C14 Supply Chain Management - AnyLogic 4.0

OO Approach / Active Objects and Messages

Simulator. AnyLogic (www.xjtek.com) is a general-purpose simulator for discrete but also for continuous and hybrid applications. The modelling technology of AnyLogic is based on Java so that building simulation models using AnyLogic should be easy for experienced programmers.

Model: According to the task of the comparison there are three Active Object Classes. The customer class corresponds to the wholesaler; the wholesaler class corresponds to the distributor class and to the factory class. In addition there is built a Message class that represents the movable goods as well as the orderings in the supply chain. Instances of the classes and flow control are represented in the fig. 1.

The four factories (classes *factory*) store finished products in (built-in) storages. If an order arrives, the needed amount of products will be sent after duration of transport time. Then the products enter the distributor, who has sent the order. Depending on the wholesalers´ demands, products are then routed to the wholesalers (*customer*).

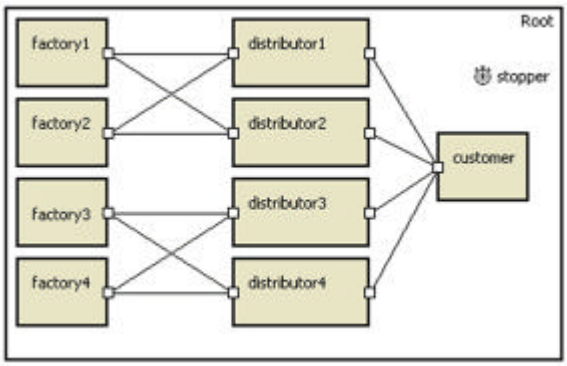


Fig. 2: Model layout of chain supply in AnyLogic root class

To simulate the supply chain, time controlled messages are used. After an initialisation time where factories produce a basic stock of products a timer triggers the distributor's order event. After sending messages to all connected factories, those factories try to meet the distributors' demands. If the needed amount is available the ordered products are sent to the distributor using the same type of messages.

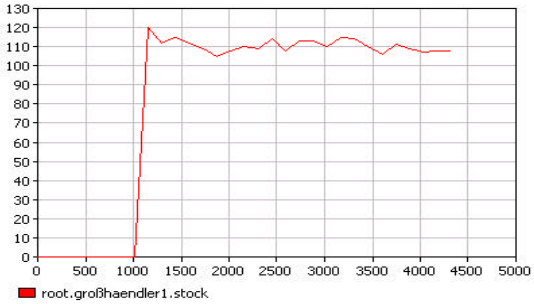
Below there is given the code which handles the orders a distributor sends to the factories:

```
if (msg.receiver==id) {
stock[msg.type]=stock[msg.typ]+msg.anzahl;
  nOFstock=nOFstock+msg.number;
if (msg.number==0) {
    sold[msg.typ]+=demand[msg.type];
        } else {
      costs=costs+10*msg.deliver/6;
  } };
```

Results Task a: Simple Order Strategy. The strategy is: each distributor orders every day an amount of two pieces per product at the same factory. As the costs for the distributor depend on the transport time per transported piece, this strategy results in increasing stock for each distributor as the storage becomes fuller. The table shows the costs and the delivered products for distributor D_1.

	stock	costs	delivered
min	266	23050	188
max	350	28208	272
mean	304,59	25959,08	226,77

Task b: On Demand Order Strategy. The distributors accumulate the orders of the wholesalers, no matter if the order was fulfilled or not over 24 hours and order this amount the next day at 00:00. This strategy results in constant stocks and therefore decreasing costs relative to task a (see fig. 2).



Task c: Minimal SupplyTime – Strategy. In difference to task a and task b, the distributors now try to order at the factory with the minimal supply lead time. If an order can not be fulfilled, the distributor chooses the factory with minimal supply lead time. The model is slightly changed, as every distributor has a connection to every factory and the strategy results in decreasing of costs as shown in the table.

	stock	costs	delivered
min	90	18260	199
max	110	22103	259
mean	99,97	19900,42	227,58

Michael Gyimesi, mgyimesi@osiris.tuwien.ac.at
Johannes Kropf, jkropf@osiris.tuwien.ac.at