1 and level 2 are shown in the Table 1.

4.4 Model Design

The entities for the system are the users, in this case, anonymous oilfield services company workers who communicate to the service desk for any problems related to IT.

Table 1. Service times Level 1 and Level 2 (Minutes).

	Lerel 1- SERVICE TIMES	Levels 2 SERVICE TIMES
PRODUCT	USER DISTRIBUTION	AVERAGE TIME
LDAP- Directory Services	N(49.2, 18.6)	136,27
DSM- File Sharing	N(49.2, 18.6)	105,29
Teleworker-SecureGateway	N(49.2, 18.6)	136,27
PCS-Detected Is sue Resolution	−932 + 981*(l./((1 /U(0.5,0.5))-l.))**(1./89.8)	104,16
Windows 7	N(49.2, 18.6)	136,27
SDE-BitLocker	N(49.2, 18.6)	92,61
SCCM- Enterprise Image Management	48.6-10.3*LN((l./U(0.5,0.5))-l.)	105,29
Connected Backup	49.8-10.6*LN((1./U(0.5,0.5))-1.)	105,29
Enterprise Services- Not Listed	48.8-8.52*LN((l./U(0.5,0 5))-l.)	138,7
Exchange Email- Outlook	−646 + 694*(1./((1./U(0.5,0.5))-1.))**(1./66.8)	105,29
Reader	−810 + 859*(1./((1./U(0.5,0.5))-1.))**(1./79.9)	146,81
Internet Explorer	N(49.6,18.9)	116,27
SAP NAM Finance PC1	−920 + 970*(l./((1./U(0.5,0.5))-1.))**(1./93.7)	160,24
PC Security Management-PCS	47.2-10.2*LN((l./U(0.5,0.5))-1.)	95,74
DSM-Print Queues	−254 + ER(303,288)	111,8
System Health Tool	−2.02e + 003 + 2.06e + 003*(l./((1./U(0.5,0.5))-1.))**(1./191)	91,81
Exchange Email- Account Settings	−616 + 666*(1./((1./U(0.5.0.5))-1.))**(1./61.)	102,39
Virus Qean-Up	N(47.6,16.1)	108,49
Quest	−17.2 + W(4., 70.4)	112,97
SDE- Desktop Encryption Services	−765 + 814*(l./((1./U(0.5,0.5))-1.))**(1./77.7)	145,21
WinZip	−164 + ER(214,146)	90,14
Exchange Email-MailBox Management	−1.2e + 003 + L(1.25e + 003,20.2)	87,39
MDS Active Directory	−764 + 813*(l./((1./U(0.5,0.5))-1.))**(1./77.7)	111,01
ToIP-Standard MACD	N(48.7,15.6)	93,27
Other Applications and Services- Not Li	45.3-10.8*LN((1./U(0.5,0.5))-1.)	136,27
Office	N(49.2,18.6)	136,27
DSM- Server DNS	N(49.2,18.6)	136,27

The locations in the model are:

- A router (1), which sends the entities to the Bogotá Service Desk or other Service Desk's (escalation) depending on the time.
- A queue (1), where the entities arrive and are sent to Apropos to be processed.
- One (1) location called BSD representing Apropos, where entities are processed, a percentage of these entities are escalated and the remaining are processed by the service desk analysts.
- To describe the analysts fifty-one (51) desks represented the level 1 and level 2 analysts.

The model represents one week of work for the system. For this reason, shifts are created to handle the simulation run time and the locations.

4.5 Processing

The entity (user) reaches the router SD's location that routes the interactions to BSD or other services desks depending on the opening hours of the office that is from 6 AM to 8 PM. After that pass to the location called BSD which processes about 26% of the incoming interactions passes to the analysts to be processed, and the other 74% is escalated to the next level of service outside the BSD. The 26% of interactions that remain in the system are processed by analysts depending on the type of product they belong after be processed the entity leave the system (Refer to Fig. 3).

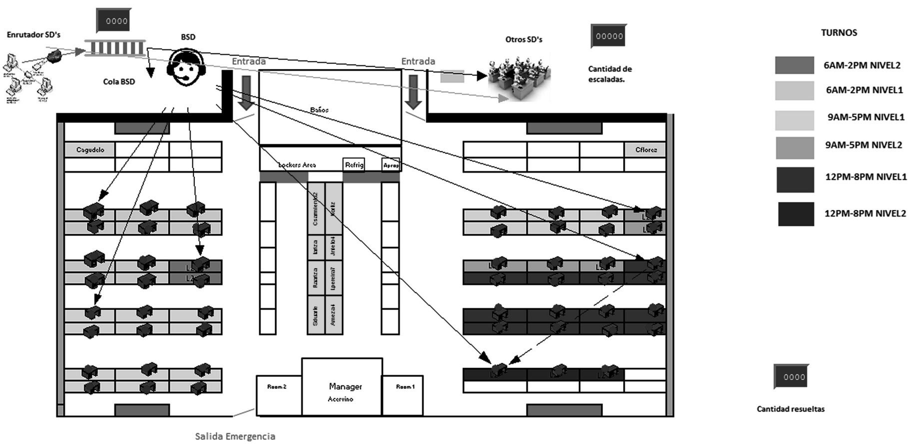

Fig. 3. Layout BSD simulation

4.6 System Output

For the verification, a detailed review of the model, and a statistical analysis was made. The validation was done using the Welch Method. As a result, the acceptance of the model gives results like the actual system.

After the model validation was performed, the simulation horizon runs 168 h, the equivalent of a week (Monday through Sunday).

The model showed that the average utilization of the service desk capacity is 95%. Which means that in a week, level 1's who bear the brunt of the operation, reach to solve about 50 interactions. These are roughly the 26% of the in-coming interactions, meaning that on average an analyst interacts with 190 incidents, can be a little more depending on whether or not they work weekends.

From the simulation, the number of incidents resolved by level 2 analysts equals just only 37% of the number of incidents resolved by analysts at level 1.

Other measurements found are the number of users served equaling 9,729. Escalated quantity incidents equals 7,377, which is expected to be 74% of users who initially arrive on the queue. The amount of created tickets is 2,519 which is expected to be 26% of users coming service desk and can provide them the service. The number of tickets (incidents) solved is 2,177 and waiting to be solved and out the system are 342.

5 Proposal for Improvement Based on the Simulation

Some of the problems that BSD Management want to attack using simulation is the unexpectedly large volume of interactions at the same time, and the effect on the analysts two scenarios will arise. For the first scenario the number of incoming interactions increase in 30% and for the second these interactions decreased 30%. The idea is to find a configuration that allows the BSD take action in case of emergency.

In addition to these alternatives, other alternatives will be created to improve the real system.

5.1 Increased Incoming Interactions by 30%

To achieve the assumption, the average of incoming interactions per day and hour are increased by 30%, finding new arrivals rates.

An alternative using backups analysts is the solution for this scenario, where a group of new analysts, in this case (12) are added to the operation in one shift which the BSD is not in operation, i.e. from 8 PM to 6 AM (Monday to Saturday) the sole purpose will be to process the incidents that are queued. Besides this, it is proposed that analysts level 2 work as an analyst level 1 and tutoring and mentoring tasks are distributed among the team leaders. Shifts and the number of analysts per shift remain the same from Monday to Sunday as in the current system.

In this alternative the averaged of utilization for the analysts is 97.7%, on the other hand, the time an incident delay in the system was reduced by approximately 8 min, from 48 min to 40 min with this alternative. Table 2 presents the differences between the real system and the alternative of 30% increase incoming incidents. (Refer Table 2).

Table 2. Differences between real vs 30% increase alternative.

	Real	Increase 30%	Difference
Number of users served	9500	11852	20%
Number of escalated incidents	8685	8537	2%
Number of tickets created	3253	3493	7%
Number of tickets solved	3347	3205	4%
Analyst needed	51	64	20%
Analyst utilization	/	97%	/
Service Time	49	40	23%
Incidents in queue	/	288	/

5.2 Decreased Incoming Interactions by 30%

As the previous scenario, the average of incoming interactions per day and hour are decreased by 30%, finding new arrivals rates.

The number of incidents in the queue is reduced to 45, the users entering to the system is approximately 6,678, (Refer Table 3).

Table 3. Differences between real vs 30% decrease alternative.

	Real	Decrease 30%	Difference
Number of users served	9500	6678	30%
Number of escalated incidents	8685	5124	41%
Number of tickets created	3253	1715	47%
Number of tickets solved	3347	1670	50%
Analyst needed	51	36	29%
Analyst utilization	/	95%	/
Service Time	49	46	6%
Incidents in queue	/	45	/

The ones escalated are approximately 5,124 and the incidents are solved 1,670. Obviously, this alternative allows a maximum capacity utilization of the service desk without overworked analysts by reducing the number of incidents. The number of analyst will be reduced too.

5.3 Improved Current System

To improve the current system, a simple proposal requires level 2 analysts work as a level 1 analyst, e.g. take incidents all the time and leave additional tasks such as mentoring and tutoring including the Team Leaders.

This proposal improves the system greatly. System utilization is only 90%. The average number of incidents resolved by the analyst is 47, and the average time spent on an incident system is 48 min. With this improvement, costs are reduced to only hire

Table 4. Differences between real vs improved system.

	Real	Improved	Difference
Number of users served	9500	9699	2%
Number of escalated incidents	8685	7395	15%
Number of tickets created	3253	2469	24%
Number of tickets solved	3347	2399	28%
Analyst needed	51	55	7%
Analyst utilization	/	90%	/
Service Time	49	48	2%
Incidents in queue	/	68	/

a small amount of analysts. In which finally, the most important resource (time) is well used; solving incidents quickly and effectively (Refer Table 4).

The results presented with the simulations made that the BSD Management decided to apply the improvement for the system, which level 1 analysts and level 2 analysts perform the same tasks; and with this applied change, data was collected to analyze the impact of the changes taken into the system.

A Mean Test is done to define if the application of the simulation have an effect in the real system.

The null hypothesis is rejected. The P-value = 0.039 is less than the significance level $\alpha = 0.05$. That means there are significant differences between the system before and after the change. Therefore, the change applied had an impact in the performance of the real system. The Mean test is valid for the global performance and according with the literature the validation is analyzed using the averages values.

6 Conclusions

This practical application of modeling has demonstrated the numerical advantages of using a simulation model to predict and improve service desk performance instead of using a queueing model as a representation of the real system. The queueing model can be a simplified representation of the system; due to the difficulty and complexity of the service desk operation, such as service times, amount of products handled is greater than 400, user availability, time zone, connectivity etc. A queueing model can never represent the system completely, as there are several uncontrollable variables.

While there are many papers on modelling of call centers and services desks, this paper explains the reason why simulation is being used to predict service desk performance. The main idea of this paper is on the system and data analysis, and solutions for the issues encountered developing the simulation model for such a complex system as the Bogotá Services Desk.

The proposed “what-if” scenario the number of incoming interactions increase in 30% showed that the alternative evaluated is useful. Although one requires more staff, the number of resolved incidents will increase by approximately 32% and inventory levels, i.e. incidents waiting to be solved is reduced by approximately 17%. For the second scenario where the interactions decreased 30%, the utilization is 95%, analysts are solving weekly an average of 46 incidents, the number of incidents on waiting was reduced from 342 to 45. The scenarios and alternatives evaluated with simulation indicated that the system was upgraded. The proposed distribution of resources increases the process utilization rates, times and numbers of users served. Additionally, each proposal involves a cost much lower than the current estimated.

Simulation allowed the company to have a better workforce planning, and within time, adjusts to future needs in a quantitative manner avoiding overloads or losses depending on the situation.

Acknowledgment. This work has been supported by the anonymous oilfield services company. The authors would like to thank the management from the service desk to give us the change to do this work. We have learned about the call center industry, management, and data analysis, which has contributed to our ability to model and analyze these systems.

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