
MODELING OF LOGISTICS PROCESSES

ACTIVITY #1

Basics of 3D modeling

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1. objective and new skills

The aim of the task is to master the basic principles of 3D process modeling, working with objects, and familiarizing yourself with the layout and most important functions of the program.

New skills
3D model creation procedure
Contents of object libraries
Modification of basic object parameters
Central and directional ports and connections
Using operators
Formatting the workspace view
Running the simulation

2. Basics of creating a model

2.1. Procedure

Creating a model in 3D mode includes three basic groups of activities (Fig. 1), which will be discussed in detail in the next classes.

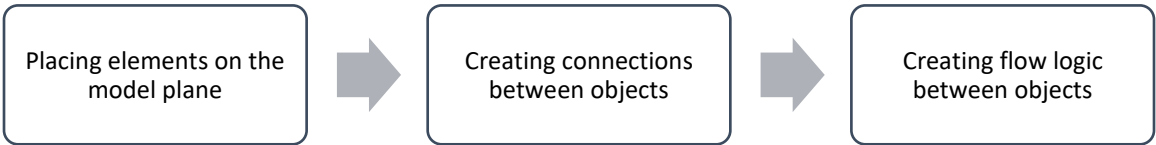


Fig.1. Principles of creating a 3D model

An example arrangement of connected objects is shown in Fig. 2.

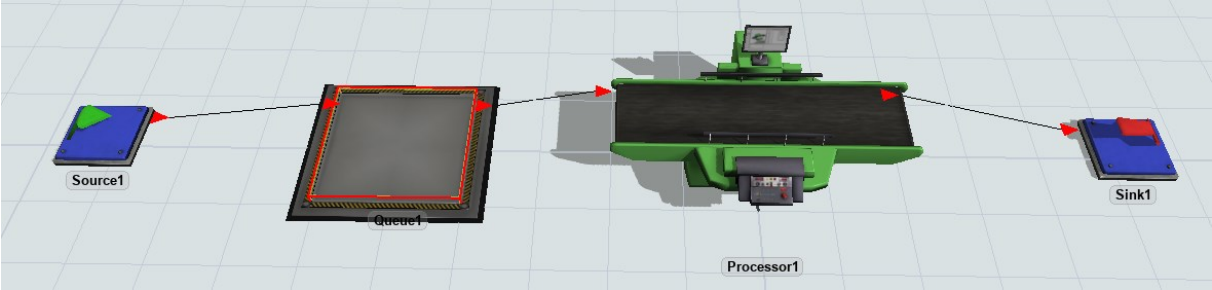


Fig.2 Examples of objects in the 3D model

Properties dialog box will appear. (Fig. 3), allowing you to change its position in the XYZ system, rotation and size). You can also configure other parameters there, such as labels, the type of generated flow element

(for the Source), associated ports and output handling (*Output*). Some objects, e.g. *Processor* , have specific functions (Fig. 4).

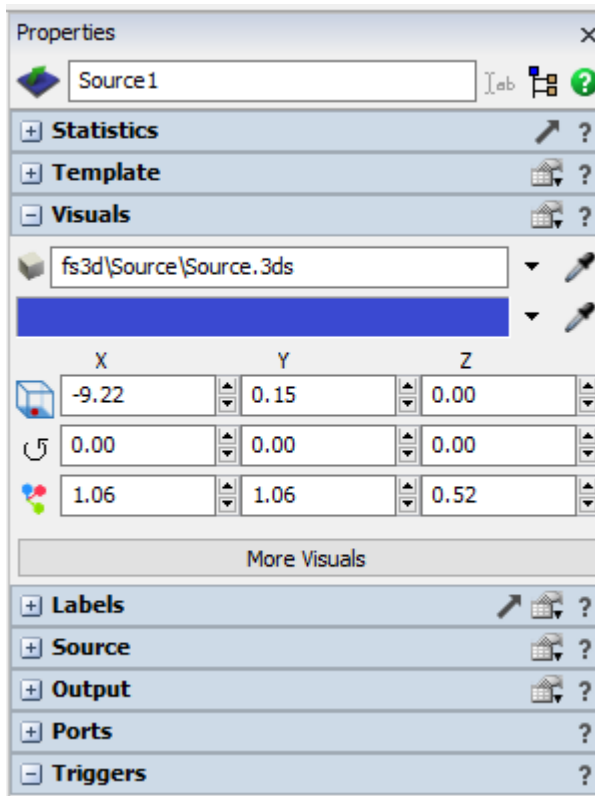


Fig. 3. Properties window for source

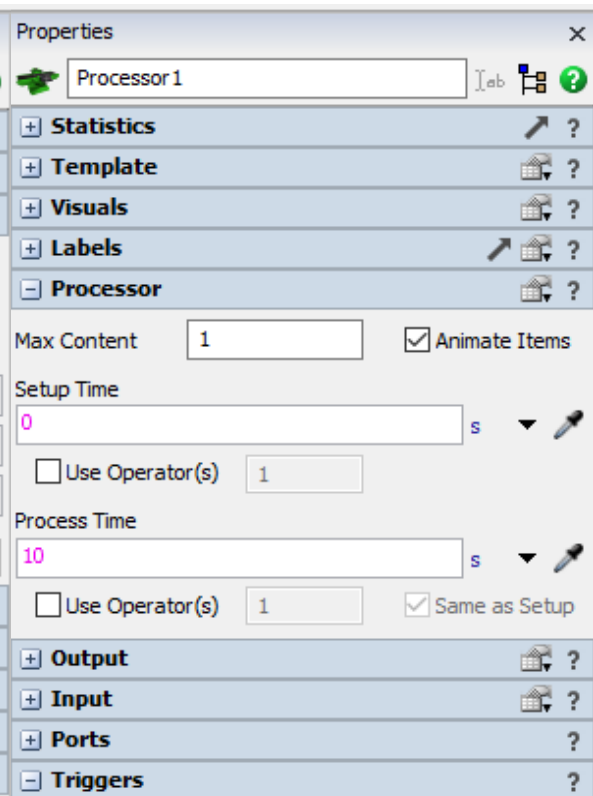
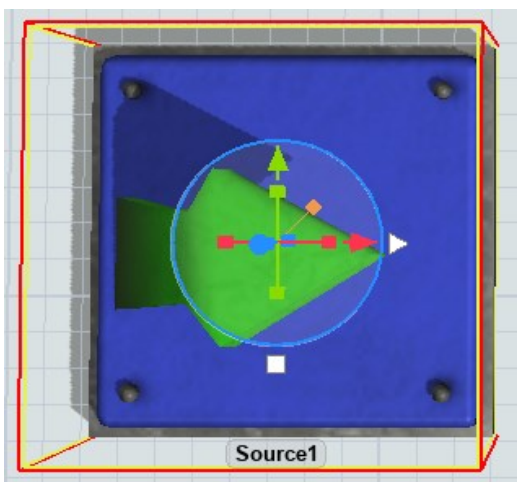


Fig. 4. Properties window for device (Processor)

2.2. Directional and central ports



When you select each object, a white arrow symbol (directional port) and a white square symbol (central port) will appear on it.

Directional ports are used to create connections that indicate the direction of flow between connected objects.

Central ports allow you to add an operator to an object (*Use Transport option*). This can be a human, an AGV vehicle or an industrial robot.

Fig. 5 Directional and central ports

Directional connections are visible as red arrows between elements in Fig. 6. They are created by selecting the white triangle and dragging the yellow line towards the target element. The same effect can be achieved with the "A" key and pointing at the start and end objects.



Fig. 6 Directional connection symbols

Operators added via **the central port** move flow elements between stations or handle them (*Processor*). Central connections are created in a similar way to directional connections. After selecting the white square, you need to indicate the operator. The same can be achieved with the "S" key. The order of selecting objects is irrelevant. In addition to creating a connection, you need to select the *Use Transport option in the handled element* (Fig. 7). The result of connecting the operator via the central port is shown in Fig. 8.

Fig. 7 Use Transport option

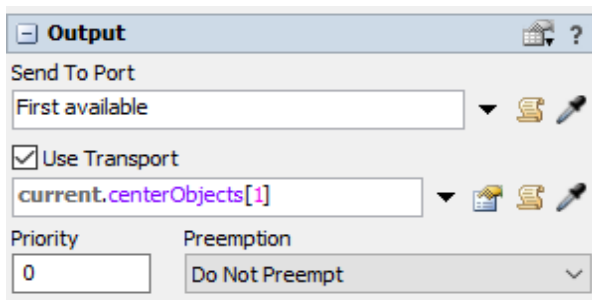
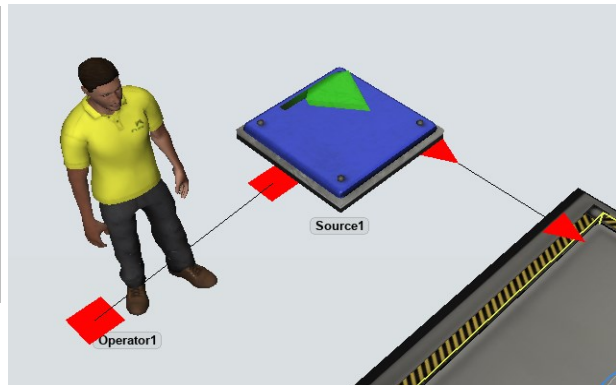


Fig. 8. Operator connected to the source (*Source*)



The effect of connecting the central operator *Operator* to the *Source*, which in turn is connected directionally to *the Processor station* shows Fig. 9.

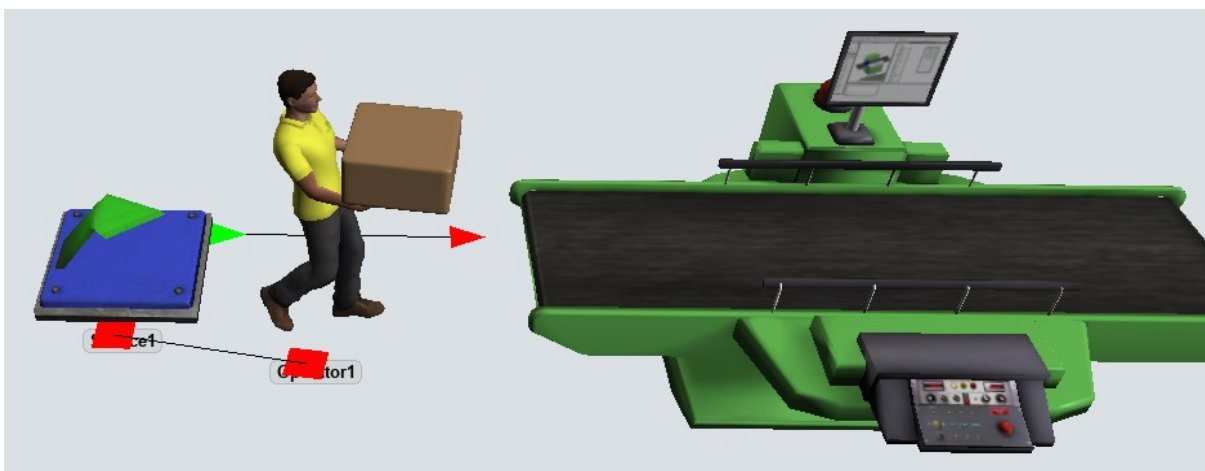


Fig. 9 Operator servicing the *Source*

3. Introductory model

3.1. Assumptions

The construction of the introductory model is intended to provide orientation in the basic functions of the program and familiarization with its capabilities. The exact configuration of the model and definition of the flow logic will be the subject of further classes.

The model includes a system for receiving and issuing products from the warehouse, along with the completion and dismantling of pallets. The following assumptions were made for its construction:

- pallets containing 8 pieces of products appear at the entrance on average every 10 seconds,
- the pallets are transported by a forklift to the storage area and placed in the intermediate area next to the storage rack,
- from the intermediate zone, the stacker crane picks up pallets and places them in a randomly selected location on the warehouse rack,
- 5 minutes after the pallet is put down, it is picked up and transferred to the unloading zone,
- transport to the unloading zone is performed by a second forklift.

Figure 10 shows the structure of the target model, which will be discussed in the next steps.

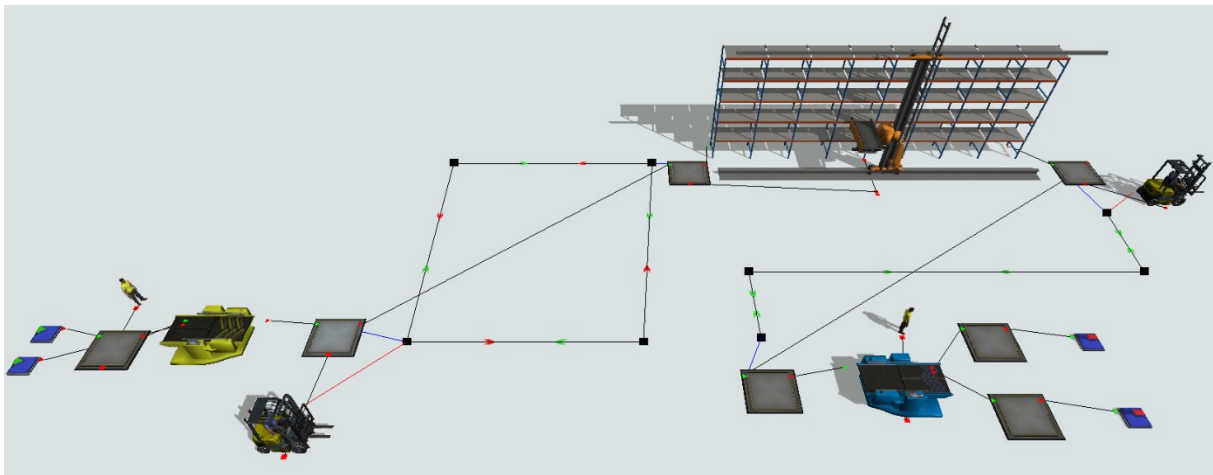


Fig. 10. The structure of the introduction model

3.2. Building the model

3.2.1. Sources

The model includes two *Source sources*, responsible for generating pallets and products separately (No. 1 and No. 2, respectively). The configuration parameters of both sources are shown in Fig. 11.

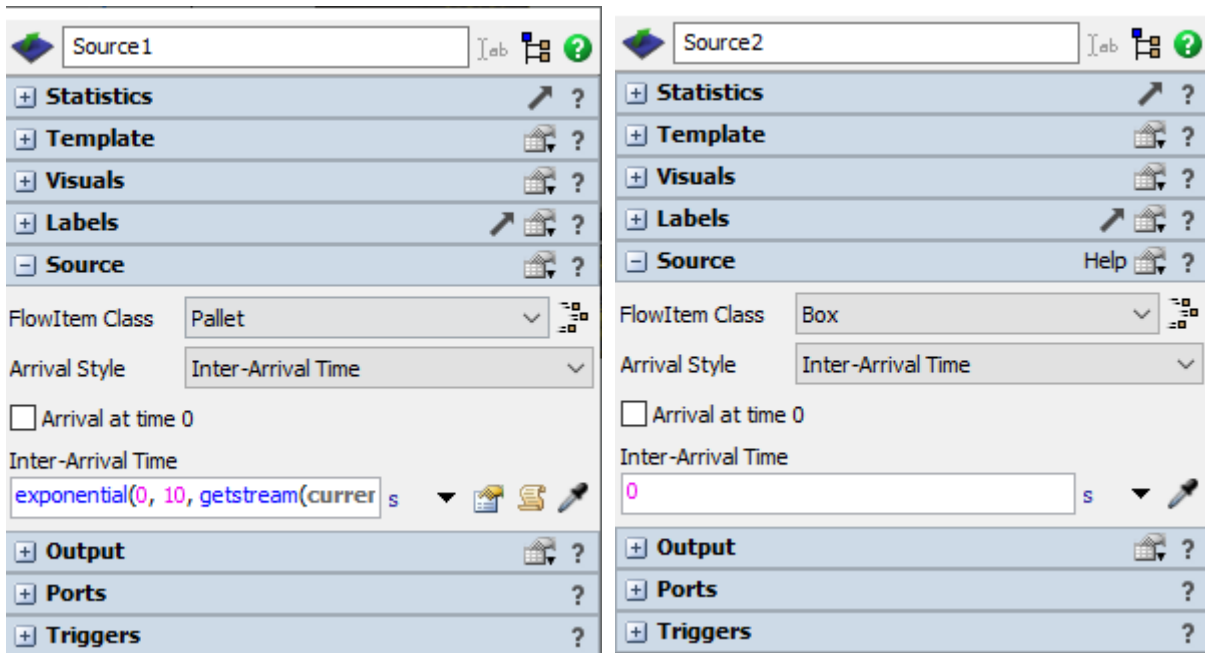


Fig. 11 Source1 and Source2 configuration

3.2.2. Buffers and packaging machine

(Queue), a packaging machine (Combiner) and an operator are added. The two previously inserted sources (S1 and S2) should be connected with the next objects by the direction ports according to Fig. 12. The operator is connected with Queue1 by the central port

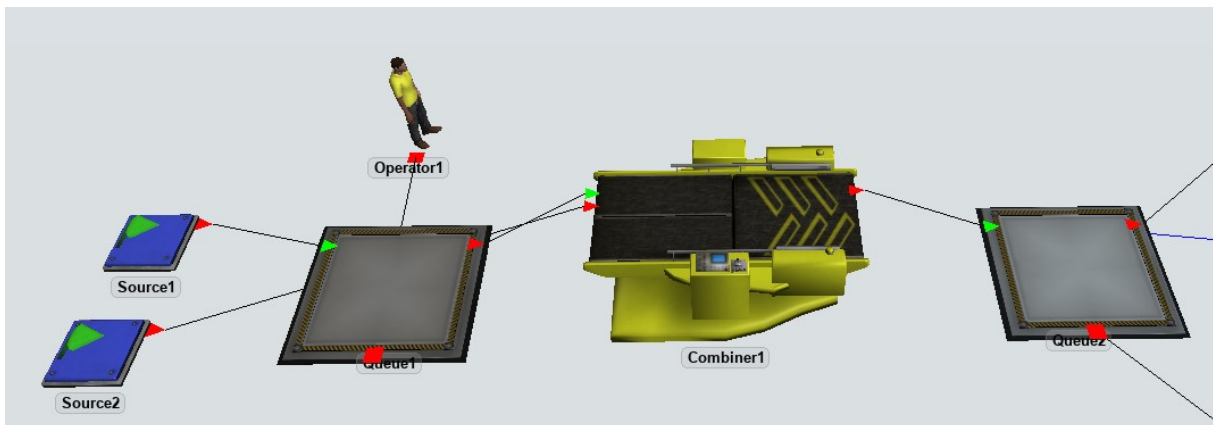
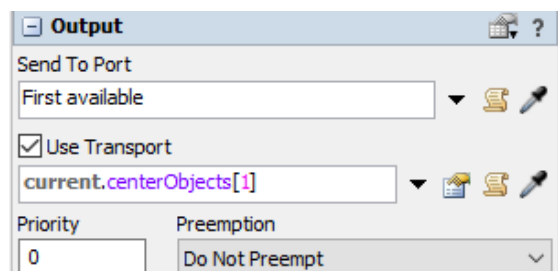


Fig. 12 Buffers, operator and packaging machine

Queue1 settings are shown in Fig. 13. It is necessary to connect to Operator1 via the central port.



The packaging machine settings (*Combiner*) are shown in Fig. 14. It is assumed that the number of products on the pallet is 8. They are delivered from input port no. 2, i.e. the one connected to *Source2*. The number of elements from port 1 (*Source1*) is 1 by default.

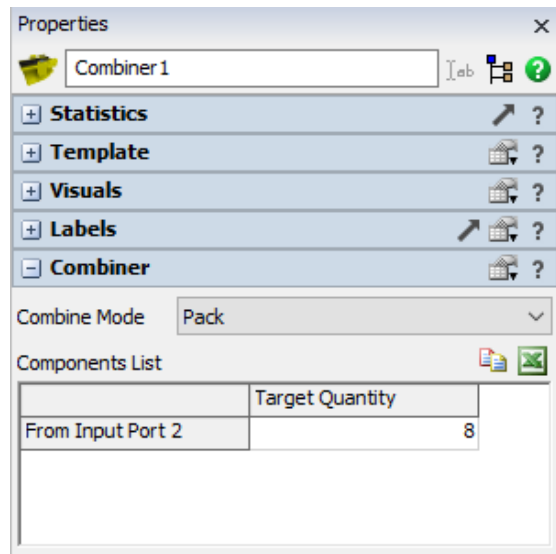


Fig. 14 *Combiner1* Settings

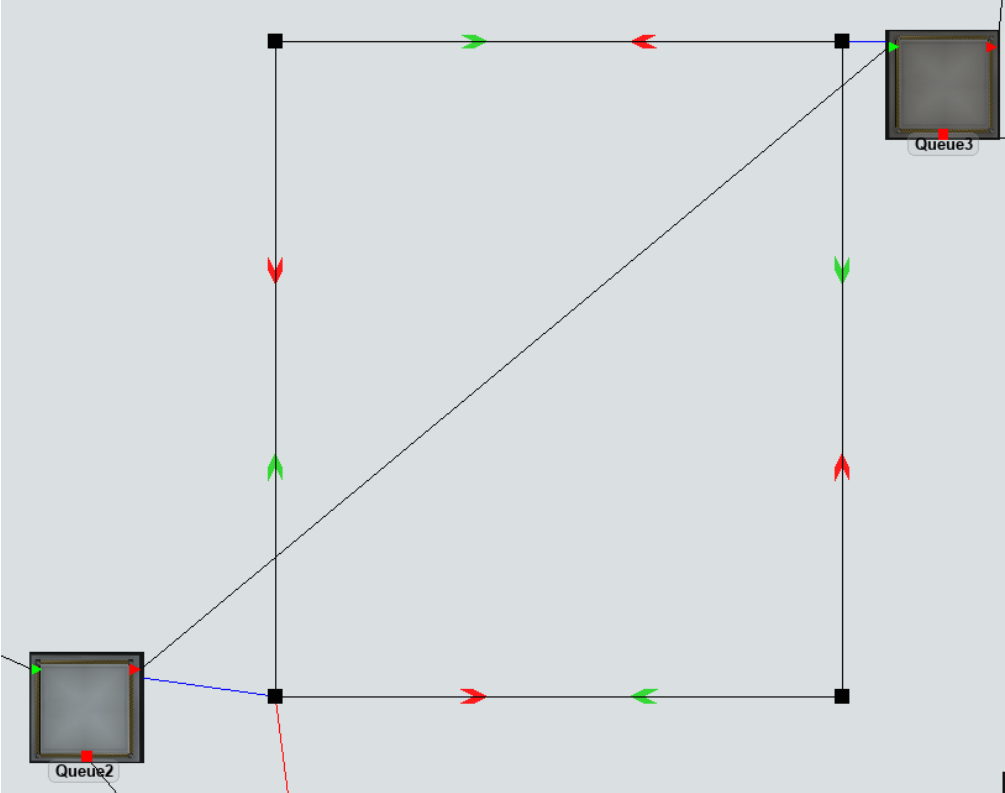
Behind *Combiner1* there is a second buffer *Queue2*. It should be connected via the central port to the forklift *Transporter1* and the *Use Transport* option should be selected, just like for *Operator1*.

3.2.3. Network Nodes (*NetworkNode*)

After *Queue2*, four network nodes should be added according to Fig. 15. They are connected directionally. Two green arrows on the connection indicate bidirectional traffic. To disable one direction, use the "Q"

option. The nodes should be connected directionally to the appropriate buffers, then the connection will be a blue line.

Fig. 15 *Combiner1 Settings*



3.2.4. Warehouse rack and rack stacker

(*Rack*) and a stacker crane (*ASRSvehicle*) are added to the model according to Fig. 16. It also shows further elements of the model. Buffers in front of and behind the rack are necessary. The pallet flow buffer 3 → rack → buffer 4 provides directional connections.

The stacker crane control ensures that it is linked to the rack via the central port and the " *Use Transport*" option selected on the rack . Similarly, the *Queue3* buffer should be linked to the stacker crane in front of the rack. In this way, all objects from which flow elements exit will be handled by *ASRS* .

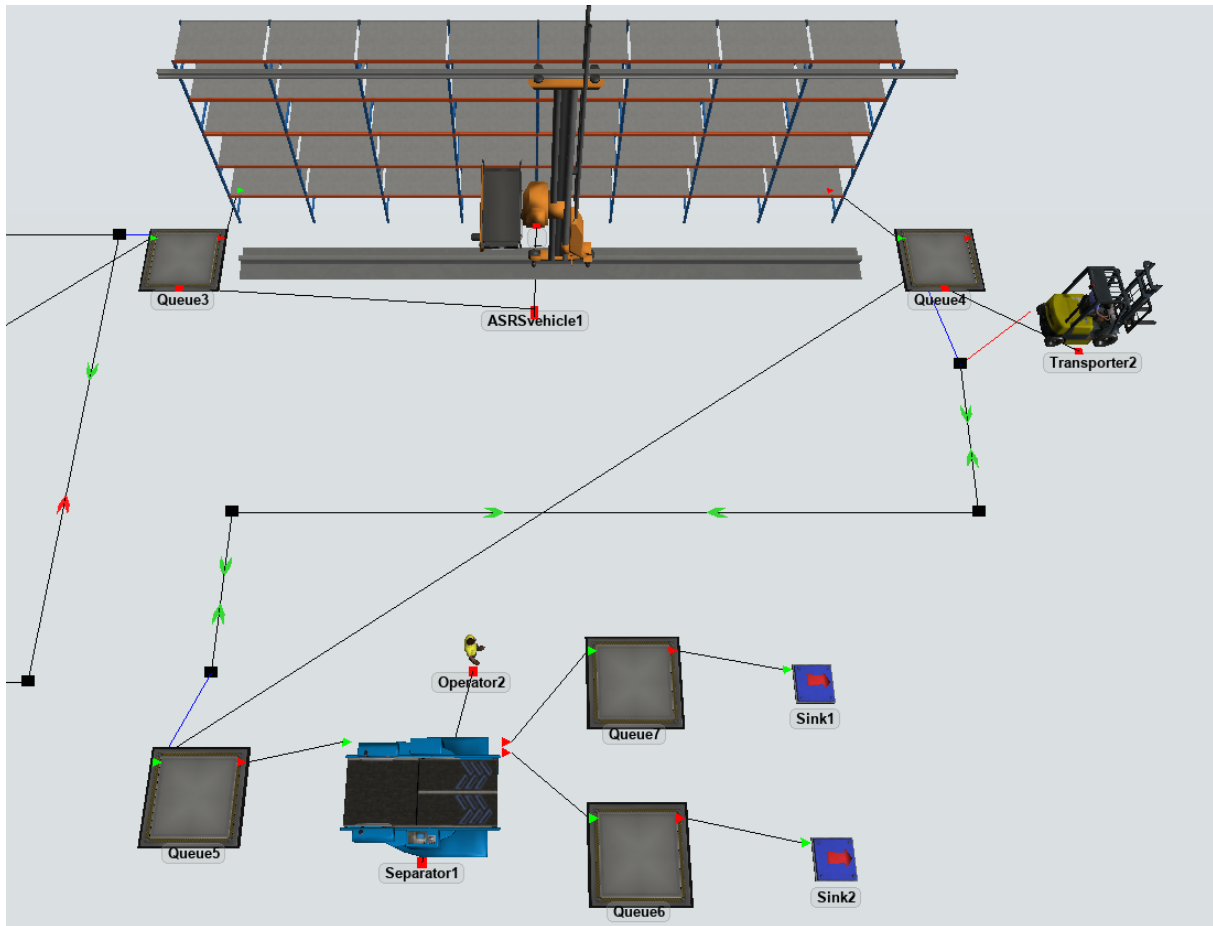


Fig. 16 Warehouse rack, stacker crane and unpacking machine (*Separator*)

Next, the forklift *Transporter2* is added , which transports pallets from *Queue4* to the unloading zone *Queue5* and then to the separator. The forklift moves along the path of nodes as in Fig. 16. It is important to remember:

- connection of the central port *Queue4* and *Transporter2* ,
- selecting " *Use Transport*" on *Queue4* ,
- the *Queue4* and *Queue5* direction port ,
- connecting network nodes with appropriate objects (*Queue4* and *Queue5*)

3.2.5. Unpacking machine - *Separator*

The *separator* is operated by *Operator2* connected via the central port. The default settings of the object have been maintained. After unloading, the pallets will be put on the buffer connected via the output port 1, while the products will go to the buffer on the output port 2.