# DISCRETE EVENT SIMULATION – HELPDESK MODEL IN SIMPROCESS

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**KEYWORDS**

Discrete Event Simulation, Simulation Models, Helpdesk, SIMPROCESS.

**ABSTRACT**

Simulation is a method for studying complex systems that are not solvable with standard analytical techniques. This contribution describes usage of the one of the simulation software called SIMPROCESS (from CACI Products Company) to model the real helpdesk system, where the main problem was the number of its staff members according to the working hours.

## INTRODUCTION

Simulation is a method for studying complex, dynamic and stochastic systems that are not solvable with usual analytical techniques (e.g. queuing or inventory theory). The first simulation models were applied to physical, chemical, biological or technical problems, but it turned out it is possible to use these methods to analyze the wide range of economic processes. Simulation nowadays means usually a technique for imitation of some real situations, processes or activities that already exist in reality or that are in preparation. It is an attempt to model a real-life situation on a computer. The reasons for this are various: to study the system and see how it works, to find where the problems come from, to compare more model variants and select the most suitable one, etc. Simulation is used in many contexts, including the modelling of natural or human systems in order to gain insight into their functioning, simulation of technology for performance optimization, safety engineering, testing, training and education. Simulation can be used to show the eventual real effects of alternative conditions and courses of action. Key issues in simulation include data acquisition of valid source of information, selection of key characteristics and behaviours, use of simplifying approximations and assumptions within the simulation, and also fidelity and validity of the simulation outcomes.

It is impossible to create a simulation model without computer. Computer simulation has become a useful part of modelling not only the natural systems in biology, physics and chemistry, but also the human systems in economy. Traditionally, all systems are modelled by mathematical models, which attempt to find analytical solutions to problems that enable the prediction of the behaviour of the system from a set of parameters and initial conditions. Computer simulation is often used as an adjunction to modelling systems for which other analyses are mathematically too complex or too difficult to be solved analytically.

## SIMPROCESS

The simulation programme SIMPROCESS is being developed by the American firm CACI Products Company (http://www.simprocess.com/). SIMPROCESS is a hierarchical and integrated tool for business process simulation, especially for the Business Process Reengineering and the Information Technology. Three main instruments are available: Process Mapping, Discrete Simulation and Activity-Based Costing. Process Mapping is used for visual description of the business processes (it combines graphical representation of the processes and activities with their text documentation). Discrete Simulation studies the dynamic behaviour of systems by experiments with computer model. The changes in the system are not monitored continuously during the discrete simulation, but only when the significant event (start or end of a process, arrival of an entity) occurs. The event can turn up in any moment of the continuous time. This type of simulation is useful for modelling of various business processes (especially production or inventory ones). Activity-Based Costing is a technique for accumulating cost for a given cost object, i.e. product, customer or process. It occurs in two phases. First, the costs of activities are determined (activity-based process costing), then the costs are assigned to cost objects (activity-based object costing).

### Main components

Processes and activities: a process can be comprised of some interrelated activities that create a new value as an output for subsequent processes.
Resources: the objects that serve for modelling of limited capacities of the workers, material or means of production that are used during the activities.
Entities: dynamic objects (customers, products, documents) that move through the processes and use various resources.
Connectors: connect processes and activities and define the direction of movement of the entities.
Pads: serve for the connectors' line-up to an activity.

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SIMPROCESS uses various graphic components and animation for a process representation. As the simple illustration we show the model of petrol station that is used at seminars at the University of Economics in Prague (Dlouhy et al. 2005) - Figure 1.

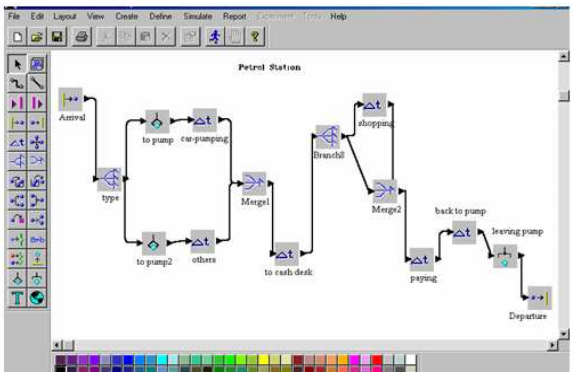


Figure 1: Simulation model of a petrol station in SIMPROCESS

Our experience shows that the system SIMPROCESS is easy to learn and its animation effects are very popular among students. Currently, we are testing a new extended version of this software in which new modelling tools are offered. One of the advantages of SIMPROCESS is a possibility of hierarchical modelling. When you define several hierarchical processes consisting of several sub-processes or activities, each individual process can be displayed on one screen. As one of our students work in a big company as IT Helpdesk Manager, we decided to create a model of the helpdesk in SIMPROCESS to find how easy or hard is to model the reality by this software.

## HELPDESK DEFINITION

The popularity of the customer centres and support centres is nowadays increasing. As it is usually a place of the first contact with the customer, it is very important for the firm – also because it might tell a lot about the firm and its behaviour, culture and habits. So the customer centre or contact centre strongly influence the first impression of the customer about the firm.

Support centre functions not only as a contact place for the customers but also for the subjects from inside of the company (departments, employees, etc.). This support or contact centres originated from call centres. Usual call centre is a group of employees that obtain the requirements of the customers and try to solve them. The requirements are reported by telephone. Nowadays these call centres made a subset of services of the contact centres. Easily explained the contact centre is extended call centre where other forms of inputs (email, web pages, fax, mail) are possible and the requirements are better recorded via using specialized software.

These contact centres participated in rise of the new branch called CRM – Customer Relationship Management. The fact, that all data about the customers are recorded at one place, is the big benefit for the company. Subsequent data processing with regard to the customer's behaviour enables a company better react to customer's requirements and wishes.

The next concept that is connected with CRM, and that also includes the public relations department, is called SPOC – Single Point of Contact. This kind of department for the present does not exists as a whole in companies, just is being declared that the firm's processes reflect system SPOC (it is useful for example in case of accidents when both the support department and the public relations department can react by acceptable form of announcement and solution). The figure 2 shows one of the possible shapes of SPOC – this model is centred on one company and helpdesk here is called service desk.

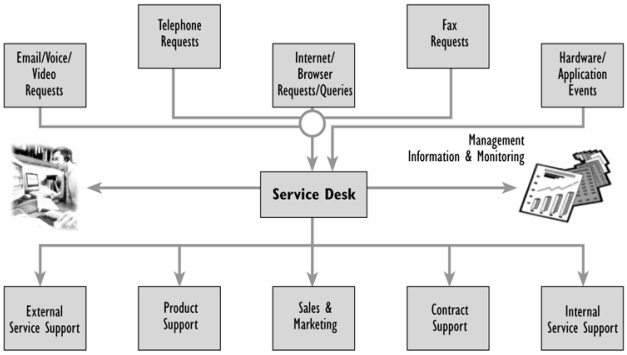


Figure 2: Scheme of the SPOC

Helpdesk is the specific case of the SPOC, but sometimes it is equal, especially when helpdesk carries out functions of the public relation department. But the main aim of the helpdesk is gathering of errors, its statistics, solutions and subsequent analysis.

The example of the parts of helpdesk shows Figure 3. In contrast to call centre, helpdesk must mainly give advice but also solve the problem in close relation among the company's processes. Sometimes it might be a very specific situation and helpdesk must be able to find out quickly and precisely what the problem is and then find a solution or a help. This procedure requires an expert knowledge, skilled employees and good software.

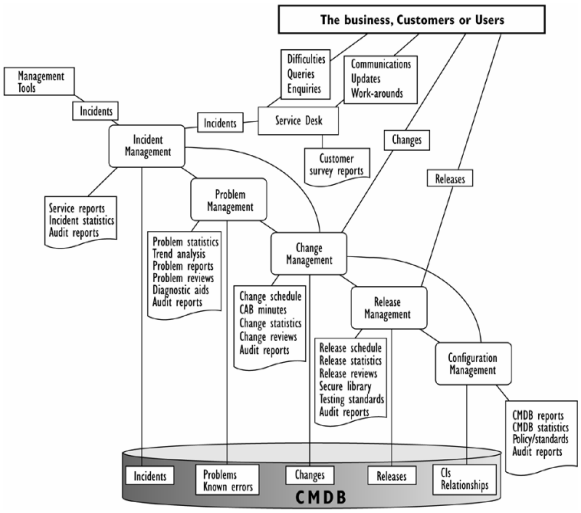


Figure 3: Example of helpdesk

## HELPDESK MODELLING

Simulation models might serve as a good tool for analysing of the real situation when a lot of uncertainty occurs. As one of us works as the IT Helpdesk Manager and needs a model for planning the number of operators, we decided to try the software SIMPROCESS. First step was to create a model that corresponds with reality and than optimize the number of operators serving to customers.

The process of creating a model was separated into 6 parts:

1. Incident Generation
2. Separation to Different Helpdesk Parts
3. Registration and Operating of the Incident
4. Decomposition into Decision Lines
5. Incident Solution Time
6. Incident Enclosure

### Incident Generation

As we described before, the operators at the helpdesk obtain requirements of customers – it might be request, problem, question, etc. – we call it arrival ticket or simply ticket. There are three possible ways of entering the ticket: by telephone, by email and from automatic systems (all automatic reports of errors from various monitoring systems). Considering the arrival times of the tickets we have found out that there is no difference among the requests. The only difference is between week and weekend. The ticket that arrived and was registered starts to be an incident.

For ticket (incident) generation we use exponential distribution with parameter 2.46 minutes for working days and 12.53 minutes for weekends (the parameter expresses the average time between arrivals of two incidents).

### Separation to Different Helpdesk Parts

The ticket is differentiated according to the skills of the operators, but the main tickets are data tickets, IT tickets and tickets linked with the store fixtures and building administration. The separation is based on the percent of tickets relevant for the given part of operators. Percents are derived from the real situation: data 32%, IT 43%, others 25%.

### Registration and the Operating of the Incident

When the ticket arrives the operator starts to fulfill the incident report. This report contains all data necessary for the operating of the incident and also for the statistical return system. At this point the average time of operating the incident is recorded. The operating means filling information, communication with the client and with the person who might propose a solution, or sometimes reference to the supervisor or controller – they must ensure the solution of the delayed ticket. Table 1 shows the times for the ticket registration.

Table 1: Times of the Ticket Registration

| Helpdesk part | Time in minutes |
|---|---|
| Data | 25 |
| IT | 15 |
| others | 45 |

### Decomposition into Decision Lines

Every incident might be solved inside the company by helpdesk – it is called solution in the 1.line. But sometimes the external firms are necessary. Table 2 shows the percent of incident solutions in the 1.line and by the external firms marked as A, B, C, D and E. On the basis of this distribution, the solution of the incident follows.

Table 2: Percent of incidents solution

| | 1.line | A | B | C | D | E |
|---|---|---|---|---|---|---|
| Data | 40% | 4% | 15% | 41% | 0% | 0% |
| IT | 24% | 7% | 8% | 55% | 4% | 2% |
| others | 0% | 0% | 14% | 48% | 26% | 0% |

### Incident Solution Time

The incident solution times are based on the SLA (Service Level Agreement) tables. These tables define times and priorities for the operators or the service firm to solve the incident. These times are not exact, because sometimes it is necessary to have more time for the solution and sometimes the incident is closed sooner. According to this knowledge we take them as average times - see Table 3.

Table 3: Incident Solution Time for Helpdesk and Service Firms (in hours unless stated otherwise)

| Priority | IT | Data | others |
|---|---|---|---|
| 1.line | 30 | 10 | 0 |
| A | 4 | 4 | 6 |
| B | 12 | 12 | 24 |
| C | 48 | 48 | 72 |
| D | 7 days | 7 days | 1 week |
| E | 30 days | 30 days | - |

**Incident Enclosure**

Incident enclosure is an activity that covers several other activities as: verification and validation of the solution, feedback and reactions of the customer, physical incident enclosure in system, problem report to other departments, creating incident reports etc. Time for the incident enclosure for the helpdesk parts is in Table 4.

Table 4: Times of Incident Enclosure

| | Time in minutes |
|---|---|
| IT | 10 |
| Data | 15 |
| Others | 60 |

**Resources**

The only resources in the model are the operators of the helpdesk. The total number of them is given by the sum of the operators of the specialized parts of the helpdesk: IT – 5 operators, Data – 4 operators, others – 3 operators. All operators work from 6 a.m. till 10 p.m. during working days and IT operators work as well during weekends.

**MODEL IN SIMPROCESS**

Everything as was described we have put into the SIMPROCESS software – on Figure 4 is the whole model and on Figure 5 the IT part.

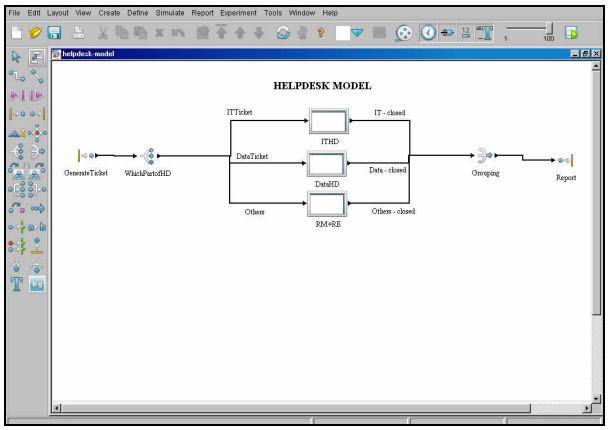


Figure 4: Helpdesk Model in SIMPROCESS

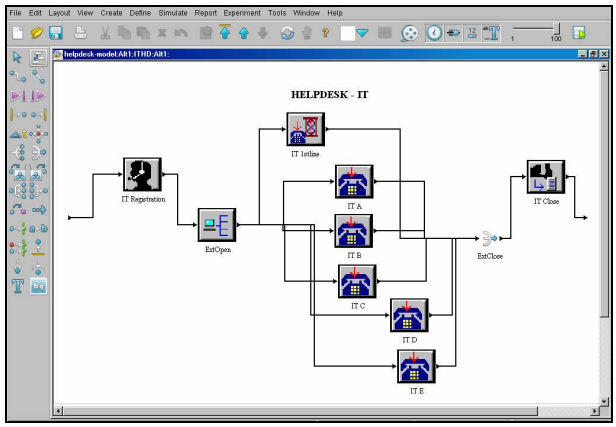


Figure 5: Model of the IT Part

The simulation lasted 1 week of simulation time and more simulation experiments were tried. The average number of incidents for the given period was 2110. About 710 stayed in system (it is because the fact that the times of solution outside the helpdesk are higher than 1 week) and the rest was solved (closed incidents). The incident was in system 1.3 of a day at average, maximum time was 4.5 days (for the closed incidents). Tables 5 and 6 show us the percent of utilization of the operators. It is clear, that all operators are busy the whole working time.

Table 5: Resource Percent Utilization

| Resource Names | Idle | Busy | Planned |
|---|---|---|---|
| DataOperator | 10,16% | 60,83% | 29,01% |
| IToperator | 5,69% | 61,90% | 32,41% |
| OthersOperator | 0,15% | 70,84% | 29,01% |

Table 6: Resource Percent Utilization When Available

| Resource Names | Idle | Busy | Reserved |
|---|---|---|---|
| DataOperator | 14,31% | 85,69% | 0.0% |
| IToperator | 8,42% | 91,58% | 0.0% |
| OthersOperator | 0,21% | 99,79% | 0.0% |

**COMPARISON WITH THE REAL SYSTEM**

The comparison with reality confirms accuracy of the model. The number of generated tickets was between 1980 – 2210. The real week data tells us that this number is 1995 at actual week. The resource analysis is more complicated to confront because of the lack of real data. As the sum of overtime work of the operators is high, we may assume that nearly 100% usage of resources is possible – and too high.

**OPTIMIZATION OF IT RESOURCES**

The optimization was applied only to the IT helpdesk operators. Their usage is very high if they are 5. So the scenarios with 5,6,7,8 and 9 operators were tried. As the

optimum 7 operators were chosen, because their usage is nearly 70% (see Table 7) but the number of incidents that waited for resource was 50% lower and the waiting time for the IT operators was significantly lower – compare Figures 6 and 7. The number of incidents in process stayed nearly the same in both cases as on Figure 8. In case of 5 operators, they were busy nearly all the time, but when they are 7, the situation is better – see Figure 9.

Table 7: Resource Percent Utilization When Available

| Number of operators | | Idle | Busy |
|---|---|---|---|
| 7 | IToperator | 32,20% | 67,80% |
| 5 | IToperator | 8,42% | 91,58% |

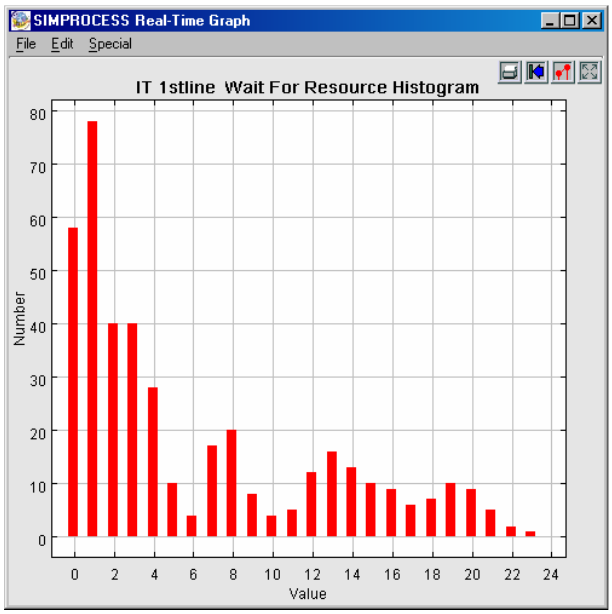


Figure 6: Wait for Resource Histogram for 5 Operators

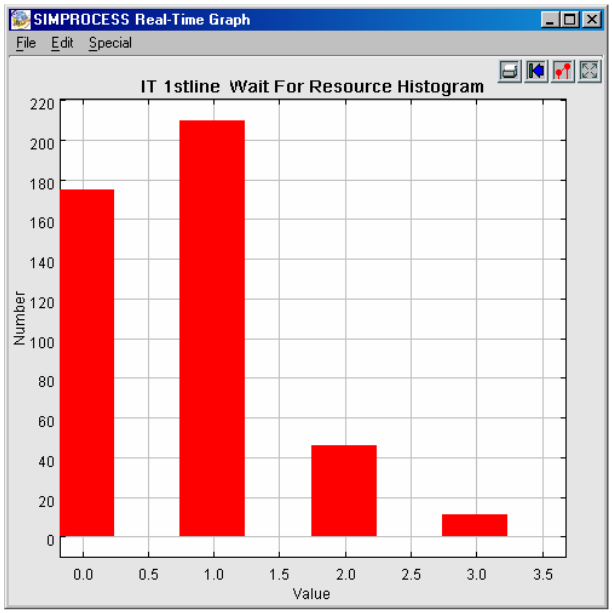


Figure 7: Wait for Resource Histogram for 7 Operators

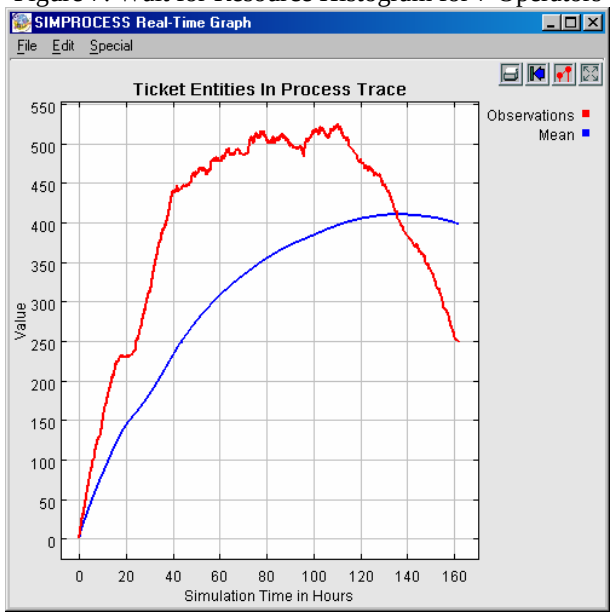


Figure 8: Number of Incidents (Tickets) in Process

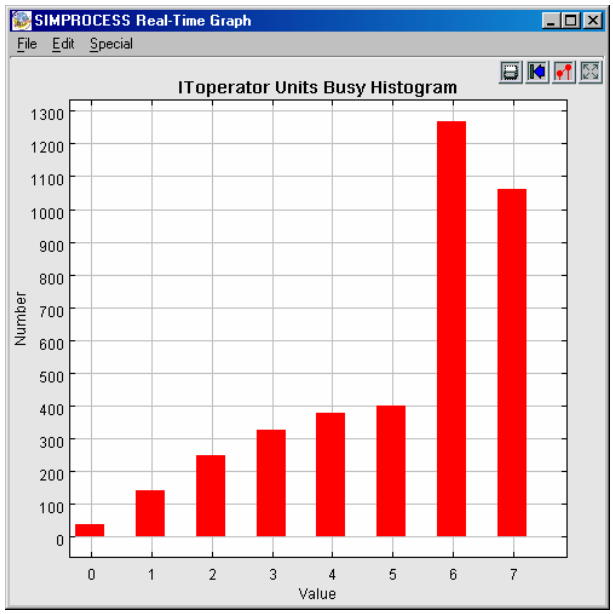


Figure 9: Histogram of IT Busy Operators

## CONCLUSION

This simulation model is nowadays used for the optimization of the number of the helpdesk's operators, and for the optimization of the operator's working time as well. The process of the model creation was easy in SIMPROCESS, although some facts had to be simplified, but the results showed the managers clear recommendation which way to go. In this work the system was specialized at one concrete helpdesk, but the situation at other ones could be similar. The main

success we see in the fact that we have not only found the solution but we have persuaded the managers of the helpdesk to believe the simulation software and to believe the results of the simulation. They did not suppose it to be so accurate. They adopted the method and the results of the simulation and they were very surprised by the perfect functionality of the helpdesk in reality with the smaller number of the operators than before.

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