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The using of Simulated Models in Management

The paper brings up many explanations regarding the understanding of connections between causes and effects, through simulated models. It wishes to establish and simulate some scripts witch concur to the development of a business.

1. The simulated process. Introductive elements.

The simulate term referees to a specific class of dynamic models who need a detailed observation in time, of occasional dimensions witch intervene in a complex system. Time moments that make an event to be activated are occasional. The events are discreet, so that, between two events it's considered that nothing happens.

The simulating process of discreet events is applied, generally, for the studying of systems in which it is necessary the fallowing of the way that different objects are going, and in which in different time moments, events happens, events who makes suddenly and irregular states of system.

Through simulated models based on discreet events, it could be analyzed easily the behavior of a system in case of some changes, or it could be seen the behavior of a new system even before the prototype is made. The building and easily made simulated experiments, combined with the generating of statistics and the seen of the results is close connected with software simulating systems.

2. The simulated business with Extend 6 program

A company has a new affair for renting boats to the fishermen that arrive in Delta. The manager of the company hopes that, through low prices and quality services can defeat the competition and attract the clients. The clients who wish to rent a boat, are sitting in front of the rental office, and wait to be served by the order that they arrived. The service that they are getting, consist in completing a rental demand of a boat, choosing one of the rental options and receiving some

recommendation. At the end, the client leaves the office, get the boat and goes in Delta.

The manager of the company wishes to use a simulated program with Extend 6, to investigate some scripts.

In case of, for rental, is available one type of boat, the objective of the simulated process consist in determining the number of working points with the clients for renting contracts , so that, the waiting time of clients and the length of the waiting line, to be smaller.

In case of offering different types of boats, the objectives of simulated process consist in determining the number and types of boats necessary for rental, so that, to be evaded the possibility of missing boats and insatisfaction of clients.

Continuing, working points with clients, will be named as " serving stations".

The manager of the company has proposed to himself to make the fallowing models:

Model 1. To obtain the data necessary for the simulating process, it has been chosen a normal working day, and it has been recorded the number of fishermen which arrived in group at the rental office every 10 minutes. Through statistic grouping method it has been obtained Table 1, with the distribution of relative frequency of client number.

Table 1.

Number of fisherman from a group	Relative frequency
0	0.65
1	0.14
2	0.18
3	0.03

For the beginning, we'll assume that the serving duration of a client is exactly 10 minutes. The manager of the company decided to simulate one week, and that means 7*24*60=10.080 hours.

The objectives of simulated process: determination of the number of working points for signing the rental contracts, so that, the waiting time for clients and the length of the waiting line to be smaller.

In figure 1 it's showed the simulated model associated to the first script, but with a single serving station, proposed by the manager.

Totally have been signed 607 contracts in one week of simulated work.

The average number of clients in rental office is 0.73, and the maximum length of waiting line is 7 clients. Average waiting time of a client in serving station is 12.15 minutes, and the worst case scenario it could be waiting one hour.

It can be seen that, the using rank of serving station is only 60 %, and the maximum length of the waiting line are too big. That's why, we are introducing an additionally serving station.

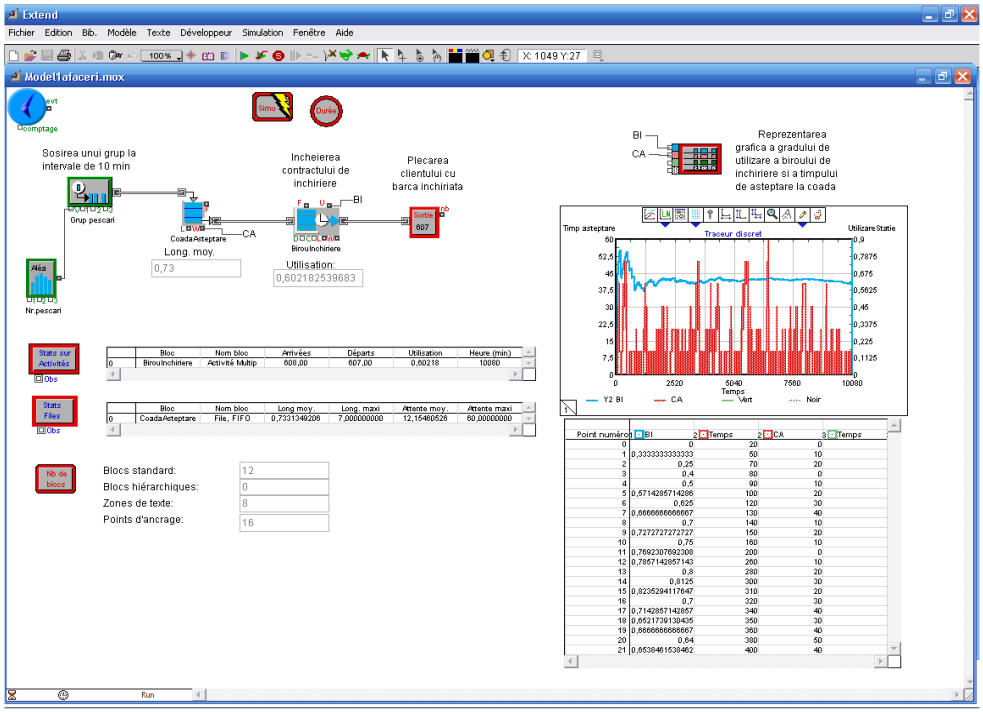

Figure 1. Model 1 with one serving station

In figure 2 we can see that the using rank for each of two serving stations is approximate 32 %.

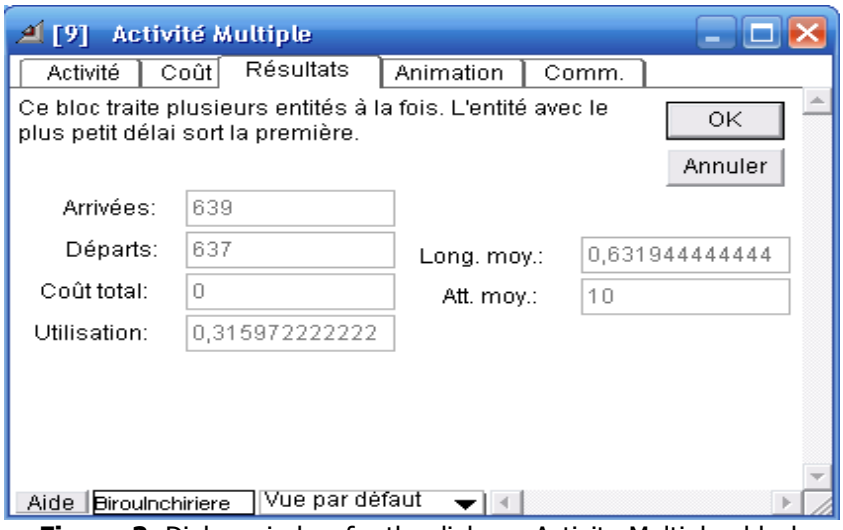

Figure 2. Dialog window for the dialog « Activite Multiple» block

In the rental office entered 639 clients and has been served 637, during 10.080 minutes, and the average number of clients in each serving stations are approximate 0.63. Maximum length of waiting line dropped down from 7 to 4, and the maximum waiting time dropped down from 60 minutes to 10 minutes (figure 3).

Figure 3. Dialog window for the dialog « File FIFO » block

Model 2 . With **probable** spell of between two arrivals and serving time that is probable, represents correctly the real situation. The groups aren't arriving exactly at 10 minutes, and the time of signing a contract isn't exactly 10 minutes.

It's considered the spell (interval) between two arrivals as being a probable dimension with triangular distribution, and the time of signing a contract is a probable dimension with exponential distribution.

To simulate the new model is necessary to be modified only at "Group fishermen" block and "Rental office" the distributions. At the "Activite delai" block we put again a single serving station.

After the simulated process, the results are :

- average waiting time of a client is approximate 13.66 minutes, comparing to 12.55 minutes in constant dimension model, and the worst case scenario, the maximum waiting time is 102.87 minutes comparing to 60 minutes.
- Average length of waiting line is 0.79, and maximum is 7 entities.
- The using rank of serving stations is approximate 56 %.

In serving station average are 0.56 entities, and average waiting time for signing a rental contract is 9.69 minutes.

It's introduced another serving station ant the results dropped down at average waiting time from 13.66 minutes to 2.14 minutes, and the average length of

waiting line has dropped down from 0.79 to 0.14 entities. The using rank of a serving station is 31 %, and average clients number present in the office is 0.62. The average time of signing a rental contract is approximate 9.76 minutes.

Model 3. In this model it increases the number of serving stations (maximum four), connected to the dimension of waiting line. It can be seen, that using a variable number, between 1 and 4 serving stations, the performances of boat rental office, has been worsen, comparing with the case of using a constant number of two serving stations. These results can be explained by the using rank of a serving station (55 %) is approximate equal with the average number of entities from a station (0.57), which means that the most frequent used is one serving station.

The manager of the company has decided to continue the experiments of simulated process based on two serving stations model. The objective of the following simulated process consist in determination of the needs of renting boats, to evade the probability of missing boats and loosing clients.

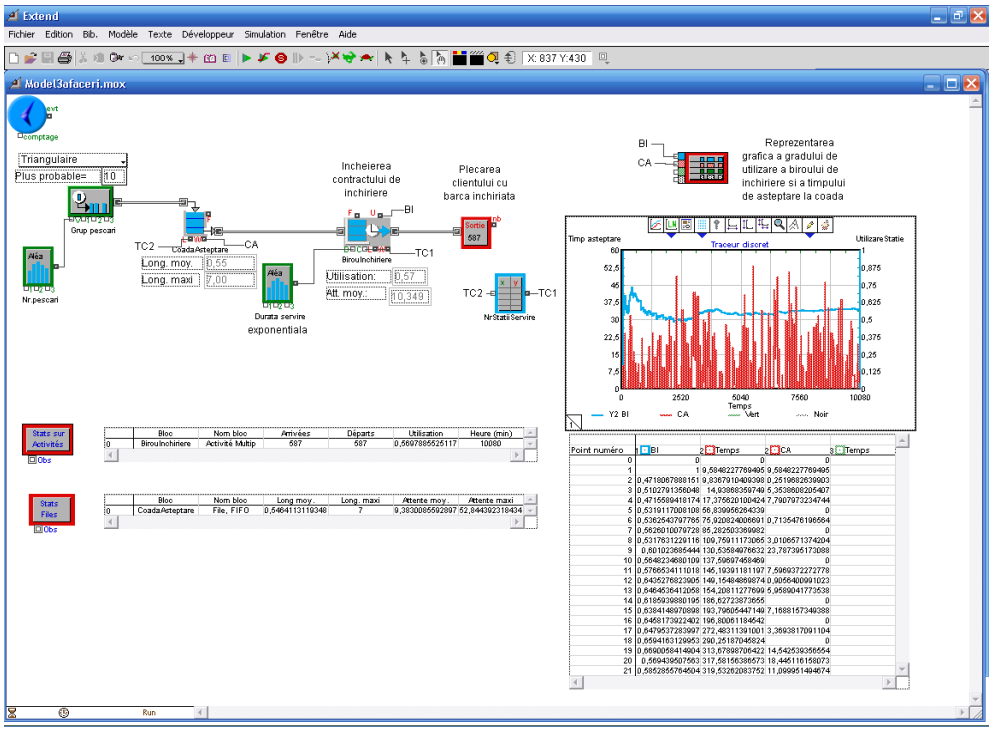

Figure 4. Simulation model with various variable number of serving stations

Model 4. The manager of the company observed that approximate 20 % of fishermen want to rent an engine boat. Initially, the company has 70 boats, from which only 20 have engine. The clients for engine boats, rent the boats for 2 days,

plus or minus one day. The renting time of boats is constant distributed between three and four days.

The simulated process is presented in figure5, and in figure 6 we can see the dialog windows of "State files" and "Stats activites" blocks.

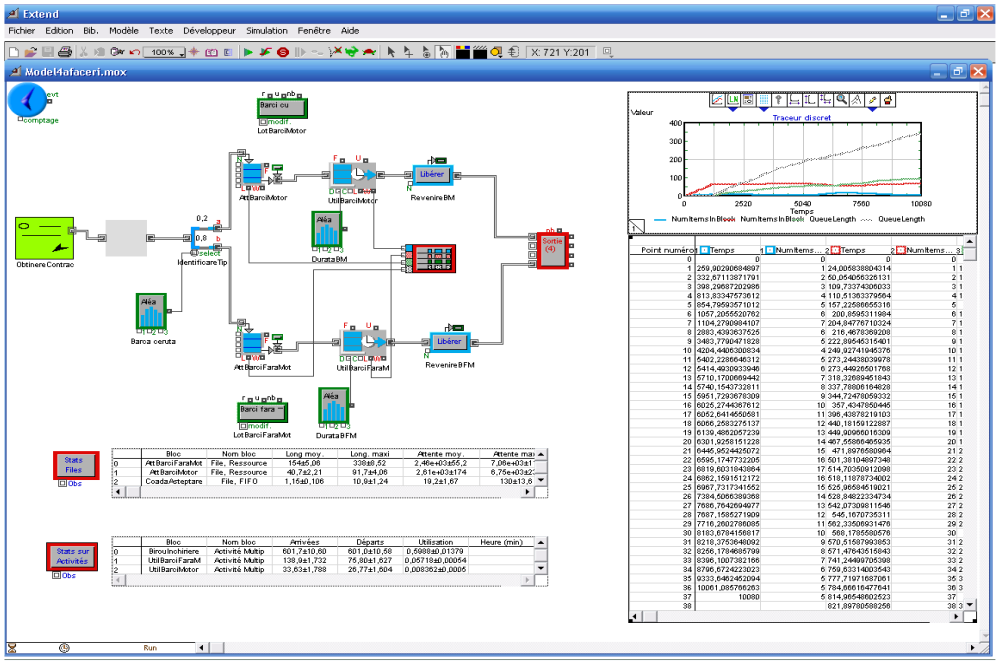

Figure 5.

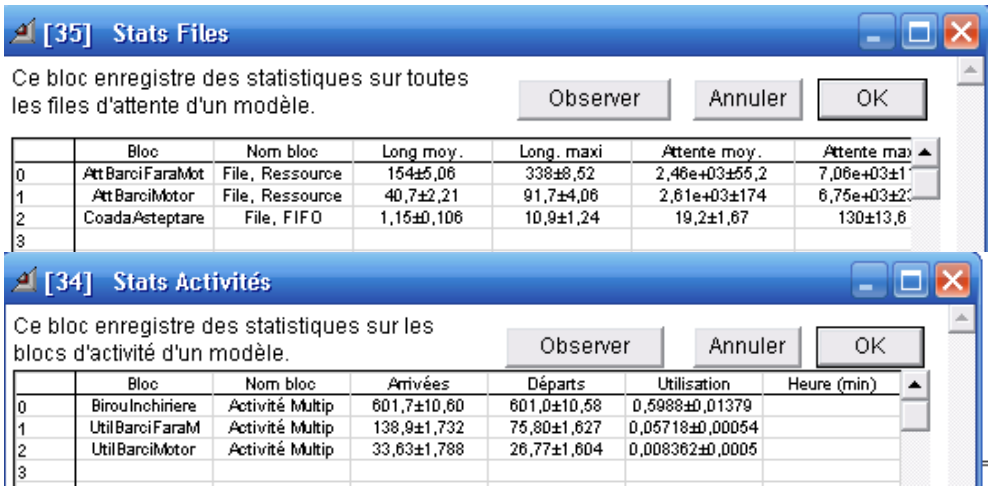

Figure 6.

For engine boats, with the probability of 95 %, average length of waiting line for receiving the boat is 40.7+/-2.21, and the maximum length is. 91.7+/-4.06.

For no engine boats, with the probability of 95 %, average it rents 138.9+/-1.732 no engine boats, from which it returns 75.80+/-1.627 boats on week and 33.63+/-1.788 engine boats, from which it returns 26.77+/-1.604 boats on week.

The big waiting line and time of waiting for receiving a boat are caused by the missing of boats from the stock.

It is tried the modification of boats stock at the beginning of the week. It is added 5 engine boats and the results are presented in figure 7.

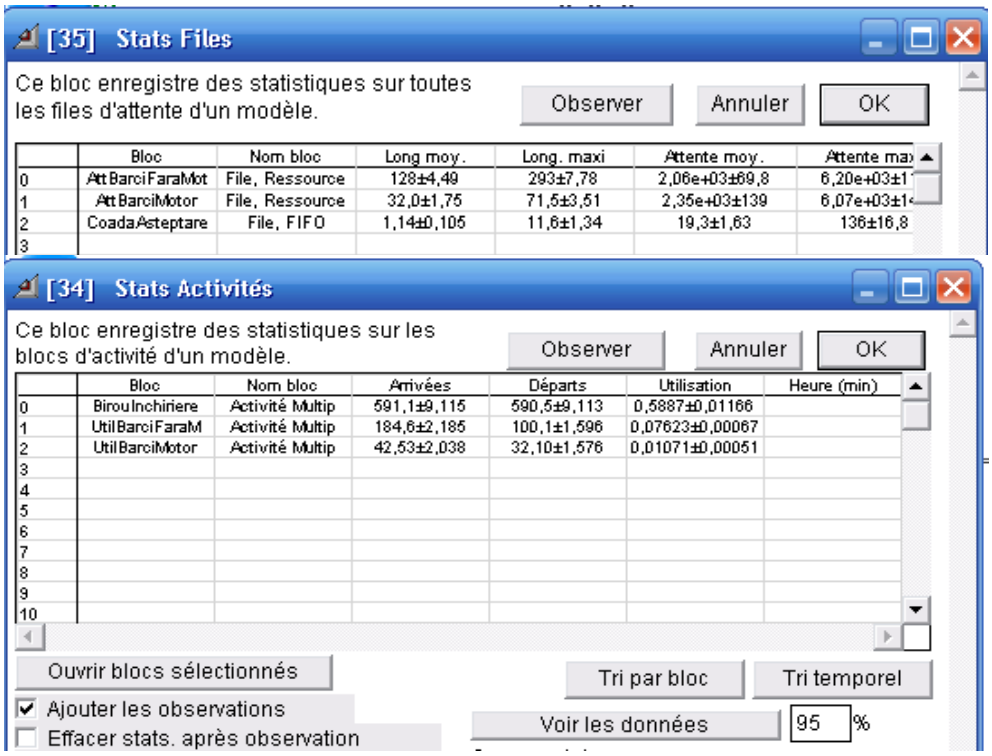

Figure 7.

3. Conclusion

The simulating of an affair in Extend 6 pointed out a base principle of modeling and simulating, by that meaning that it started from a simple model of the issue that need to be solved and it's developing the model till it reaches out a better understanding of the connections between causes and effects.

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