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Simulation in Citizen Relationship Management

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ABSTRACT

Telecommunications play an important role in providing services for citizen and through this study is been trying to use modeling and simulation system for Communications Center (solving failure process) also solving problem, speed of solving the failure, followed by optimization system and offers a model for managers . Based on this role the manager can use the model that presented above for identifying different strategies then applying best practice for satisfying citizens (citizen relationship management (CIRM).

For example, before the occurrence of a repeated failure can identify risky areas and detect them. If we assumed, service provider are as customers that used government services, the managers can evaluate productivity of service providers and choose the right reward system or the decision for using more service providers .

No technical managers can use this model Because of its simple structure. The above system has been simulated with the Arena software and because the system simulation credit on random numbers we have used the data registered in the system for probability distribution function.

1. Introduction

Telecommunications is a general term for a vast array of technologies that send information over distances. Mobile phones, land lines, satellite phones and voice over Internet protocol (VoIP) are all telephony technologies - just one field of telecommunications. Radio, television and networks are a few examples of telecommunication.

In addition, telecommunication Company provides services directly for citizens, also provide services for other organizations therefore play an important role in electronic government.

Many concepts in citizen relationship management (CIRM) are considered from Customer Relationship management (CRM) ,citizen relationship management emphasis on service that present to citizen while Customer Relationship Management emphasis on sales and profitability [20].

The main aim of Citizen Relationship Management is, moving from the government-oriented towards to the citizen-oriented. In other word, Citizen Relationship Management is a growing effort on all levels of government to respond quickly, succinctly and accurately to citizen

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requests or inquiries for answering questions and general information about policies, practices, and procedures [20].
The aim of both CRMs is to be , more effective and efficient working relationships, to better anticipate and meet customer(citizen) needs and to develop a more detailed working understanding in order to reply customers(citizens)'s demands , expects, and demands from those who serve them [20].
Simulation models are flexible and solve real problems without making too many restricting assumptions as in most analytical models [14].
Shannon defines simulation as the process of designing a model of a concrete system and conducting experiments with this model to understand the behavior of a concrete system and/or to evaluate various design options for the operation of the system [2].
Performance evaluation of random systems is one of the important issues of management. A computer simulation is useful instrument, based on mathematical methods.
In former studies explains the field of telecommunications and customer satisfaction. As you can see in all the researches, data mining tool have been used, but in this research, simulation is being used for current status and offer solutions for problem.
Percent rate and solving failure is high in telecommunication centers due to some official work in parallel while this process is occurring in less than the time recorded, and this leads to decisions not just for citizens to solve problems, this is crucial for contractors since after removing the high failure rate, brings fines to them.
In this study, offering solutions for failure rate (waiting time of customers), computer simulation has been calculated duration of employment linesman, the duration of employment officers in Cable, the number of current failure.
Arena used for simulation software and sample data in real systems [13, 16].
The rest of the research deals with the simulation scenario and is organized following: In the second part work in the telecommunications field with central customer satisfaction (citizen-Oriented) presented and also took issue with the same problem (literature Review). The third section has been explained simulation scenario, and then we give in section four simulation results.

2. Literature Review

Table 1 shows some paper in the field of telecommunications (fixed, mobile). As can be seen in the subject matter of all paper using data mining tools to identify user demands and make decisions about improving services provided to them is leading to satisfaction and loyalty to citizens.
On the other hand the papers that they'll continue have similar issue raised in this research:
Yalc_nkaya and Mirac Bayhan present a modeling and solution approach based on discrete-event simulation and response surface methodology for dealing with average passenger travel time optimization problem inherent to the metro planning process.
The objective is to find the headways optimizing passenger average travel time with a satisfactory rate of carriage fullness. Due to some physical constraints, traffic safety and legal requirements, vehicle speeds cannot be raised any further to decrease travel time. But travel

time can be optimized by arranging headways (i.e. the time period between the departure times of two consecutive transportation vehicles) in a timetable. In the presented approach, simulation met models that best fit the data collected from the simulated experiments are constructed to describe the relationship between the responses (average travel time and rate of carriage fullness) and input factors (headways) [1].

As well as, Otamendi, Manuel Pastor, Garcı presents a paper for Selecting the simulation software for the management of the operations at an international airport that the selection process of the software has been based on the study of the capabilities of the commercial and general-purpose simulation and visualization tools available as well as on the quantification of user requirements and the development of trial versions. Analytical Hierarchy Process has been used to choose the platform, which is composed of a simulation model developed in JAVA and two visualization screens, one in JAVA and the other in Visual Basic [2].

According to subjects discussed in this section, express the failure problems and related simulation process.

Table 1. Some papers in the field of citizen relationship management in telecommunication

Subject	Authors	Journal profile
Customer retention, loyalty, and satisfaction in the German mobile cellular telecommunications market	Torsten J. Gerpott, Wolfgang Rams, Andreas Schindler	Telecommunications Policy 2001
Data mining for decision support on customer insolvency in telecommunications business	Daskalaki, I. Kopanas, M. Goudara, N. Avouris	European Journal of Operational Research 2003
Determinants of subscriber churn and customer loyalty in the Korean mobile telephony market	Hee-Su Kim, Choong-Han Yoon	Telecommunications Policy 2004
Determinants of customer loyalty in the wireless telecommunications industry	Abdolreza Eshghi, Dominique Haughton, Heikki Topi	Telecommunications Policy 2007
Consumer behavior in the Italian mobile telecommunication market	Clelia Mazzonia, Laura Castaldia, Felice Addeo	Telecommunications Policy 2007
Two-level model of customer retention in the US mobile telecommunications service market	Ranganathan, Yair Babad	Telecommunications Policy 2008
Understanding customer satisfaction and loyalty: An empirical study of mobile instant messages in China	Zhaohua Deng, Yaobin Lua, Kwok Kee Weib, Jinlong Zhanga	International Journal of Information Management 2009
Managing customer relationship management projects: The case of a large French telecommunications company	Adel Beldi , Walid Cheffi , Prasanta K. Dey	International Journal of Project Management 2010

3. System description

First subscriber notify failure phone through the 117 telephone information telecommunication center, then the failure of telephone will be registered in MDF center and present failure form to air an cable network. Air and cable networks specify the type of failure. If the failure type is air failure after specifying Kafo number, it will be delivered to the related linesman If the linesman being unemployed then he sent to the site for resolving the failure. If the failure type is cable failure the failure form present to the cable technicians for resolving.

3.1.The problem

In current system for failure solving in telecommunication centers, duration of failure solving records is based on hour, for example, if a linesman failure form be in area and each of these could be resolved in five minutes, in a registration form will be registered one hour, also this form involved duration of returning failure form, from air and cable network to 117, in the case may the employees be busy and a lot of time will be registered for transferring.

In these simulation systems, we’ve estimated average speed for failure solving 9 hours and 55 minutes, Whiles this time in the real system is about 10.

Knowing the exact time for failure solving, (waiting time of customers) and busy time of employees, number of failures in each region, these factors cause to reduce the time required to resolve failure that are beneficial for both subscribers and the contractors.

After analyzing the current system and considered comment of center staff, we decided that the time for solving failure register based on minutes, and removed the return of failure form to 117.

By this view we simulated system and will be describe the simulation process next.

3.2.Simulation process

We used Arena tools for simulation. Arena is an easy-to-use, powerful tool that allows you to create and run experiments on models of your systems. By testing out ideas in this computer "laboratory," you can predict the future with confidence and without disrupting your current business environment. Any business environment, from customer service to manufacturing to health care, can benefit from simulation. And whether you're analyzing an existing supply chain or a new emergency-room layout, you follow five easy steps with Arena [2]:

Create a basic model. Arena provides an intuitive, flowchart-style environment for building an "as-is" model of your process. Simply drag Arena's modules—the shapes in the flowchart—into the model window and connect them to define process flow.

Refine the model. Add real-world data (e.g., process times, resource requirements, and staff levels) to your model by double-clicking on modules and adding information to Arena's data forms. To create a more realistic picture of your system, replace the animation icons that Arena automatically supplies with graphics of your own (e.g., from ClipArt or other drawing packages).

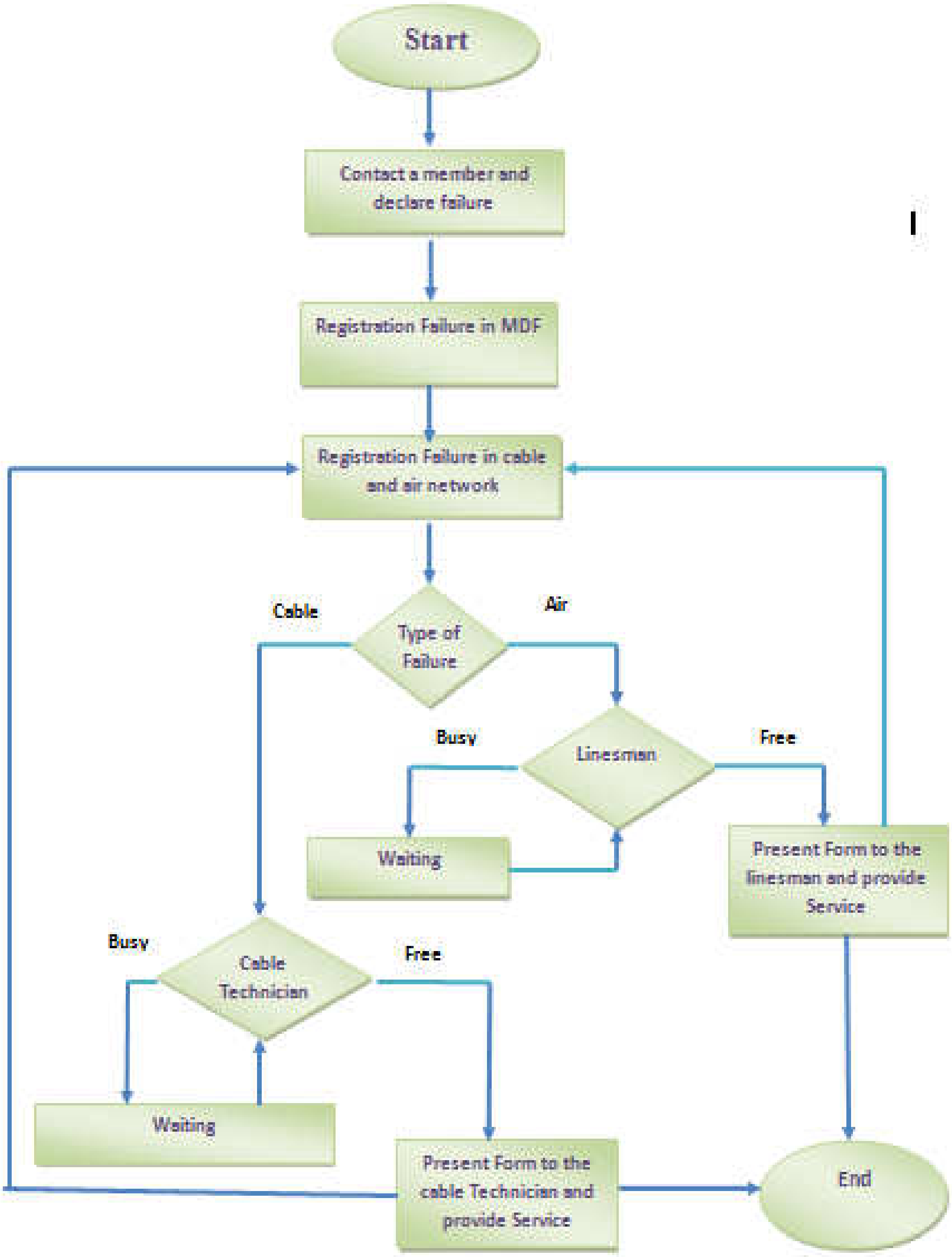

Figure 1. Flowchart for telephone failure solving

Simulate the model. Run the simulation to verify that the model properly reflects the actual system. Identify bottlenecks and communicate with others through the dynamics of Arena's graphical animation.

Arena provides automatic reports on common decision criteria, such as resource utilization and waiting times. Augment the built-in statistics with your own, so that Arena reports what's important for your decision-making needs.

Select the best alternative. Make changes to the model to capture the possible scenarios you want to investigate, and then compare the results to find the best "to-be" solution [2].

According to the description of failure solving process (in section 1.3. system description) it is clear that type of system desired is multi queue - multi servers.

Simulation process procedure is as follows:

Step1 .Identifying the main events of system

Table 2 shows the main event in failure solving process and its related possibility distribution function.

The times for main events is recorded in telecommunication system in the center, to obtain the data was used the recorded information and then the probability distribution functions computing with input analyzer of Arena software for each one .

Time for solving cable failure is about 24 hours so its time is considered with the same fixed amount of 24 hours.

The inverse-transform method, when the random variable drawn has a closed form for its inverse cumulative distribution function, or numerical techniques using a polynomial approximation to the inverse of the cumulative distribution function, when the inverse cumulative probabilistic distribution has no exact inverse function. Also, in some cases, the convolution method is used; that is, the desired random variable X is expressed as the sum of other random variables that are independent and identically distributed. These random variables can be generated more readily than by the direct generation of X.

In general, the algorithm implemented for generating a random variable X that has a cumulative distribution function F and an inverse cumulative distribution F-1, is as follows (recall that ~ is read "is distributed as"):

Generate U ~ U (0, 1)
Set X = F-1(U) and return

U (0, 1) represents a random sample drawn from a uniform distribution with a range between 0 and 1. F-1 (U) could be the closed form of the inverse cumulative distribution function or a polynomial approximation to such function.

For obtaining results, we calculated above parameters:

Average waiting time (AWT) for subscriber is:

$$AWT = \frac{TTIQ}{TNS}$$

That (TTIQ) is total time in queues and (TNS) is Total number of Subscriber.

Above formula was used for calculation average time that a subscriber exiting in system:

$$ASST = \frac{AWT+TST}{TNS}$$

ASST is average subscriber staying time and TST is total Service time that Service provider (linesman A, B, cable technician) present to subscriber.
According to Table 2, distribution function for linesman A is Normal and linesman B is Weibull Distribution.
Weibull Distribution has a closed-form inverse cumulative distribution function given by:

$F^{-1}(U) = \beta\, [-\ln(1-U)]^{1/\alpha}$

ST (linesman B) = $\sum_{i=1}^{tns} \left(\beta\, [-\ln(1-U_i)]^{1/\alpha} \right)$

If failure is air type, then:
TST = ST (Linesman A) or TST = ST (Linesman B).
If failure is cable type then: TST = ST (Linesman A) +1440 or TST = ST (Linesman B) +1440 (1140 min is the time for cable failure solving).
The failure forms are distributed between the two linesman according to Kafo numbers, Of 30 cases, 18number related to the failures linesman number one (60%)and 12 cases (40%) is related to the linesman number two. In general, failures are three types: Air, cable and internal and in the 30 failure about 16 number air-related failures, 13 cases of internal and there is a cable failure (53%, 43%, 4%).

Table 2. The main events and theirs distributions

Event	**Distribution**	**parameters**
Time Between subscriber contacts	WEIBULL	129,0.399
Time for presented form from 117 to cable and air network	WEIBULL	4.68,0.275
Time for service linesman A	Normal	98.7,58.7
Time for service linesman B	WEIBULL	67.4,1.02

Step2.Designing simulation flowchart

Figure 2 shows flowchart for starting simulation and Figure 3 shows service provider (the linesman and cable technicians) for solving failure.
In simulated system, there is two linesman and a cable technician.
After designing flowchart and computing probability distribution functions we are modeling system in Arena software. Figure 4 shows the model.

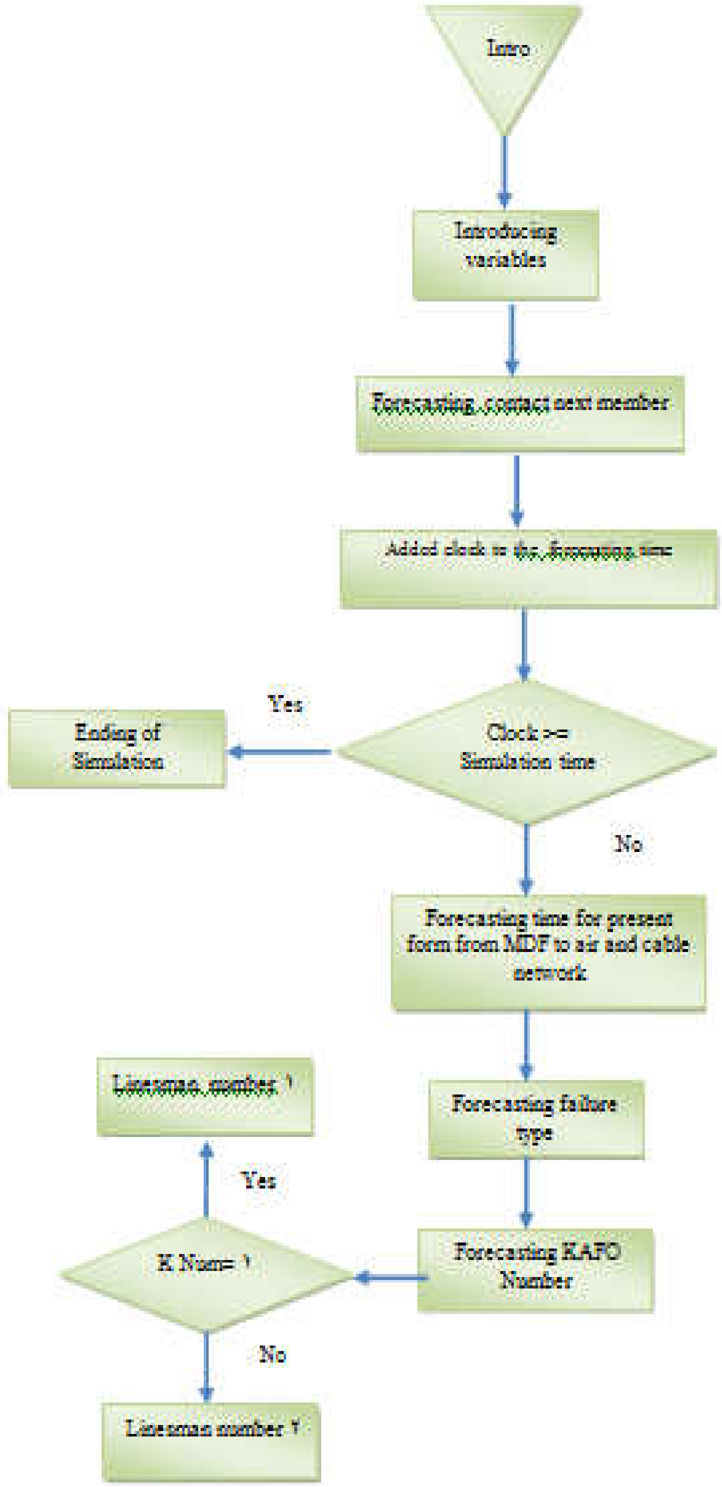

Figure 2. Flowchart for starting simulation

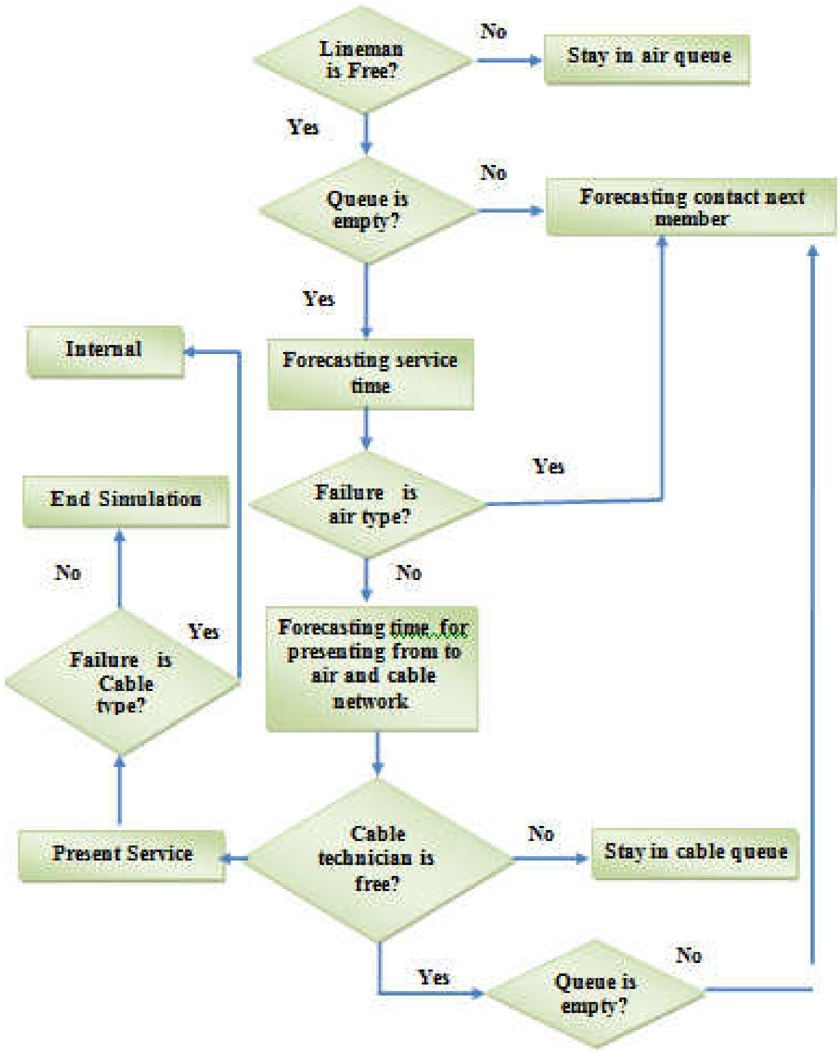

Figure 3. Flowchart for service provider

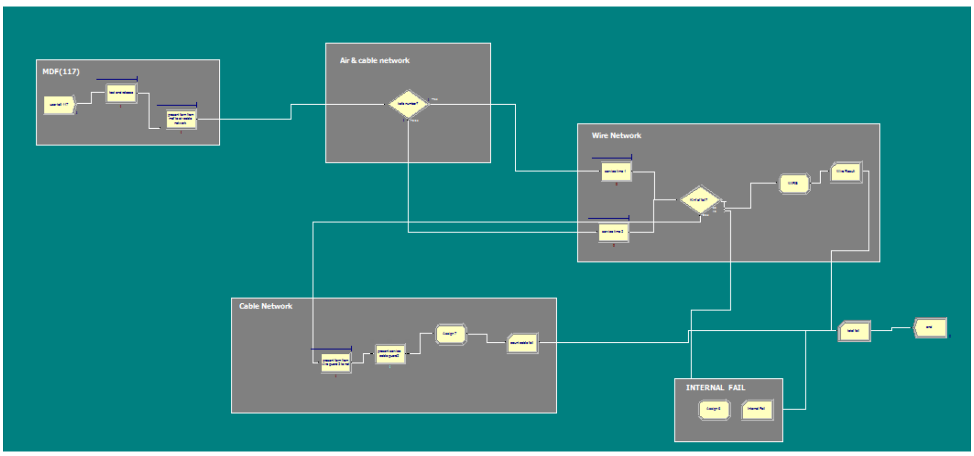

Figure 4. Simulation Model in Arena

4. Simulation Results

Table 3 shows the results of simulations, including time waiting for customers in the queue waiting time and duration of employment in different service providers.

Table 3. Simulation Results

Parameters	Value	Queue
wait time	65 min	In all Queues
wait time	6 min	MDF- cable network
wait time	6min	Cable network-linesman A
wait time	25min	Cable
wait time	10 min	Cable network – linesman B
Lines man A.utilization	0.1443	-
Lines man B .utilization	0.0680	-
Cable technician .utilization	0.1462	-
Number of total failure	3344	_
Number of Cable Failure	136	-
Number of Air failure	1791	-
Number of Internal Failure	1417	-

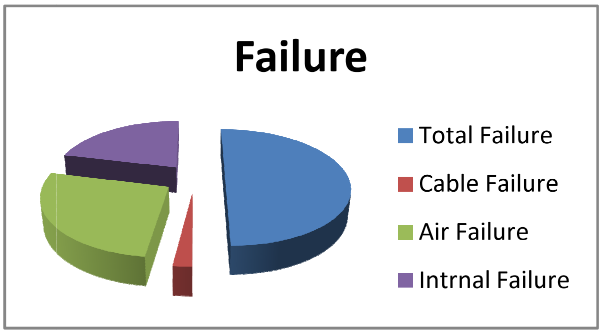

Figure 4. Relationship between Total Failures and type of failures

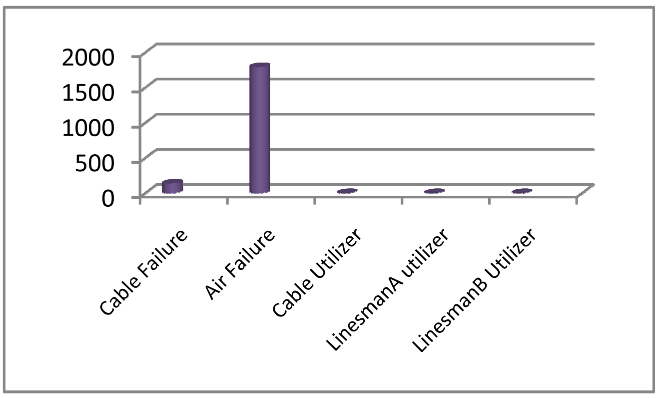

Figure 5. Relationship between Service Provider Utilization and type of failures

5. Conclusion

This study reviews the process of solving failure in telecommunication. We have modeled and simulated the system. The most important parameter that affects customer satisfaction is speed of resolving failures because by this parameter, we can identify appropriate services to our citizens.

The most important factors for satisfying customer is waiting time and identifying common needs of them properly. This study analyzes the desired system, according to comments provided by the staff organization. We do changes in the system, and then simulate it.

By simulation, we reached that time for resolving failure reduction of 10 hours to an hour and five minutes the number of failures for each area and busy time of employee was computed.

Based on obtained information, the organization can identify risky areas appropriately, for example, if the number of failures in the air be too much in regional we can offer decisions in order to increase the work amount to reduce the speed of resolving Failure to follow customer satisfaction.

For the given system we used Arena simulation software and we have used statistical results for management decision-making helps.

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