

AnyLogic – Tutorial 05

Agent based modelling of an airport with pedestrians

1. Pedestrian flows

Anylogic offers tools for simulationg human behaviour. For this we need services, areas, queues, extra conditions and for visualization this time we use the 3D-toolbox of AnyLogic.

2. The model

The model this time is just a observation of our every day life. You go to an airport and want to fly somewhere. First you have to check in. Secondly you pass the security check. After you stayed some time in the waiting area you go to the boarding. We want to look at this as an airport manager.

3. Getting started

Like the last times, we need a new project:

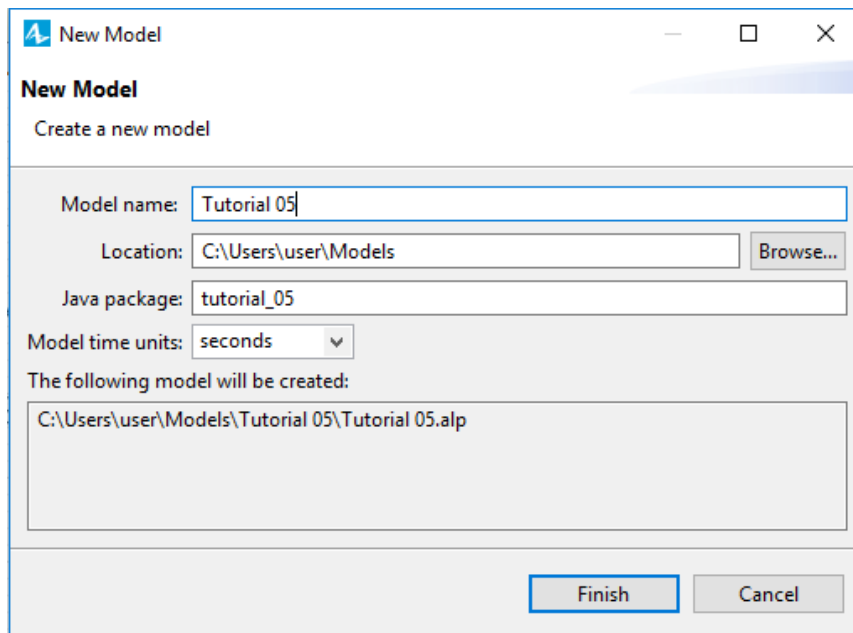


figure 1: Create the new project

4. The Airport

First we need an airport. To simplify this, we provide you a plan as picture (xid-5210709_1.png). Look into the palette and open the tab "Presentation." Drag an Image onto the canvas. In the opening dialog choose the airport file named above. Position the image on the left upper corner of your canvas (see figure 2).

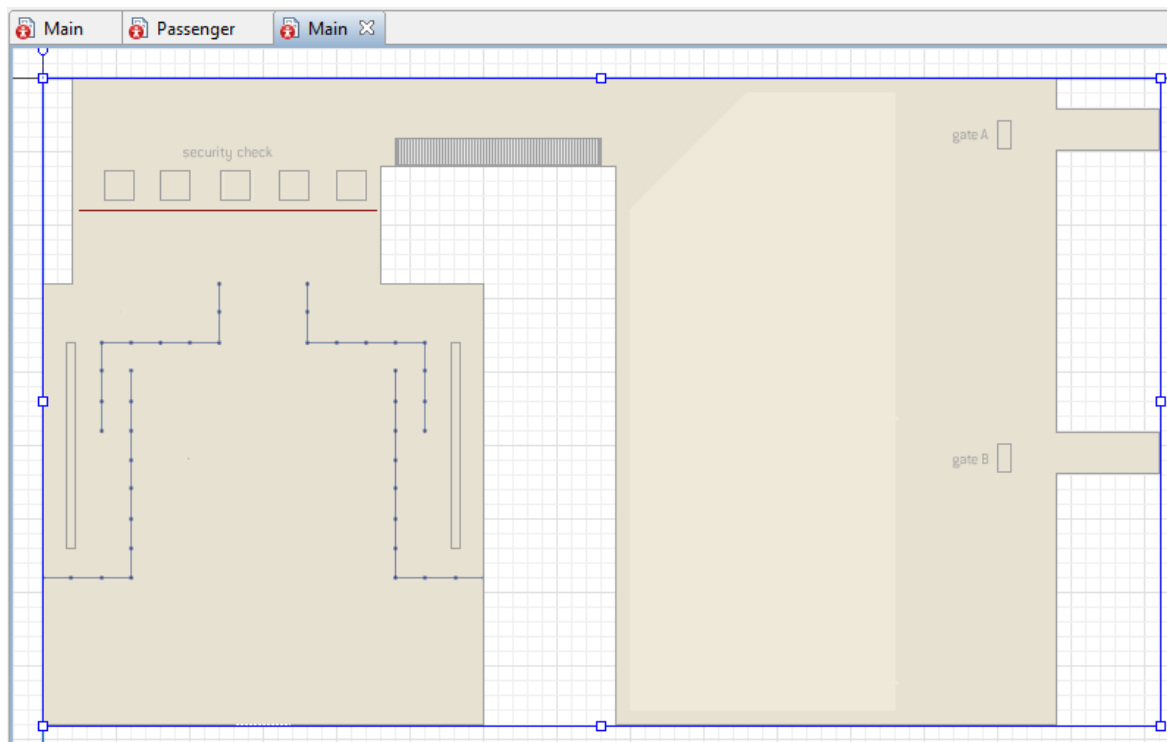


figure 2: The plan of the airport

To prevent the pedestrians walking across the area and ignoring the plan, you have to place some walls. Take a wall from the pedestrian library and place it around the floor plan. For this make a double-click onto the wall element. After this point on a corner of the plan and hold down the left mouse button. Drag the mouse to the second corner and release the button. For the next corners you only have to point to them and click short. When the wall is closed, make again a double-click.

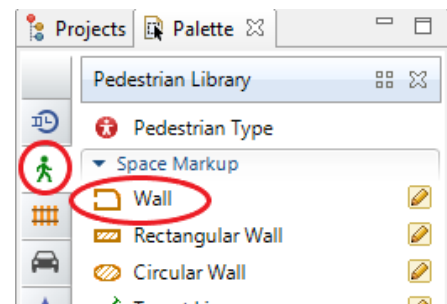


figure 3: Take a wall

After that you see a thin orange line around the shape.

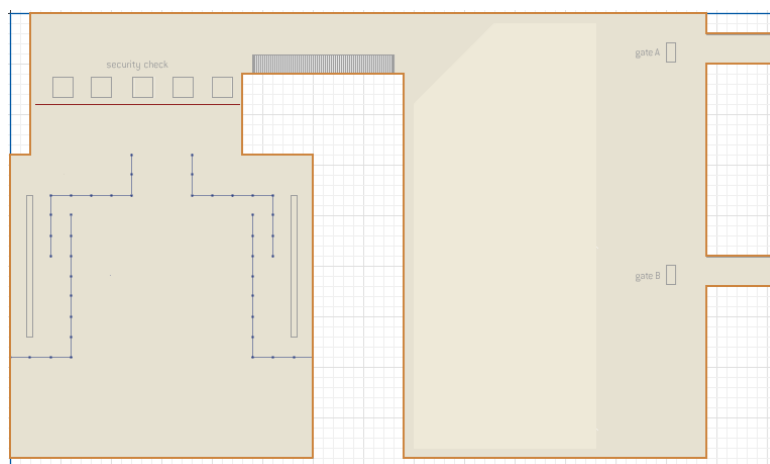


figure 4: Plan with orange walls

The pedestrians need an entry point and a target which they want to arrive. Take two target lines from the palette and place it on the canvas like in figure 5. The line on the lower left side is named “entryLine” and the upper right is “gateAline”. Target lines are used to define start points of pedestrians and targets of them. It is possible to create different people which have different targets.

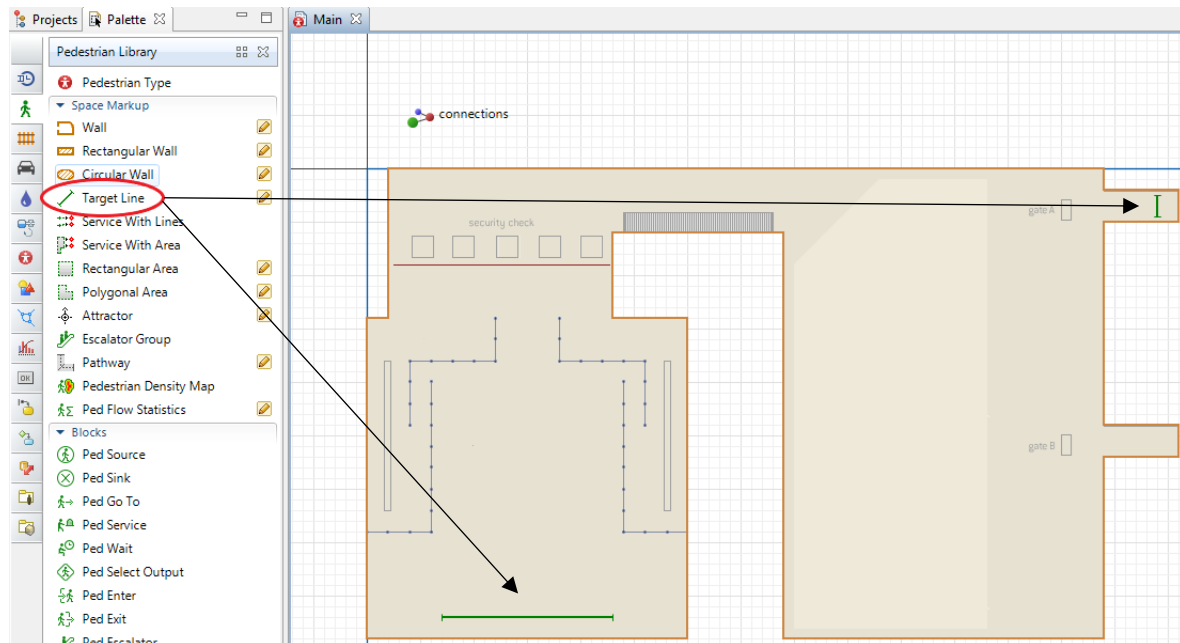


figure 5: Place the target lines

With these our future pedestrians have an entry and a target. We will see how they move now.

Name Targetline as entryline and Gate A Targetline as gateAline

5. The pedestrians

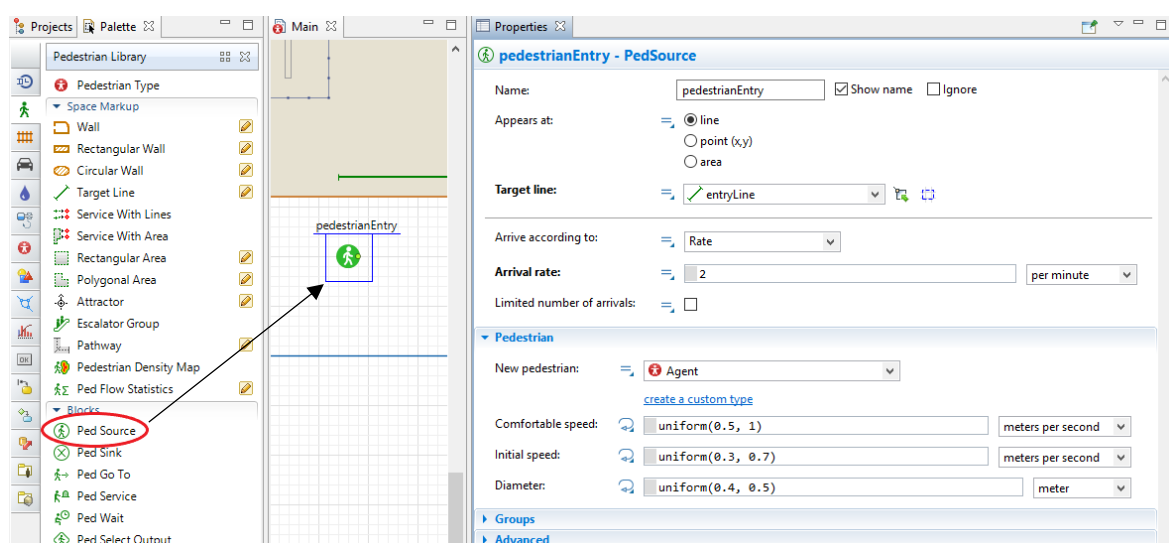


figure 6: Add a pedestrian source

Add the pedestrian source, from here they're coming. Keep an eye on the "Arrival rate" it's 2 per minute, not per second.

Next the people need a target: the "gateALine". Take a "Ped Go To" element and drag it onto the canvas.

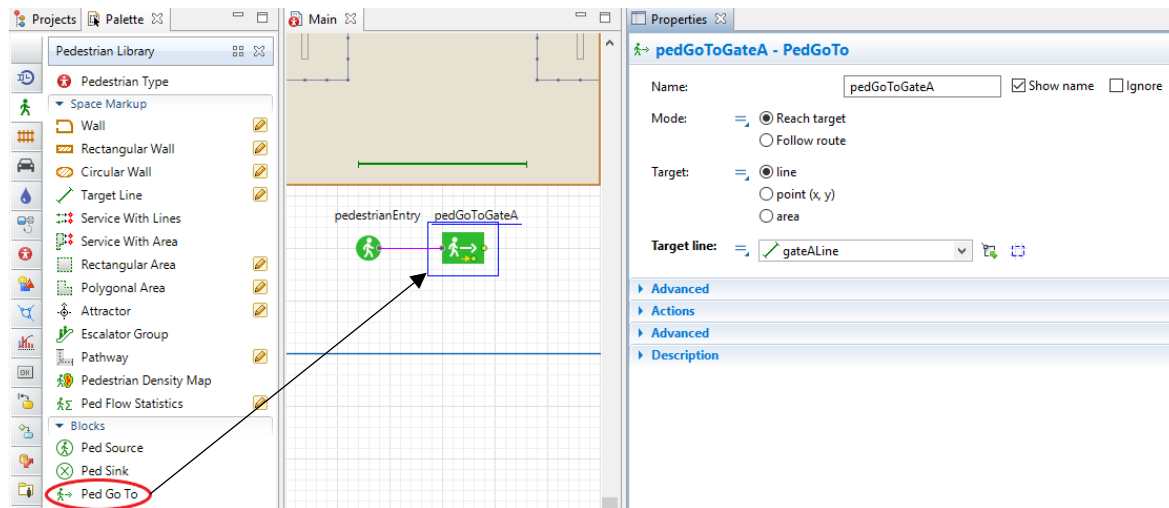


figure 7: The target for the pedestrians

And at last the pedestrians get into the aircraft. Due to the fact, that the aircraft is out of our sight, the persons disappear. Drag a pedestrian sink from the palette to the canvas. The properties keep their default values.

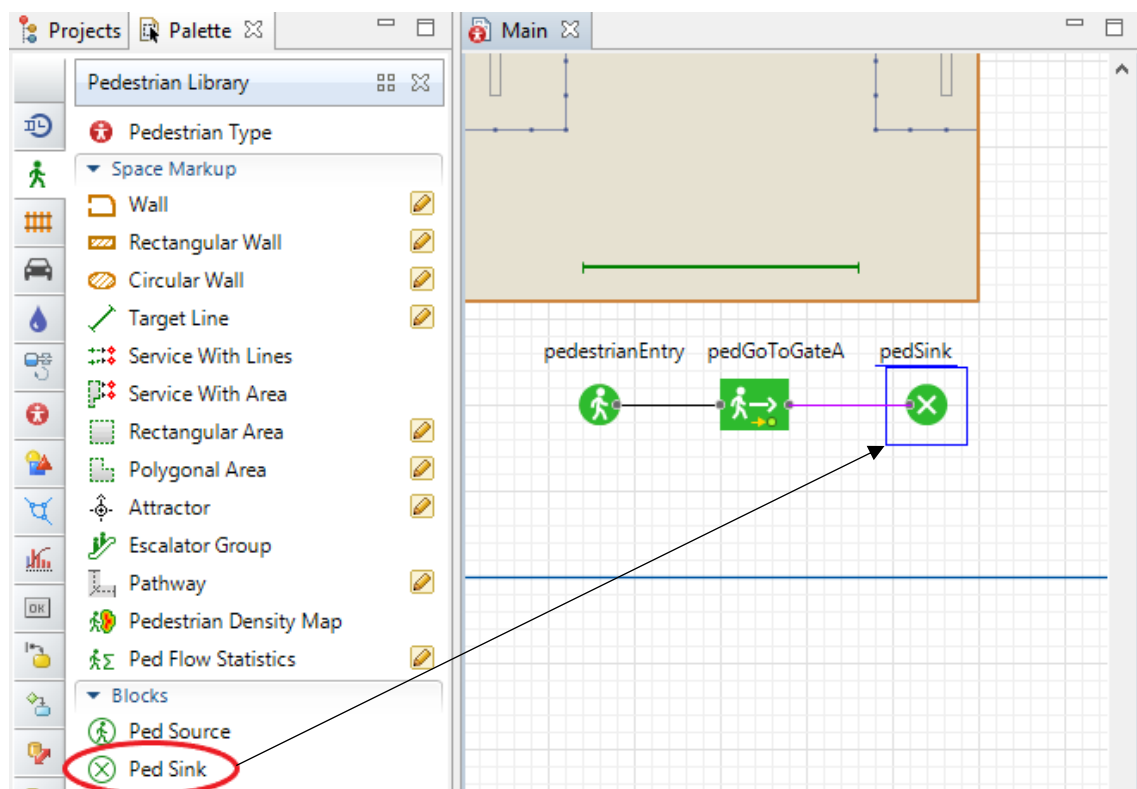


figure 8: Pedestrian sink

Give this a first try. You should see some colored dots, which comes out of the entry line and move to the line of gate A and disappear.

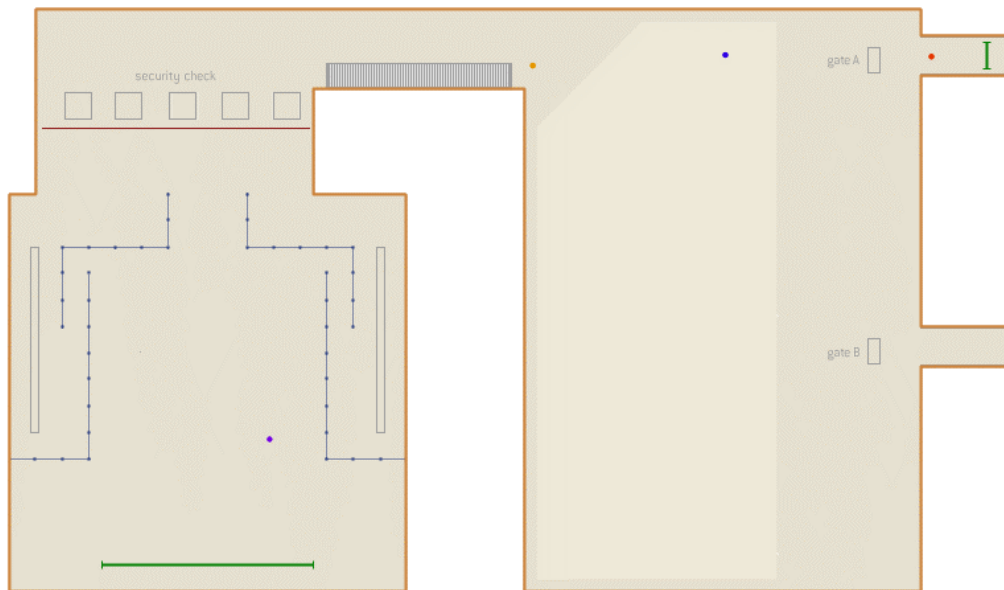


figure 9: Simulation result

6. 3D-Animation and visualization

For Visualization we need a “Pedestrian Type”. Drag it from the palette onto the canvas and name it “Passenger.”

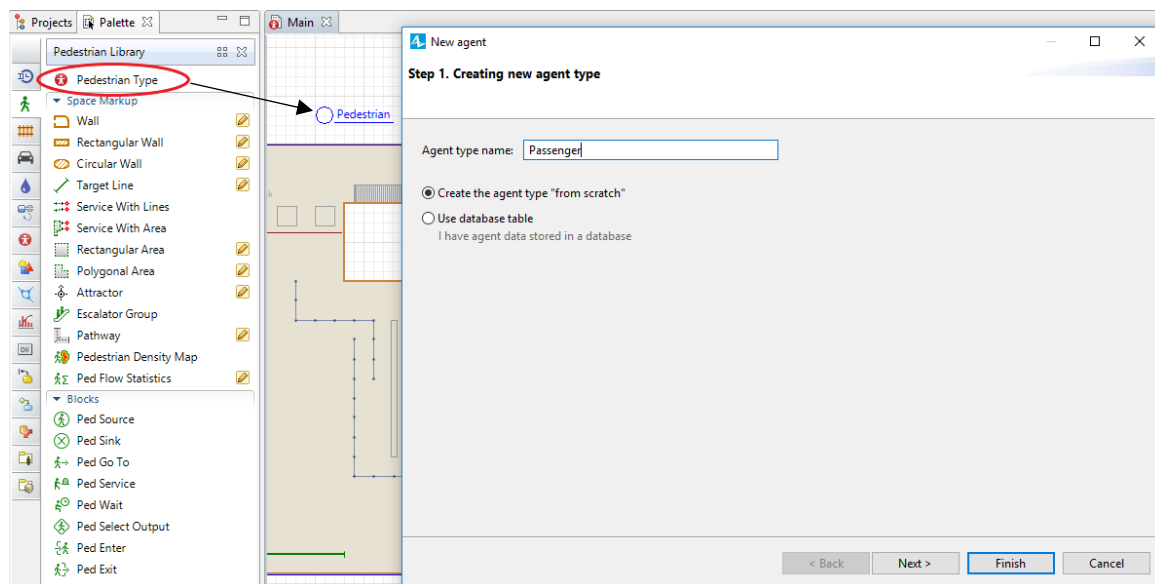


figure 10: The pedestrian type

Set the Animation to 3D and choose an animation. After that click “Finish”

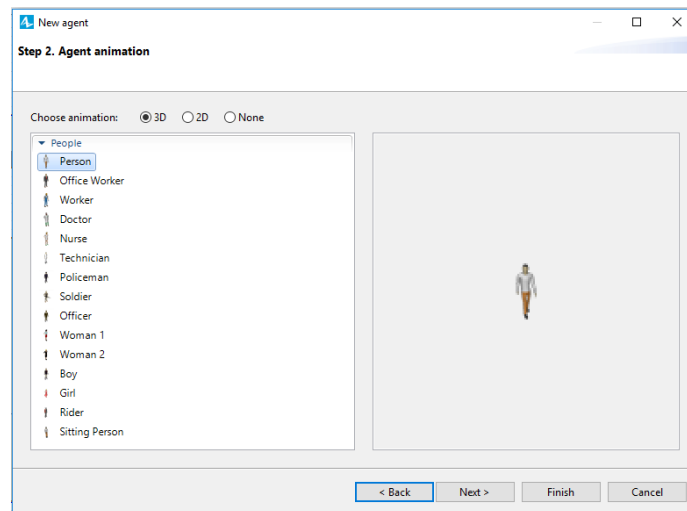


figure 11: Pedestrian animation

The agent doesn't appear on the canvas. If you want to edit it, look in the “Projects” tab on the left side of the application. There you find “Passenger” with a red agent symbol.

Edit “pedestrianEntry” and set “New pedestrian” to “Passenger”.

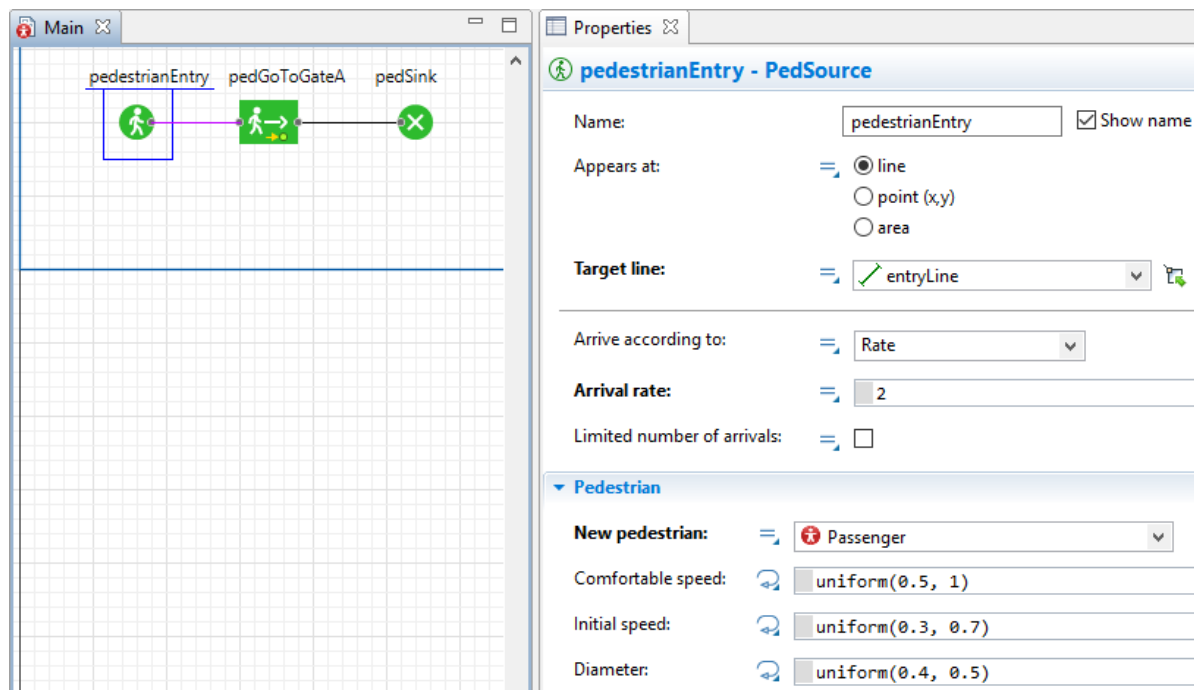
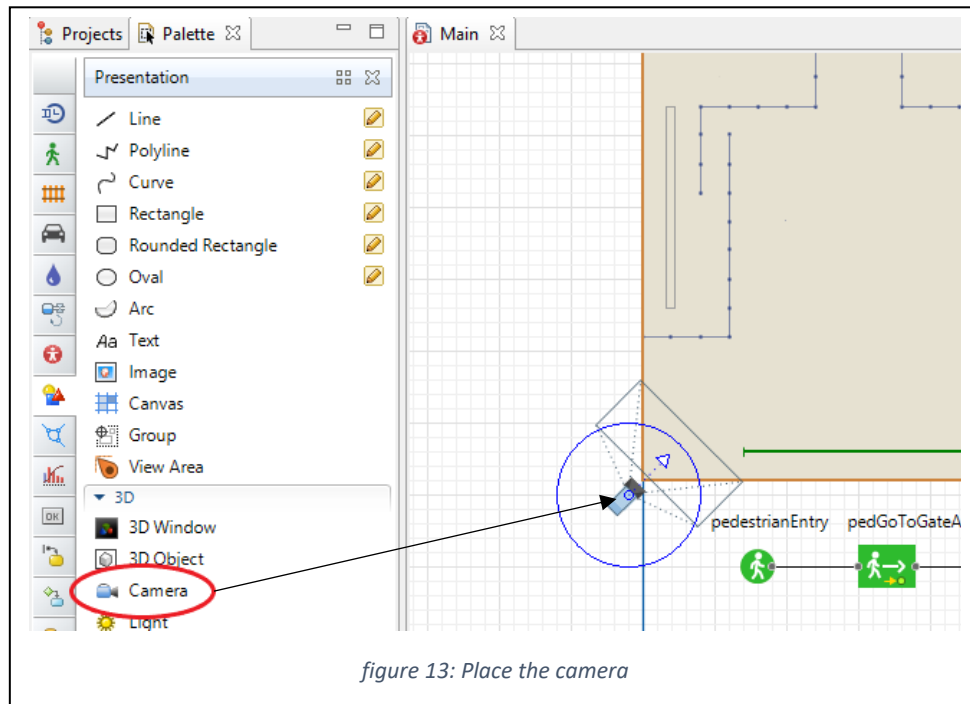
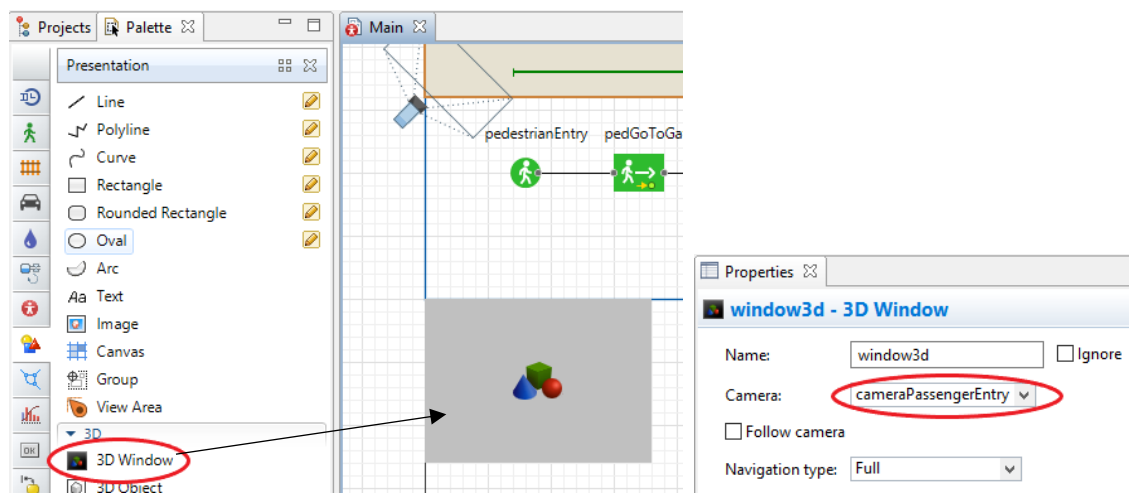


figure 12: Set passenger as animation in pedestrianEntry

In 3D Animations you need a camera. Go to the “Presentation” tab in the palette and place a camera in the scene.



To show the camera view add a “3D Window” and link it to the camera.



Again start the simulation. If the camera is positioned well you'll see the incoming passengers. Otherwise try to change the view of the camera and restart the simulation. Note that you can scroll the whole simulation board by holding the right mouse button. In the 3D window you can move through the scene by holding the left mouse button.

7. Services

The Next thing is to place a service for security checks. Note: For better placing of the elements you can zoom by pressing Strg and scoll. By clicking on a queue of a service it's possible to add a point to the path by double-click and drag it. Hence you can draw angled queues.

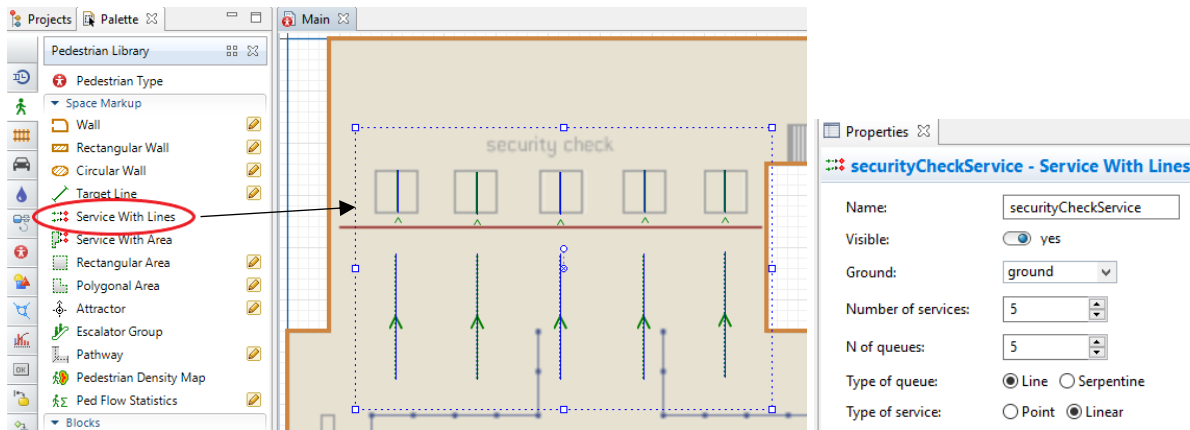


figure 15: Add the security check

The security checks must be added to the workflow by a “Ped Service” element in it. Drag this element from the pedestrian library in the palette to the canvas and set the properties.

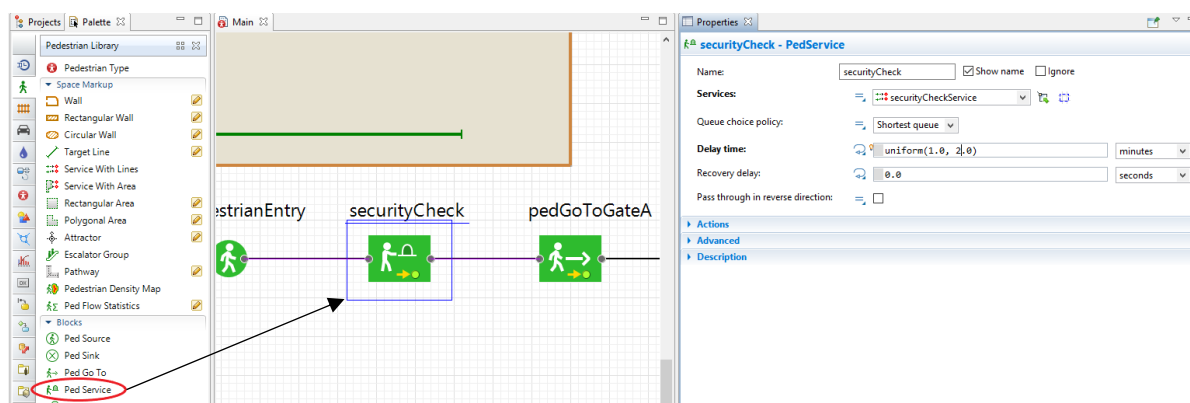


figure 16: Insert the service into the workflow

For a more realistic animation place some metal detectors and XRay scanners in the scene.

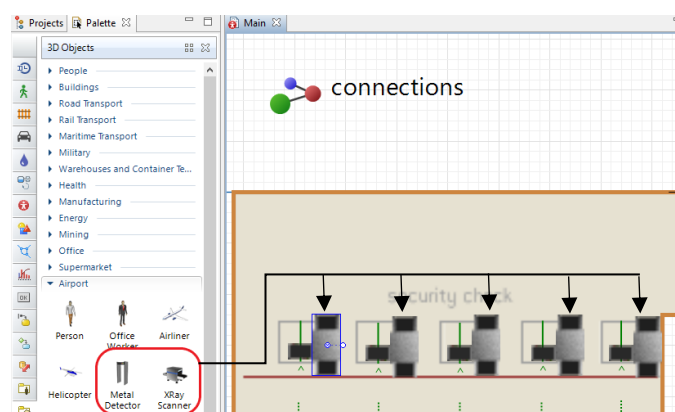


figure 17: Metal detectors and XRay scanners

After starting the simulation, you can see how the passengers complete the security check and go to the gate.

Normally before the passenger can pass the security check, they've got to check in. Lets Add this service.

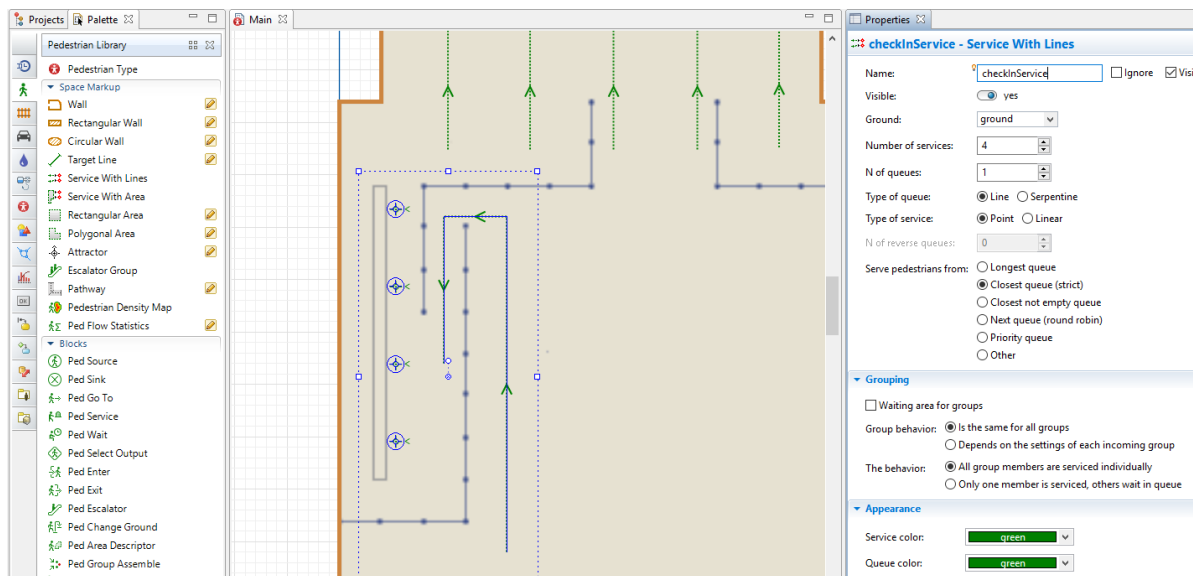


figure 18: Check in service

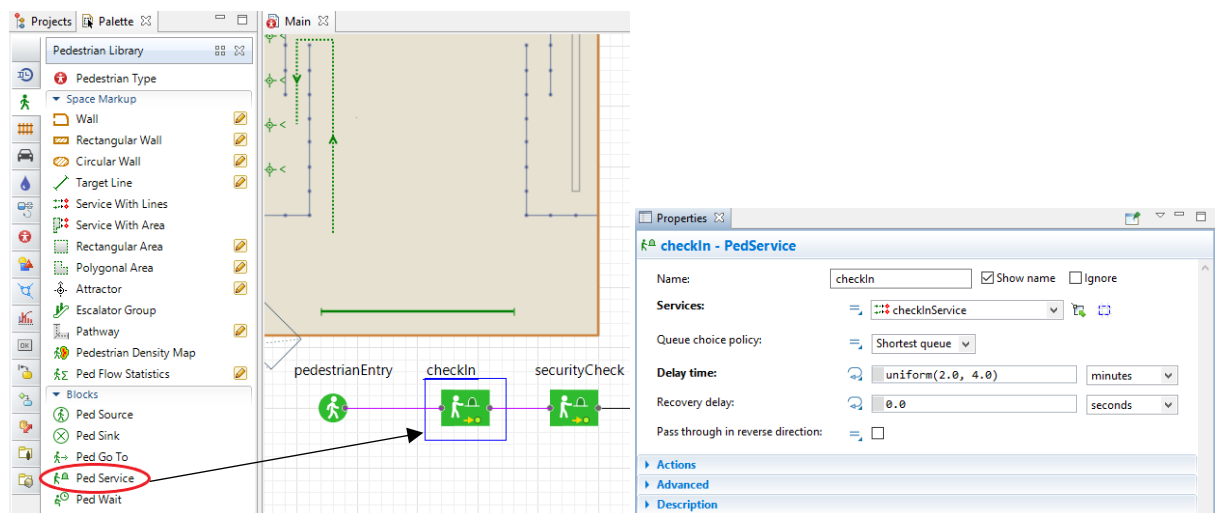


figure 19: The check in for the work flow

For a more realistic animation place some Table and Staff detectors and XRay scanners in the scene.

If you start the simulation at this point, all passengers first go to the check in and after that through the security check. But maybe our airport has the ability for online check in. In this case we assume 30% use this type of check in. Hence we need a splitter. “Ped Select Output” models this.

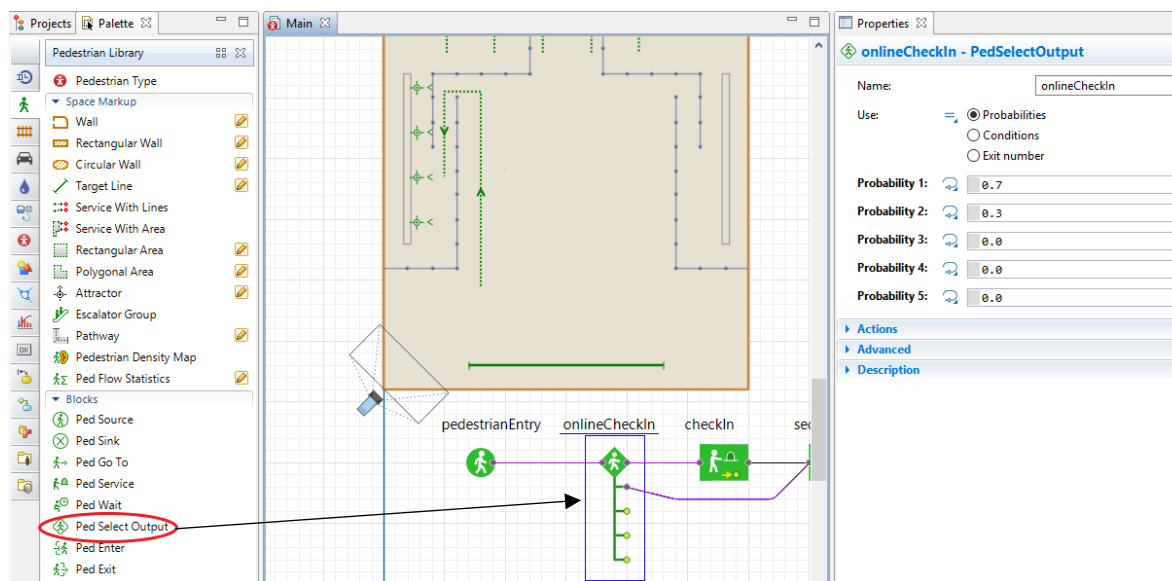


figure 20: Online check in

Please note, that the “Ped Select Output” has five outputs. Output 1 is the right corner of the diamond. Two till four are the lines below. If a probability for an output is greater than zero but the graphically node isn't connected, it compiles well but an error is thrown at runtime when the first time the path is taken.

Try another time the simulation of this model.

The next point for the passenger is to wait for boarding. Take a Polygonal area or node and place it on the light ground on the right. Drag each of the dots from the polygon to a fitting point. Again you can add point by double-clicking on a point on the border.

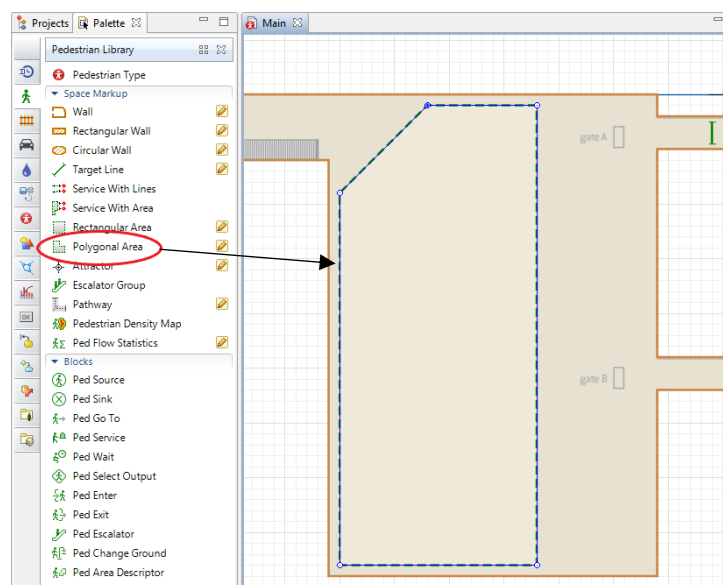


figure 21: Waiting area

The created area shall be the waiting area for the passengers before they walk through gate A. Hence we need the next step in our passenger workflow. Add a “Ped Wait” between the security check and “pedGoToGateA”.

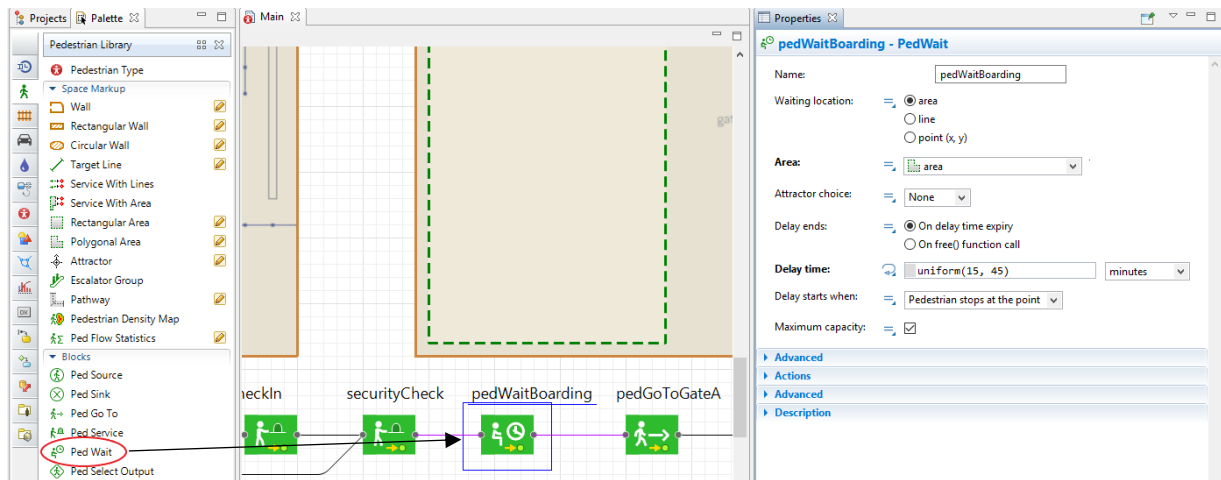


figure 22: Add a wait object to the workflow

Start the next Simulation and watch the behaviour of the passengers.

The last step is the boarding process of our passengers. We need another service for it. This time we have to services, because boarding is splitted into economy and business. Add two “Service With Lines” to the plan.

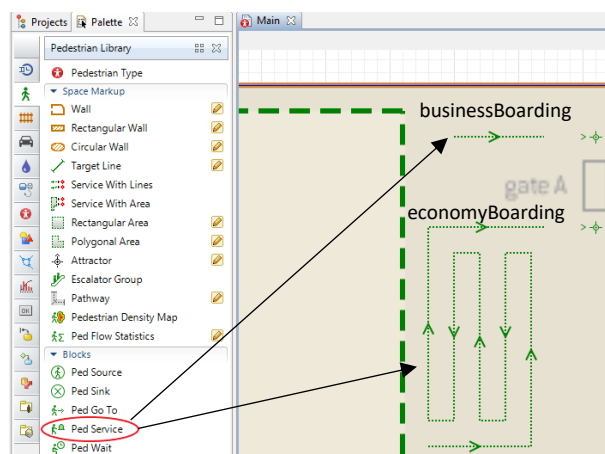


figure 23: The two services on the plan

figure 24: Properties of businessBoarding

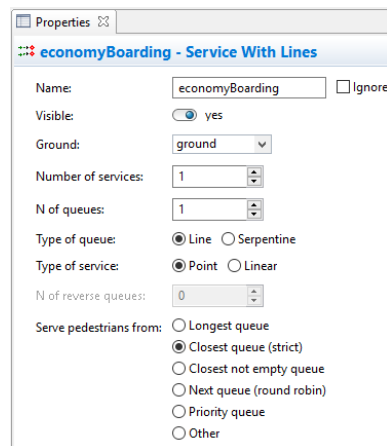


figure 25: Properties of economyBoarding

The business boarding is for business passengers. To get some of them we edit the pedestrian type passengers and our pedestrian source. First our passengers: Click on Projects on the left side in the window. Then under “Main” double-click on “Passenger.” First we need a parameter “business.” It’s type of bool and shows if our passenger is a business guy. Head back to the palette and take a parameter from the agent tab.

After that we need another a second presentation. Head to the 3D objects tab in the palette and drag an “office Worker” from it to the canvas. Set the parameters like in figure 26 and have a look on the Position parameters and the visible value.

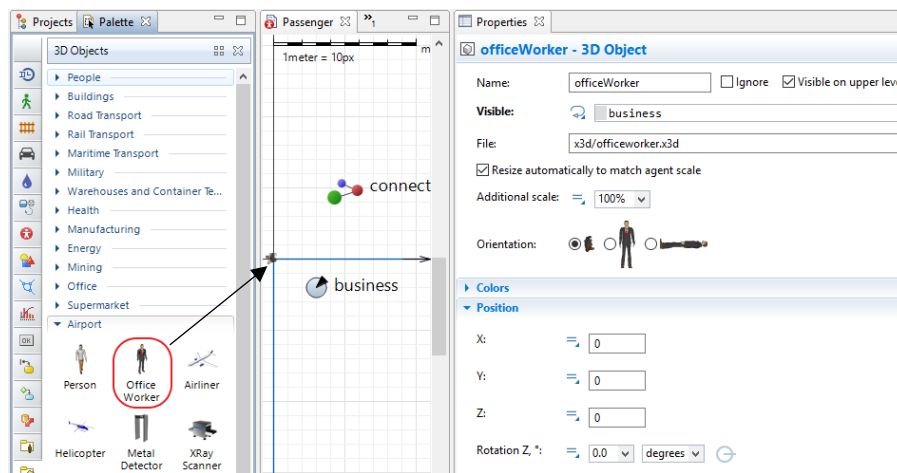


figure 26: Business passenger

After this select the other representation, the economy passenger, through the “Projects” tab. Edit the visible value to “!business”. Keep an eye onto the exclamation mark, it negates a boolean expression.

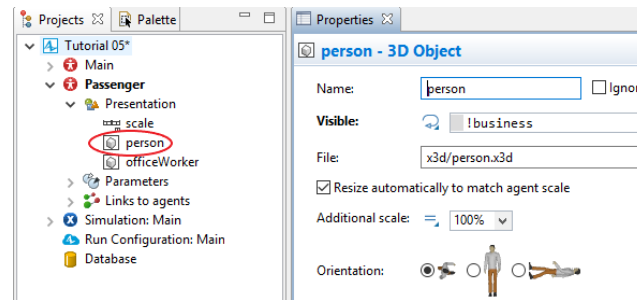


figure 27: Properties of economy passengers

To get some of our business passengers select the pedestrian source in the passenger workflow and edit it like in figure 28.

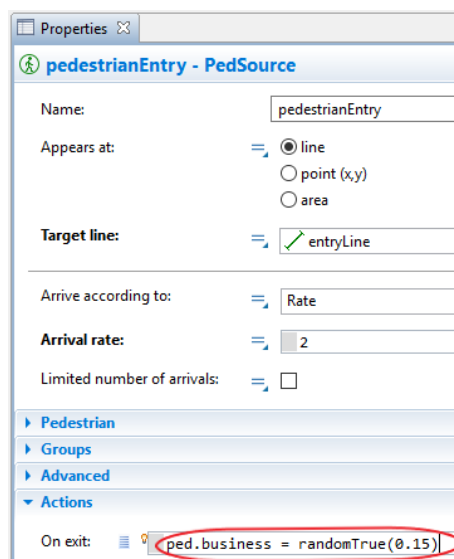


figure 28: stochastic emitation of business passengers

Finally edit the passenger workflow like, so that the boarding takes place and divides between business and economy.

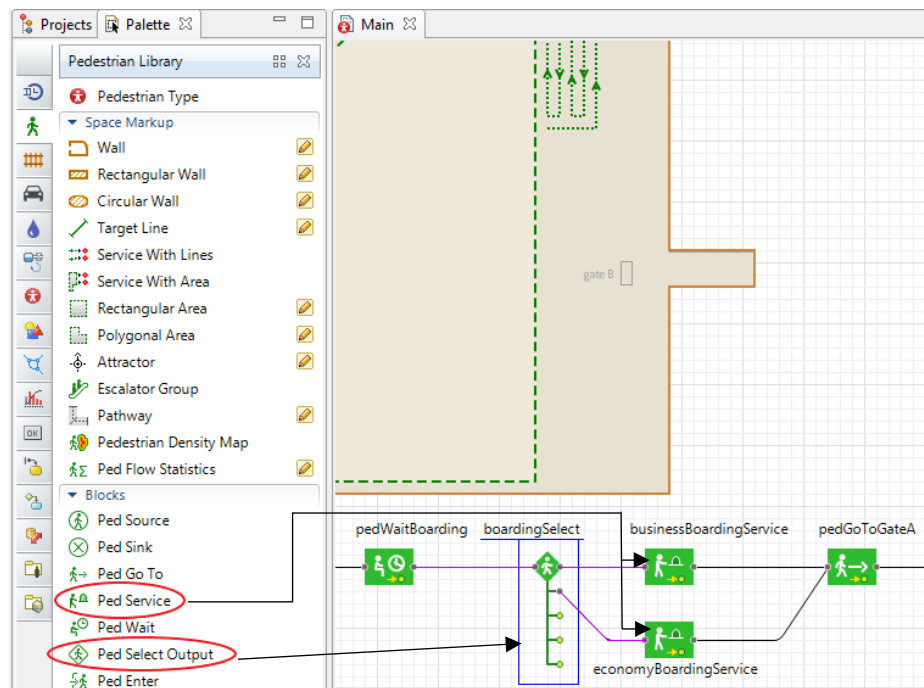


figure 29: Editing the workflow

Set the properties of the PedSelectOutput.

figure 30: Properties of the pedSelectOutput for boarding

Edit the waiting times of the services.

figure 31: Properties of business boarding

figure 32: Properties of the economy boarding

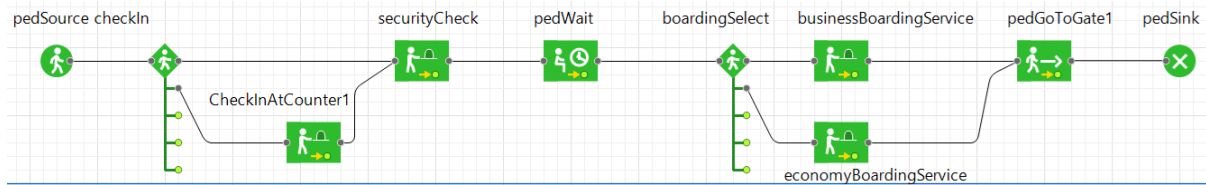


figure 33: Final pedestrian flow

Now start the simulation and watch the Behaviour.

8. Extension Exercises

1. Plot the Amount of Passengers passed from
 - a. Check In
 - b. Security Check
 - c. Waiting
 - d. Business Boarding
 - e. Economy Boarding

HINT: Any element in the workflow has a method “countPeds” which returns the pedestrian passed through it or take a “Ped Flow Statistics” element from the palette.

2. Increase the rate of incoming passengers and do the analysis again
3. Adapt the model to eliminate the bottleneck(s)
4. Create a new checkIn on the right side
5. Create a new service line at Gate B
6. Gate A People traveling to America, Gate B people traveling to Canada