Practical 2

AIM : Design and develop agent based model by

- Creating the agent population
- Defining the agent behavior
- Adding a chart to visualize the model outpu
- Adding word of mouth effect
- Considering product discards
- Considering delivery time

Scenario :

The consumer market is modeled using agent based method. The supply chains are modeled with system dynamics. Here, We are going to create an Agent Population in 2D and Define there behaviour. Consumers initially are not using any products. Then eventually the growth in the use of the product is been shown visually by the use of Charts. Consumers initially are not using any products but are sensitive to advertizing and to word of mouth. Products discard after a while and generate the need to buy a replacement of the same brand. The output of the model includes the delivery time & waiting time.

- *Phase 1*. Creating a simple model Market to create the Agents Populations.
- *Phase 2*. Definine the Agents behavior & study under each circumstances.
- *Phase 3*. Adding a chart to visualize the use of product by the consumer.
- *Phase 4*. Adding word of mouth effect to attract the customer to use the product.
- *Phase 5*. Considering product discards by the consumer.
- *Phase 6*. Considering delivery time of the product.

Solution:

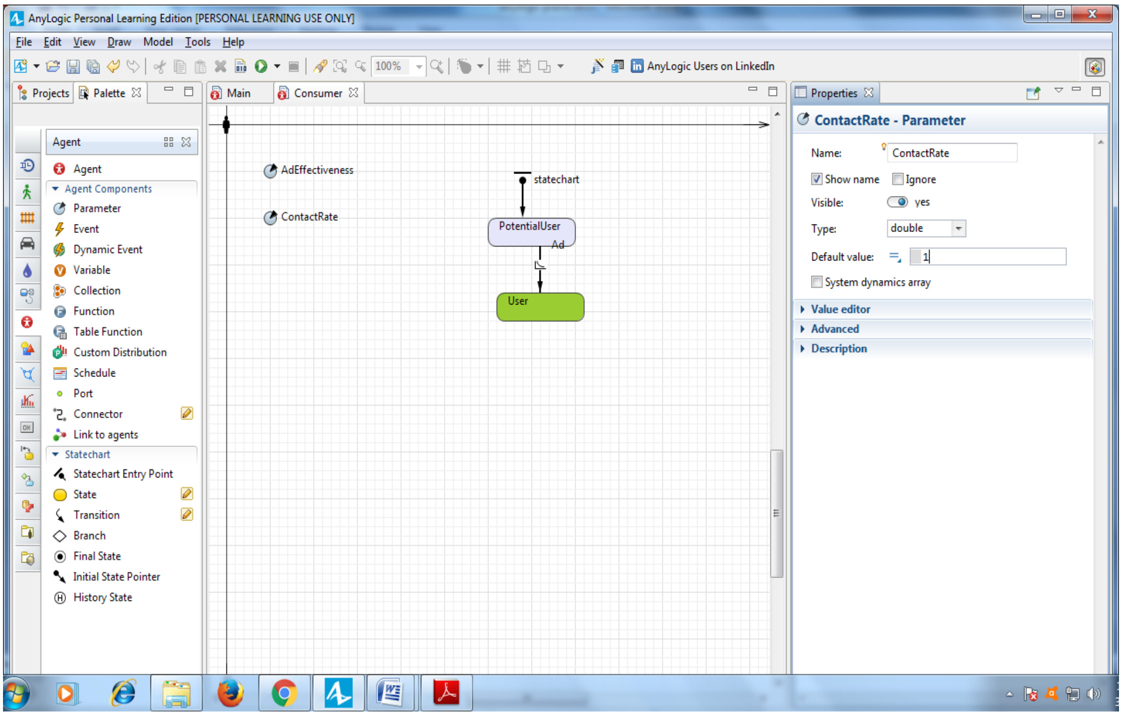
Adding word of mouth effect

1. In the **Projects** tree, open Consumer diagram by double-clicking Consumer.

2. Add a parameter to define a consumer's average daily contacts. Drag the **Parameter** from the **Agent** palette on to the diagram.

3. Name the parameter ContactRate.

4. The rate is 1 contact per day, so type 1 as the parameter's **Default value**.



ContactRate - Parameter

Name: ContactRate

☑ Show name □ Ignore

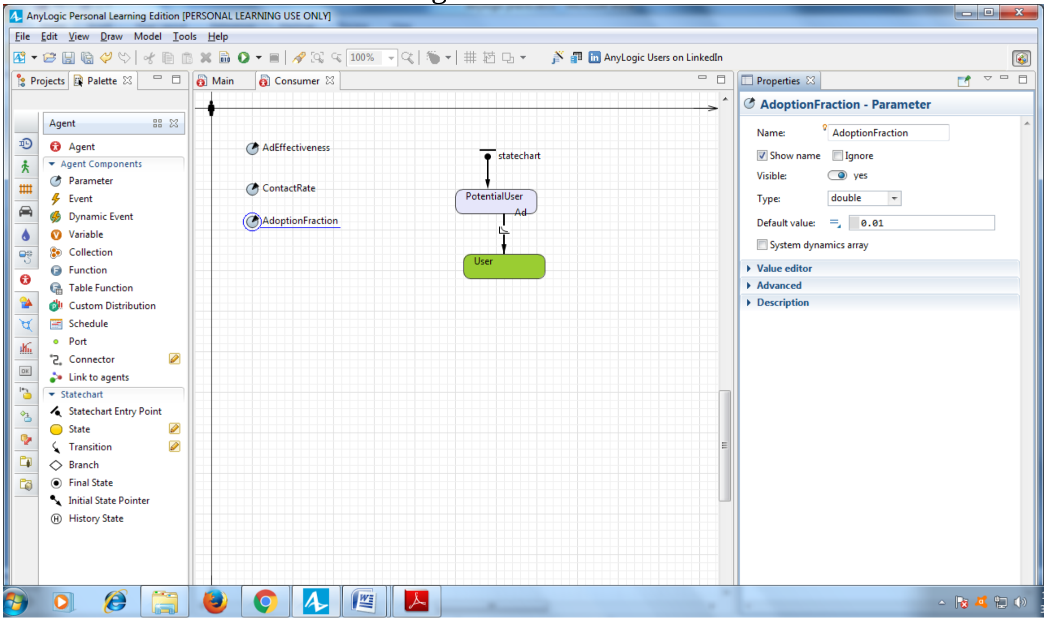
Visible: yes

Type: double

Default value: 1

□ System dynamics array

Add another parameter - AdoptionFraction - to define a person's influence on others, a number that we'll express as the percentage of people who will use the product after they come into contact with the consumer. Leave the default parameter's **Type**: double, and set the **Default value:** 0.01. The Consumer diagram should look like this:



AdoptionFraction - Parameter

Name: AdoptionFraction

☑ Show name □ Ignore

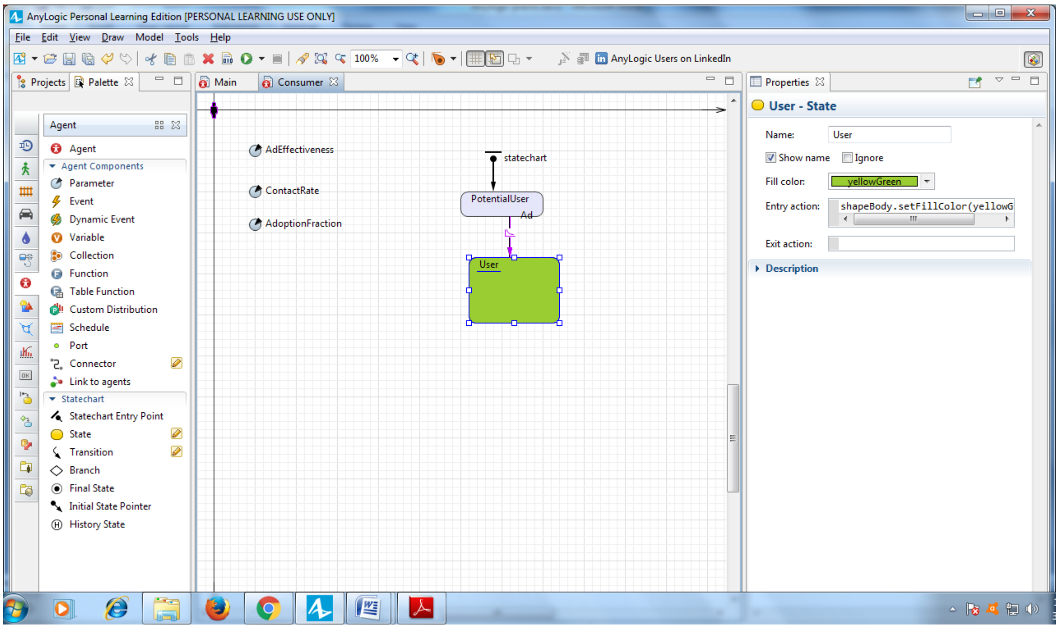
Visible: yes

Type: double

Default value: 0.01

□ System dynamics array

Open the Consumer diagram, and increase the User state to fit the internal transition we'll draw inside the state on the next step.



User - State

Name: User

☑ Show name □ Ignore

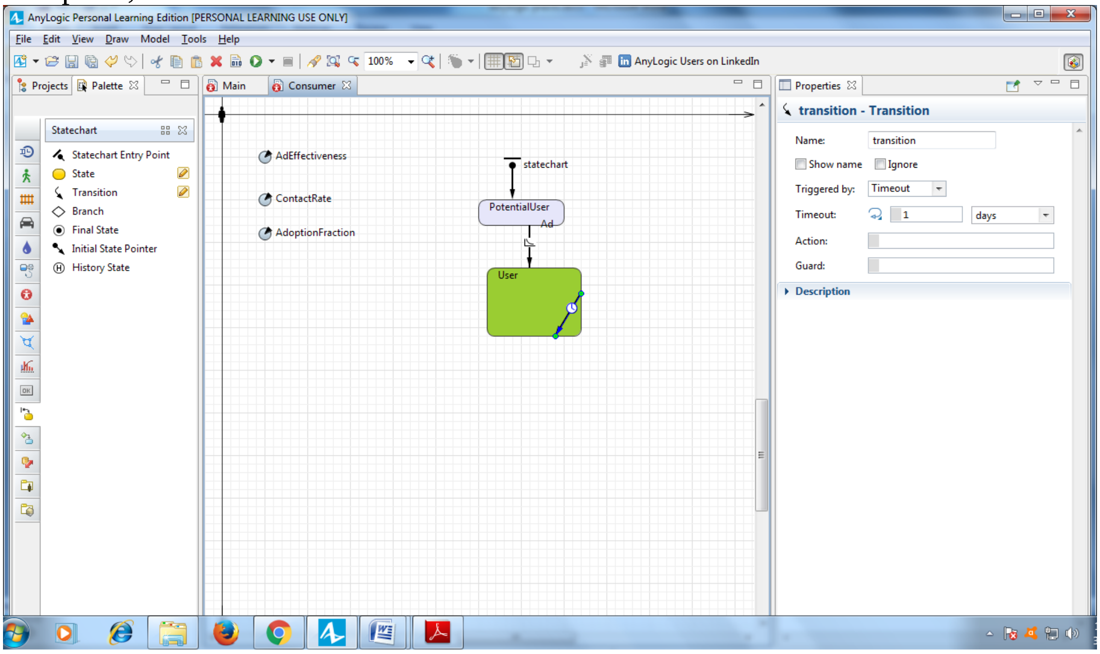
Fill color: yellowGreen

Entry action: shapeBody.setFillColor(yellowG

Exit action:

Draw an internal transition inside the User state. To draw a transition like the one shown below, drag the **Transition** from the **Statechart** palette inside the state so the transition’s start point lies on the state border.

Afterward, you can move the transition end point to another point on the state border. To add a salient point, double-click the transition.



transition - Transition

Name: transition

□ Show name □ Ignore

Triggered by: Timeout

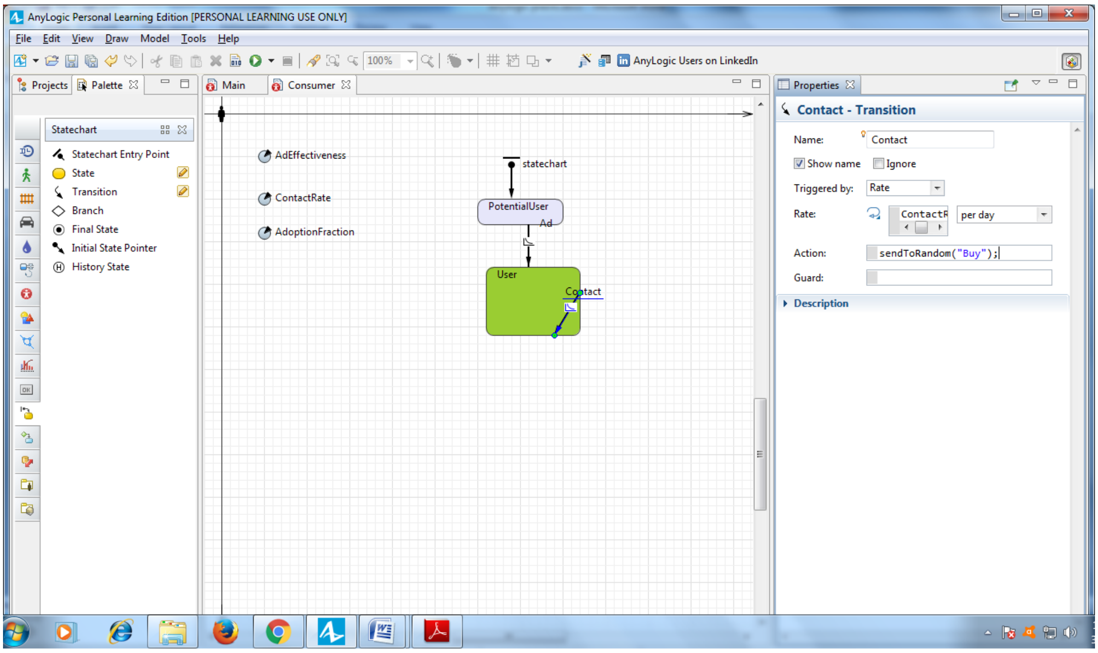
Timeout: 1 days

Action:

Guard:

Modify the transition properties. This transition will occur with the specified **Rate** ContactRate (use code completion rather than typing the parameter’s full name). Name the transition Contact and set it to show its name.

Specify the **Action** that will be executed on triggering this transition (use the code completion to write the code): sendToRandom("Buy");



Contact - Transition

Name: Contact

☑ Show name ☐ Ignore

Triggered by: Rate

Rate: ContactR per day

Action: sendToRandom("Buy");

Guard:

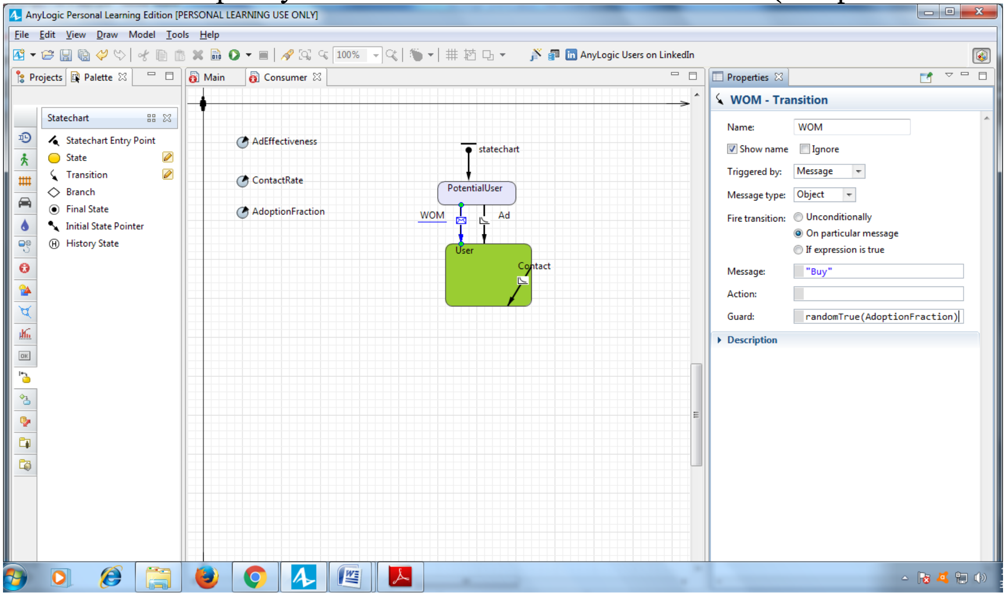
Description

Draw another transition from PotentialUser to User state, and name it WOM (Word of Mouth). This

transition will model purchases caused by word of mouth.

Modify the transition properties:

- In the **Triggered by** list, click **Message**.
- In the **Fire transition** area, select **On particular message**.
- In the **Message** field, type "Buy"
- Since we know not every contact is successful – in other words, a contact may not convince the potential user to buy our product – we'll use AdoptionFraction to make successful contacts less common. Specify the transition's **Guard:** randomTrue(AdoptionFraction)



WOM - Transition

Name: WOM

☑ Show name ☐ Ignore

Triggered by: Message

Message type: Object

Fire transition: ○ Unconditionally ● On particular message ○ If expression is true

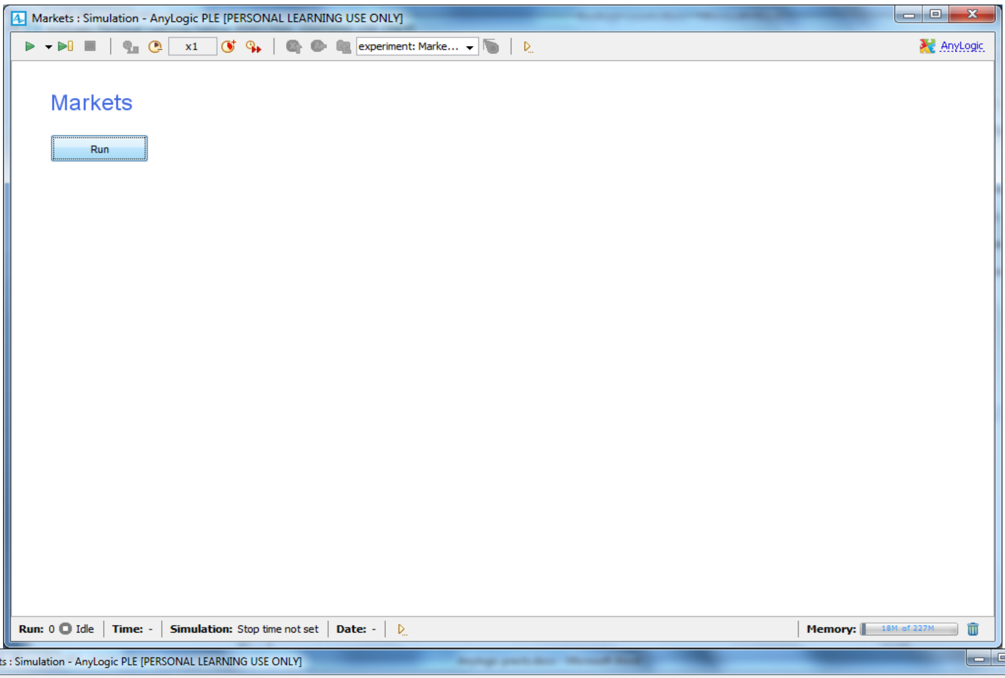
Message: "Buy"

Action:

Guard: randomTrue(AdoptionFraction)

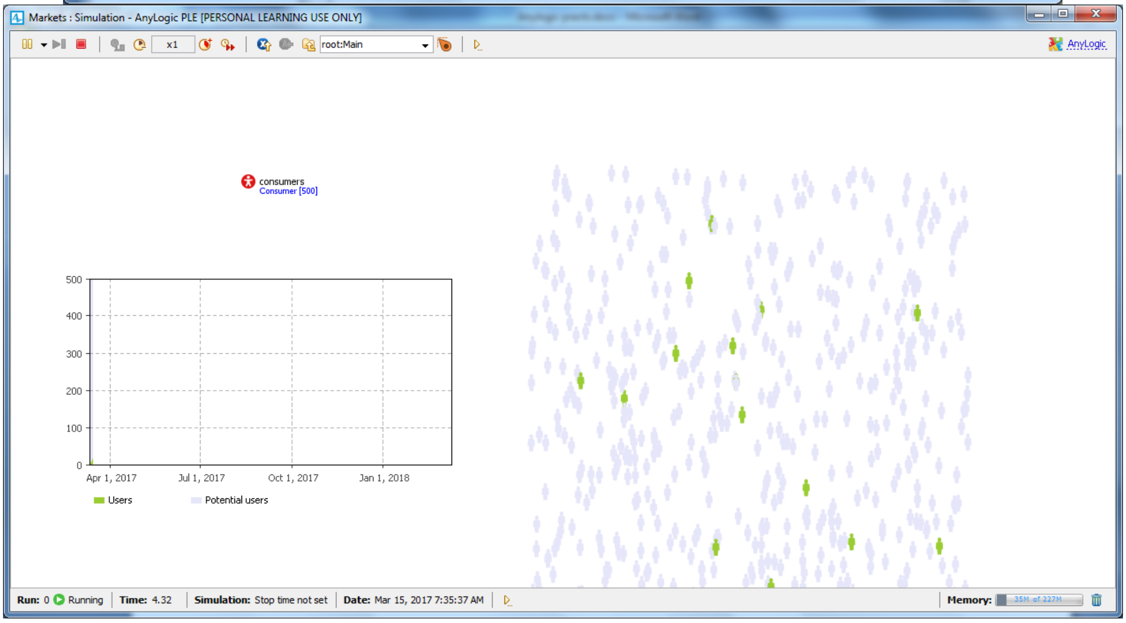
Description

In the **Projects** view, you may see an asterisk near the model item that shows your model has unsaved changes. On the toolbar, click **Save** to save your model. Run the model.



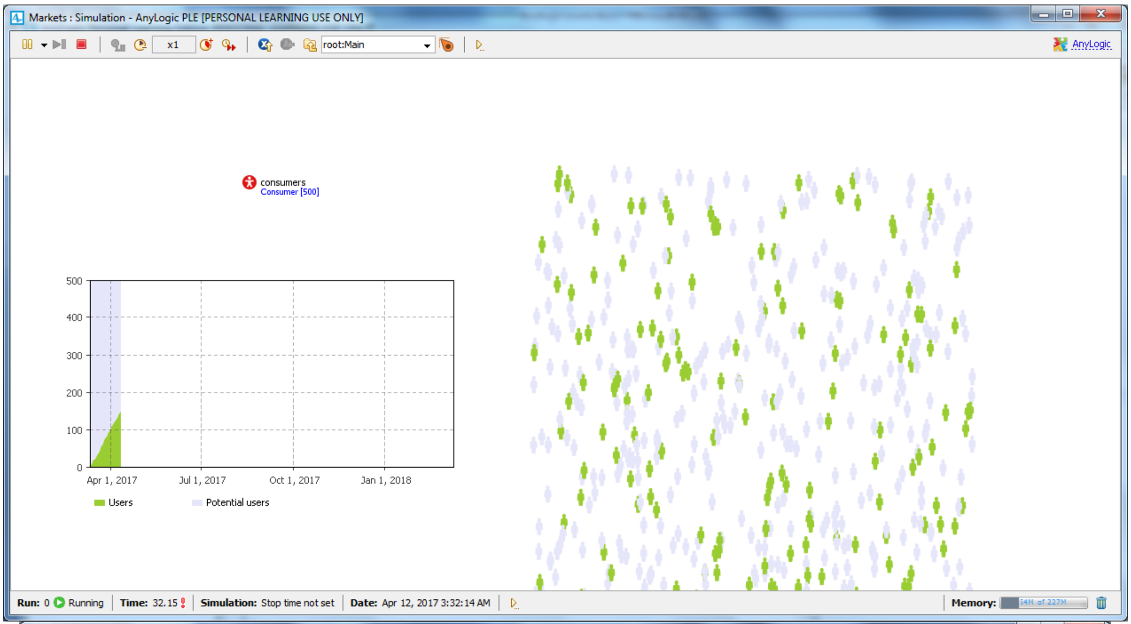
Markets : Simulation - AnyLogic PLE [PERSONAL LEARNING USE ONLY]

Run: 0 Idle | Time: - | Simulation: Stop time not set | Date: - | Memory: 18M of 227M

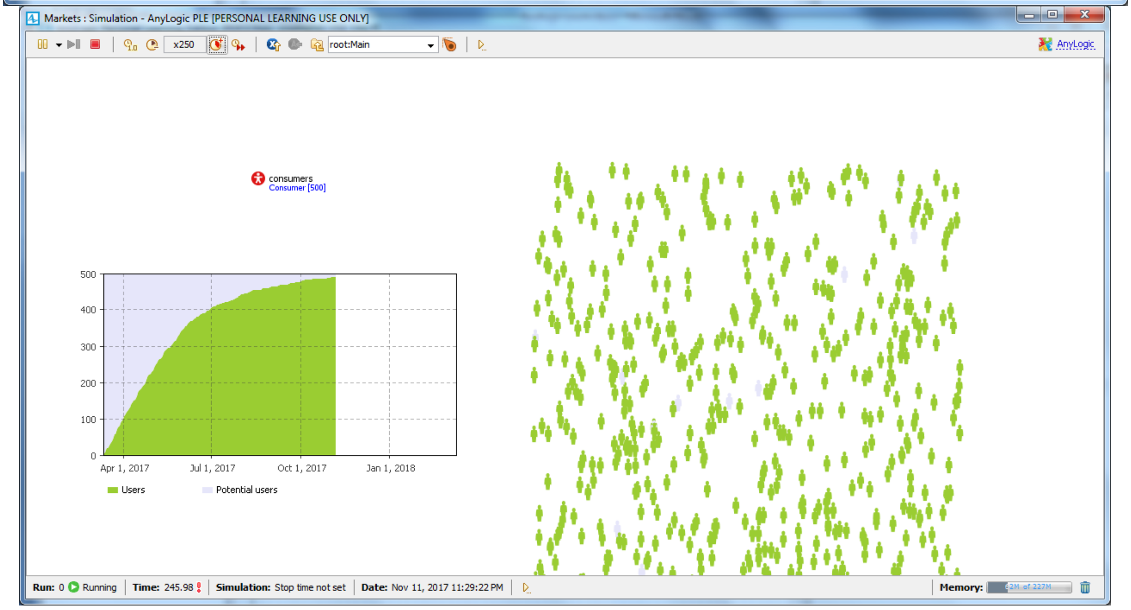


Markets : Simulation - AnyLogic PLE [PERSONAL LEARNING USE ONLY]

Run: 0 Running | Time: 4.32 | Simulation: Stop time not set | Date: Mar 15, 2017 7:35:37 AM | Memory: 35M of 227M


Markets : Simulation - AnyLogic PLE [PERSONAL LEARNING USE ONLY]

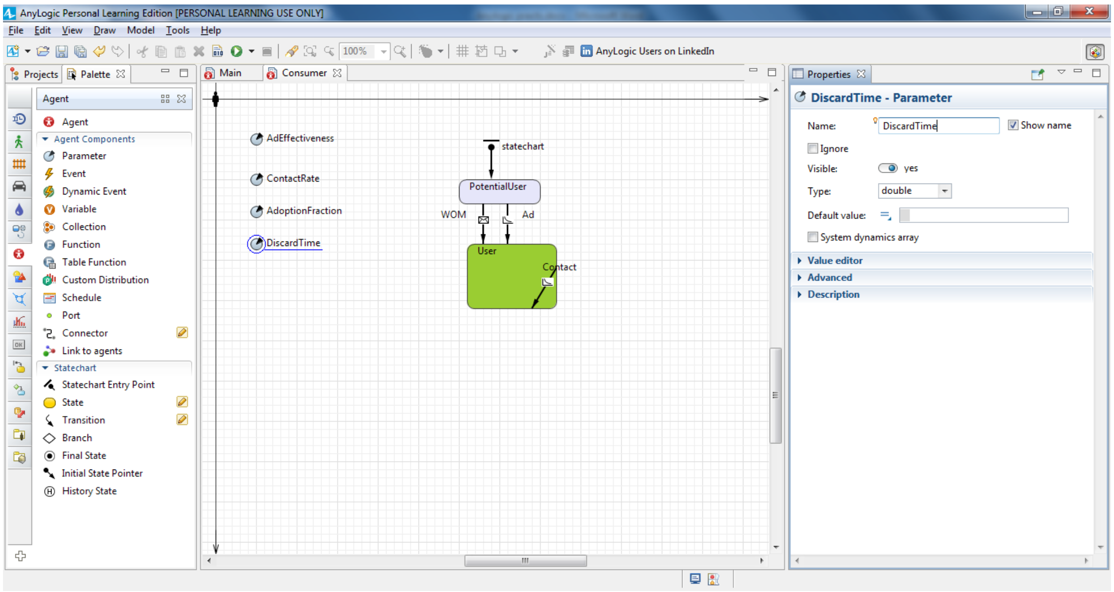
Run: 0 Running | Time: 32.15 | Simulation: Stop time not set | Date: Apr 12, 2017 3:32:14 AM | Memory: 14M of 227M


Markets : Simulation - AnyLogic PLE [PERSONAL LEARNING USE ONLY]

Run: 0 Running | Time: 245.98 | Simulation: Stop time not set | Date: Nov 11, 2017 11:29:22 PM | Memory: 22M of 227M

Considering product discards

Open the Consumer diagram and add a DiscardTime parameter



DiscardTime - Parameter

Name: DiscardTime ☑ Show name

□ Ignore

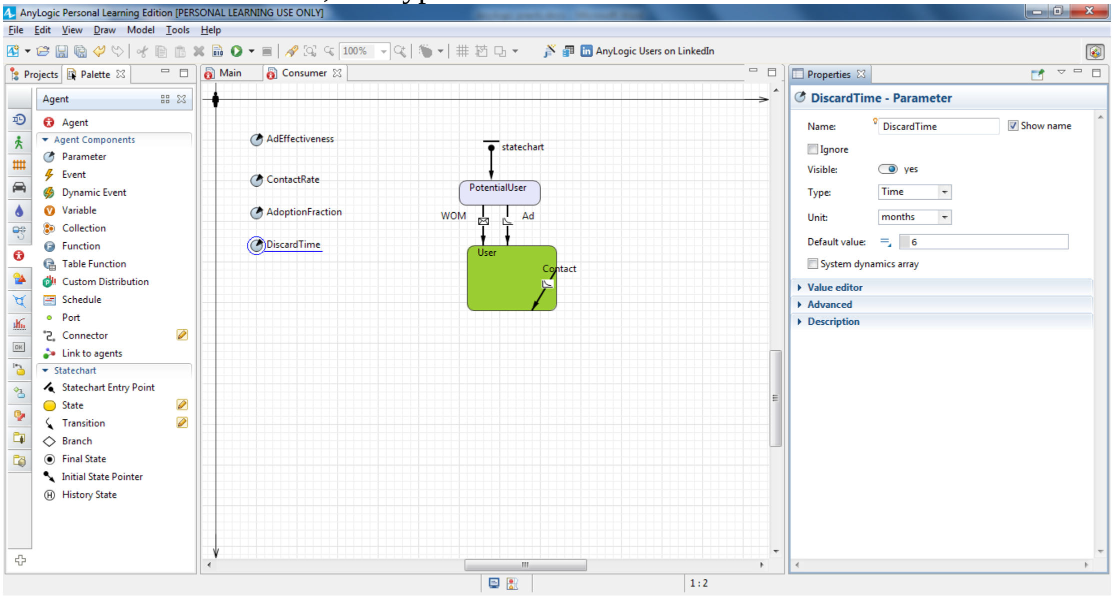
Visible: yes

Type: double

Default value:

□ System dynamics array

This parameter will define our product's lifespan. Choose **Time** as the parameter’s **Type**, click **months** in the **Unit** list, and type 6 as the **Default value**.



DiscardTime - Parameter

Name: DiscardTime ☑ Show name

□ Ignore

Visible: yes

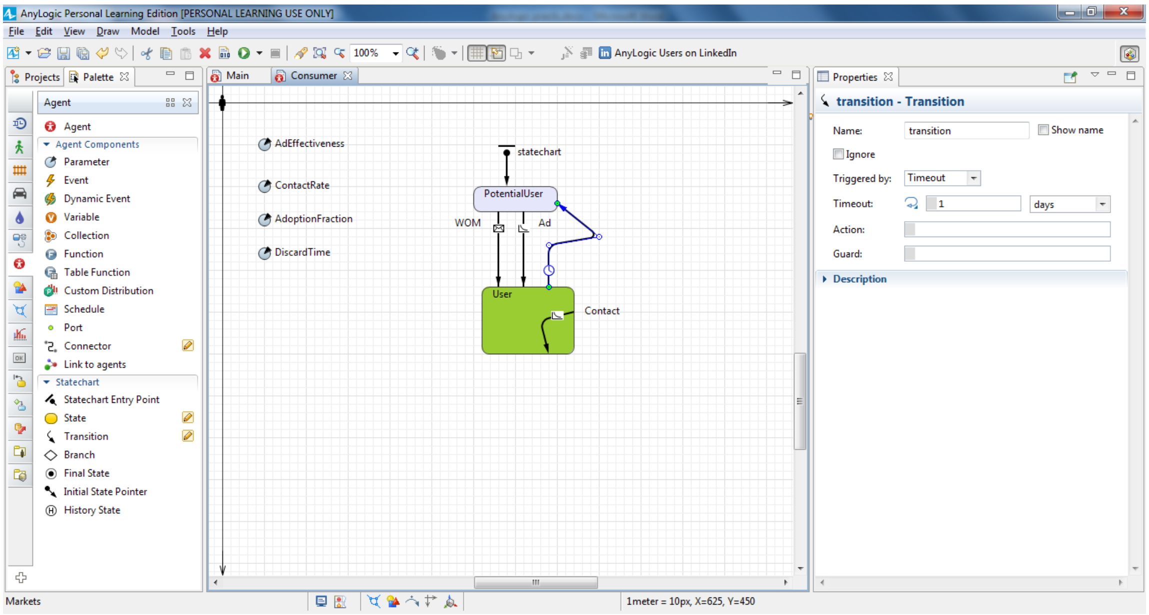
Type: Time

Unit: months

Default value: 6

□ System dynamics array

Draw a transition from User to PotentialUser state to model product discards. To draw a transition with salient points like those shown in the figure, double-click the **Transition** element in the **Statechart** palette (this should change the element’s icon in the palette to), click the transition’s source state User, click at the salient point places, and click the target state PotentialUser**.**



transition - Transition

Name: transition □ Show name

□ Ignore

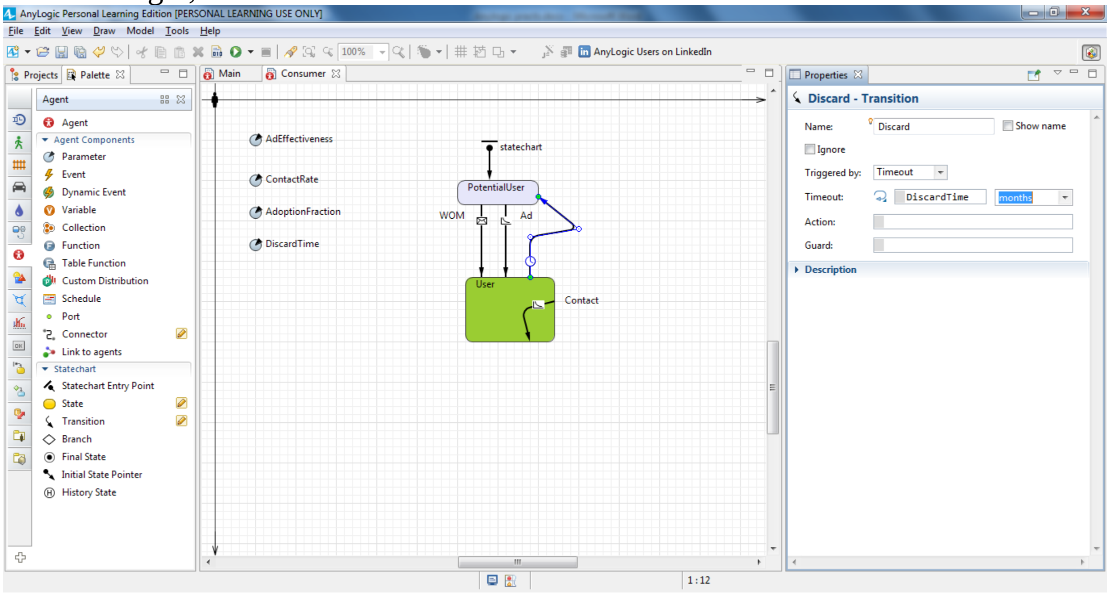
Triggered by: Timeout

Timeout: 1 days

Action:

Guard:

Name the transition Discard and set it to be triggered by a constant timeout DiscardTime. In the list to the right, click **months**.



Discard - Transition

Name: Discard □ Show name

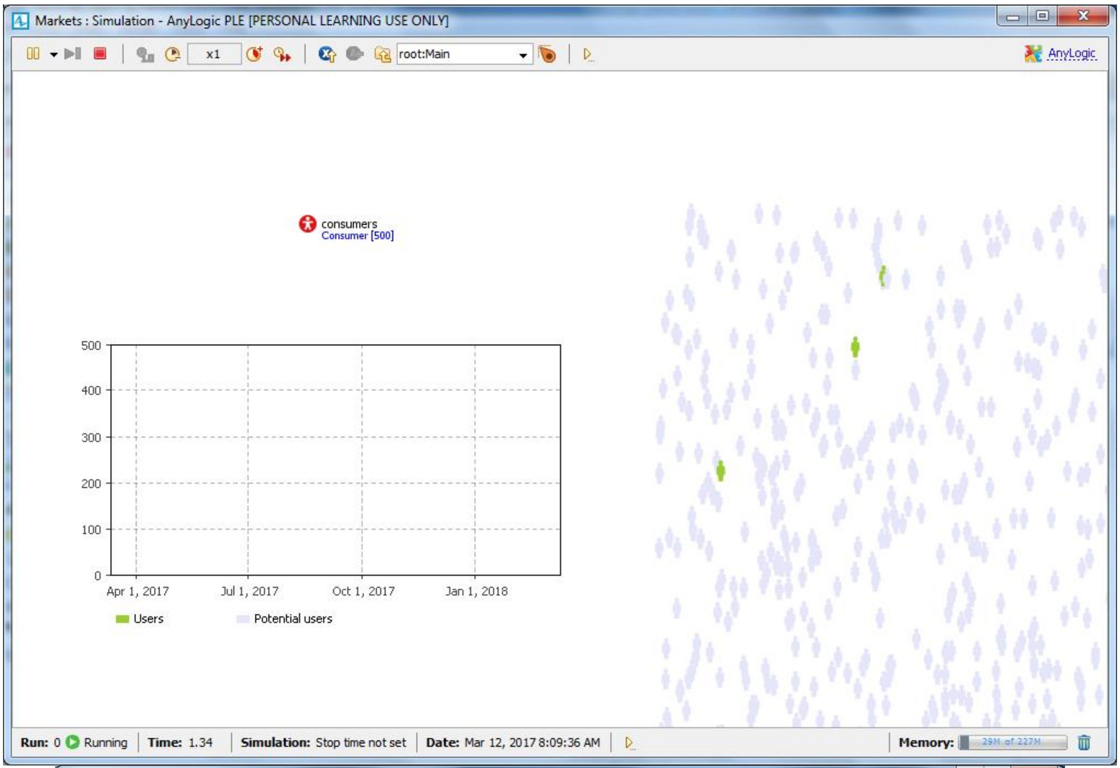
□ Ignore

Triggered by: Timeout

Timeout: DiscardTime months

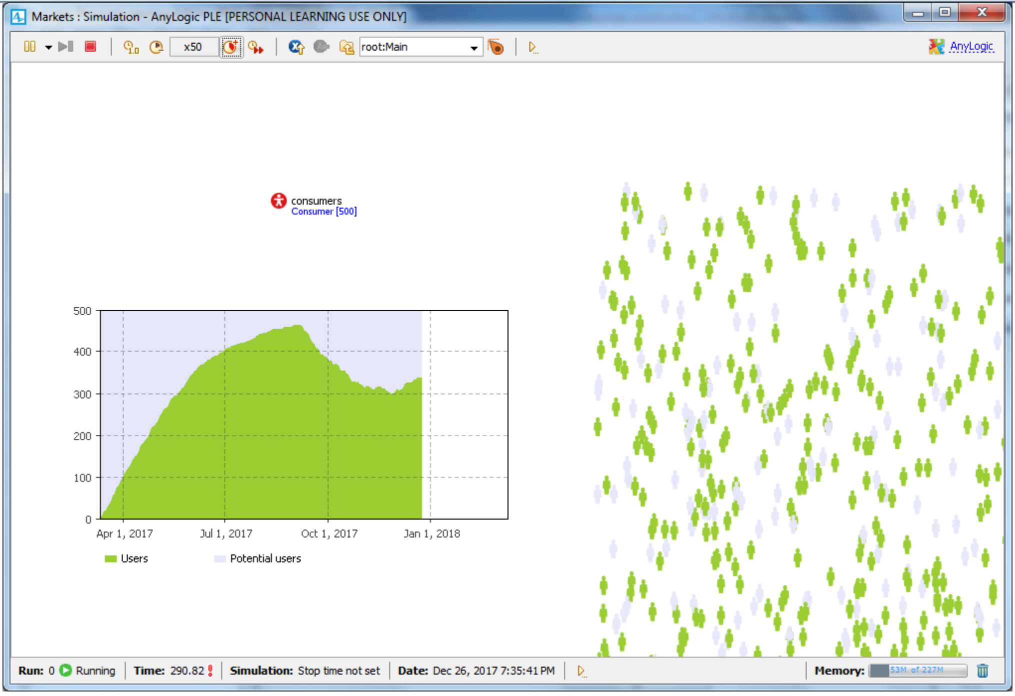
Action:

Guard:



Markets : Simulation - AnyLogic PLE [PERSONAL LEARNING USE ONLY]

Run: 0 Running | Time: 1.34 | Simulation: Stop time not set | Date: Mar 12, 2017 8:09:36 AM | Memory: 29M of 227M

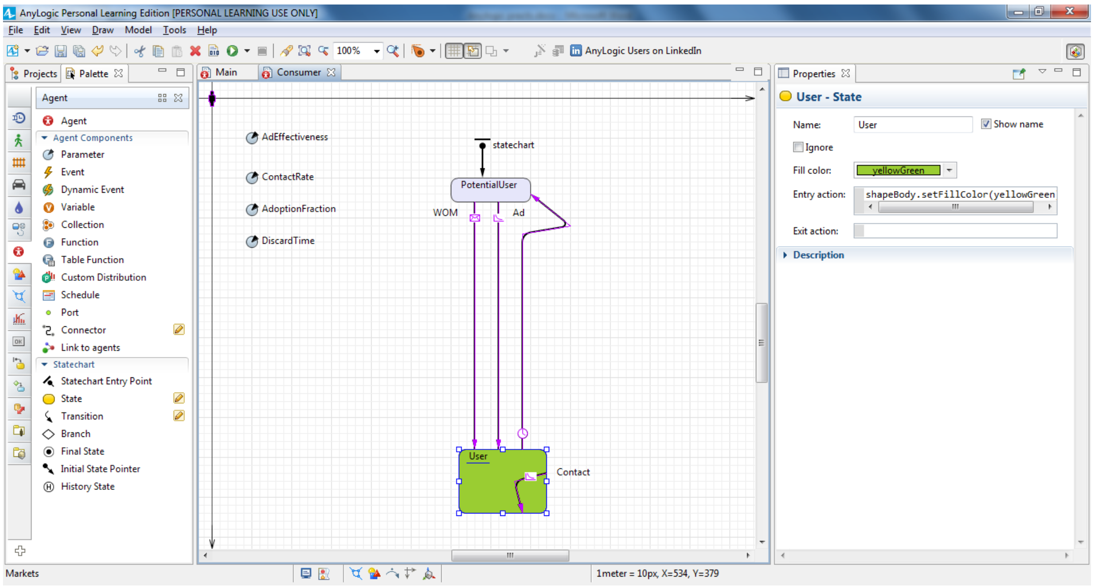


Markets : Simulation - AnyLogic PLE [PERSONAL LEARNING USE ONLY]

Run: 0 Running | Time: 290.82 | Simulation: Stop time not set | Date: Dec 26, 2017 7:35:41 PM | Memory: 53M of 227M

Considering delivery time

Prepare a place for another state between PotentialUser and User by moving the User state toward the bottom of the screen.



User - State

Name: User ☑ Show name

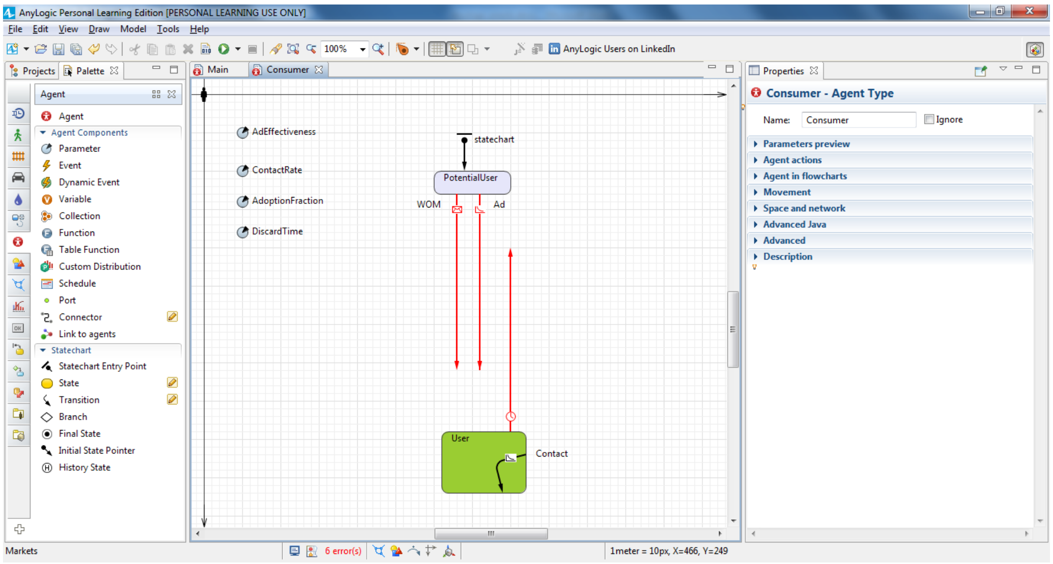
□ Ignore

Fill color: yellowGreen

Entry action: shapeBody.setFillColor(yellowGreen

Exit action:

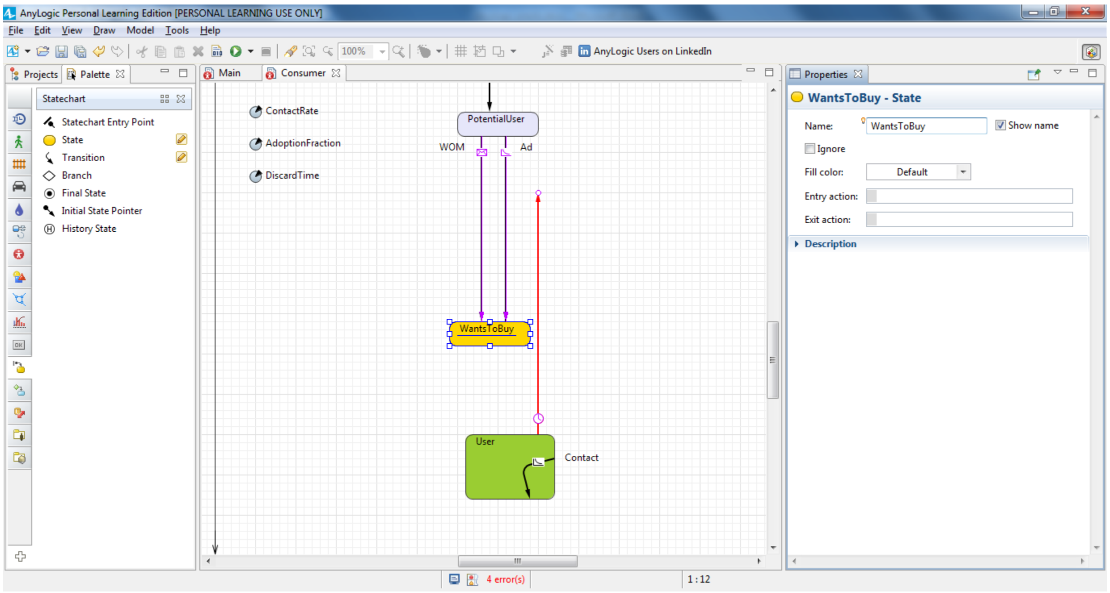
Disconnect the User state from the transitions. Select the WOM and Ad transitions, move their end points toward the top of the screen, and disconnect the Discard transition from PotentialUser. Afterward, you'll notice the disconnected transitions are drawn in red.



Consumer - Agent Type

Name: Consumer □ Ignore

Add another **State** from the **Statechart** palette to the middle of the consumer's statechart and name it WantsToBuy. Consumers in this state have decided to purchase the product, but they have not done so.



WantsToBuy - State

Name: WantsToBuy ☑ Show name

□ Ignore

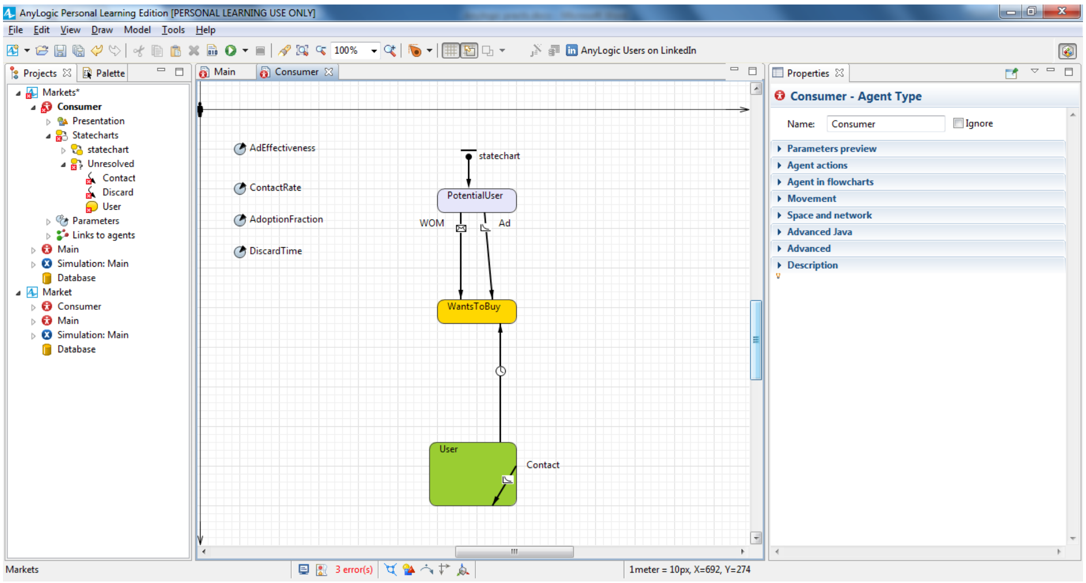
Fill color: Default

Entry action:

Exit action:

Description

Reconnect transitions to the middle state: the WOM, Ad, and Discard transitions should now end in the WantsToBuy state.



Consumer - Agent Type

Name: Consumer □ Ignore

Parameters preview

Agent actions

Agent in flowcharts

Movement

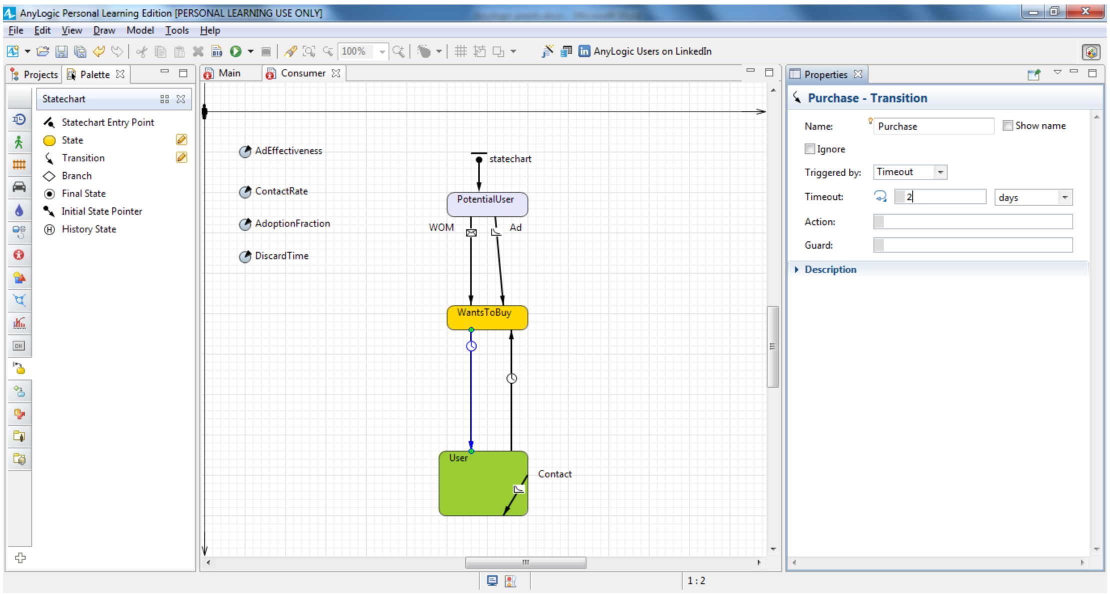
Space and network

Advanced Java

Advanced

Description

Modify WantsToBuy similar to other states:
Fill color: gold
Entry action: shapeBody.setFillColor(gold)
6. Add a transition from WantsToBuy to User state to model the product shipment and name it Purchase. Let’s assume it typically takes a user two days to get the product. This means once the consumer’s statechart enters the state WantsToBuy, it will proceed to the state User with a two-day delay. With this in mind, set 2 days timeout for the Purchase transition:



Purchase - Transition

Name: Purchase □ Show name

□ Ignore

Triggered by: Timeout

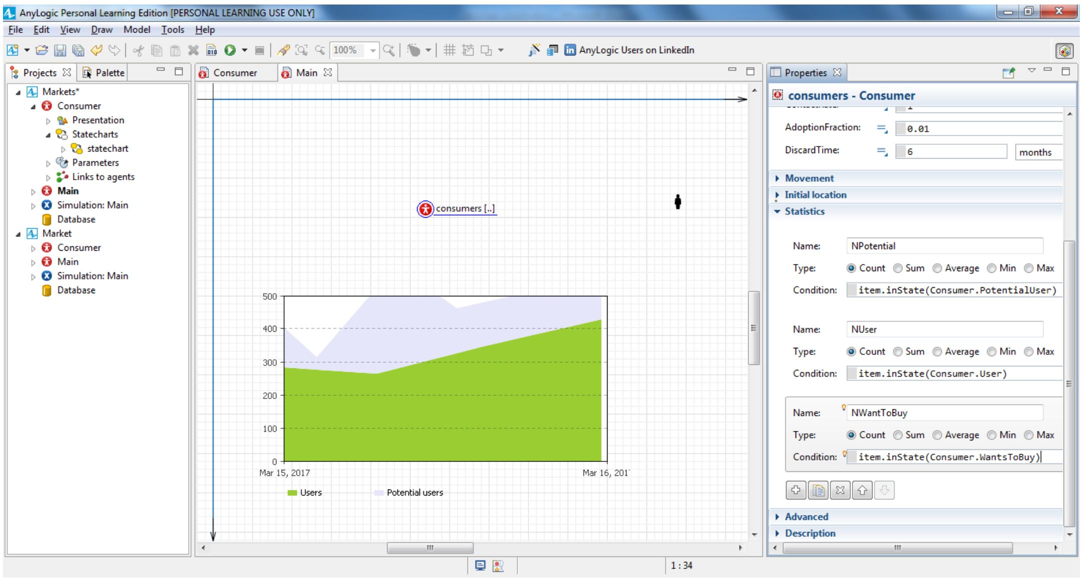
Timeout: 2 days

Action:

Guard:

Description

Define one more statistics function to count the product’s market-driven demand. In the editor of Main, click the consumers, go to the **Statistics** properties section, and add a statistics item: NWantToBuy with condition item.inState(Consumer.WantsToBuy)



consumers - Consumer

AdoptionFraction: 0.01

DiscardTime: 6 months

Statistics

Name: NPotential
Type: ● Count ○ Sum ○ Average ○ Min ○ Max
Condition: item.inState(Consumer.PotentialUser)

Name: NUser
Type: ● Count ○ Sum ○ Average ○ Min ○ Max
Condition: item.inState(Consumer.User)

Name: NWantToBuy
Type: ● Count ○ Sum ○ Average ○ Min ○ Max
Condition: item.inState(Consumer.WantsToBuy)

On Main, select the time stack chart, and add another data item to be displayed with the chart: consumers.NWantToBuy() with the title Want to buy and color gold.

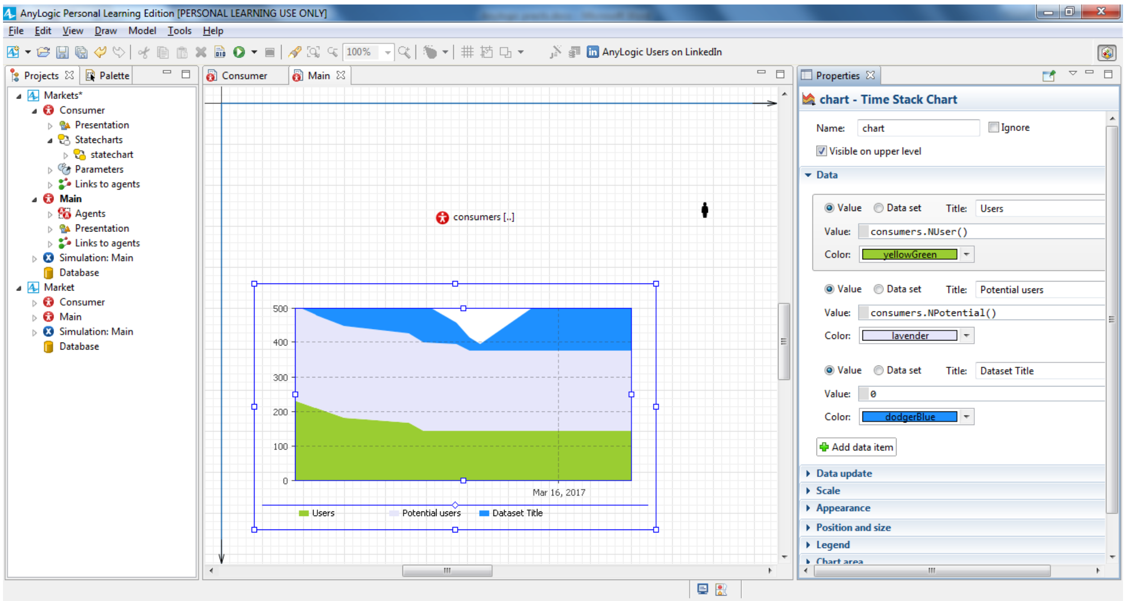


chart - Time Stack Chart

Name: chart ☐ Ignore

☑ Visible on upper level

Data

● Value ○ Data set Title: Users

Value: consumers.NUser()

Color: yellowGreen

● Value ○ Data set Title: Potential users

Value: consumers.NPotential()

Color: lavender

● Value ○ Data set Title: Dataset Title

Value: 0

Color: dodgerBlue

Add data item

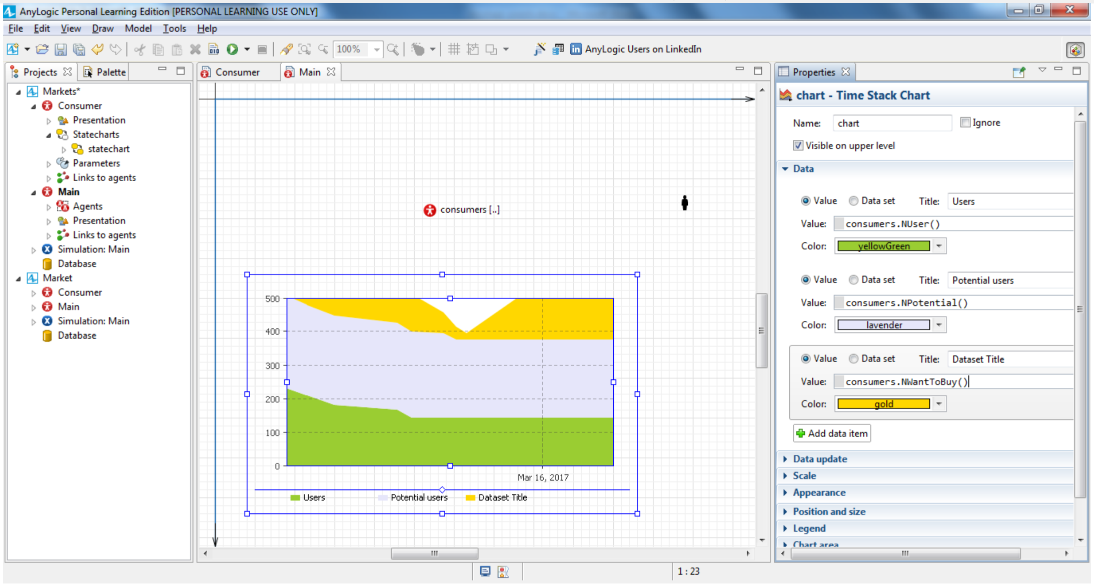


chart - Time Stack Chart

Name: chart ☐ Ignore

☑ Visible on upper level

Data

● Value ○ Data set Title: Users

Value: consumers.NUser()

Color: yellowGreen

● Value ○ Data set Title: Potential users

Value: consumers.NPotential()

Color: lavender

● Value ○ Data set Title: Dataset Title

Value: consumers.NWantToBuy()

Color: gold

Add data item

Make the newly-defined data item second in the list by selecting the item’s section and clicking the “up” button.

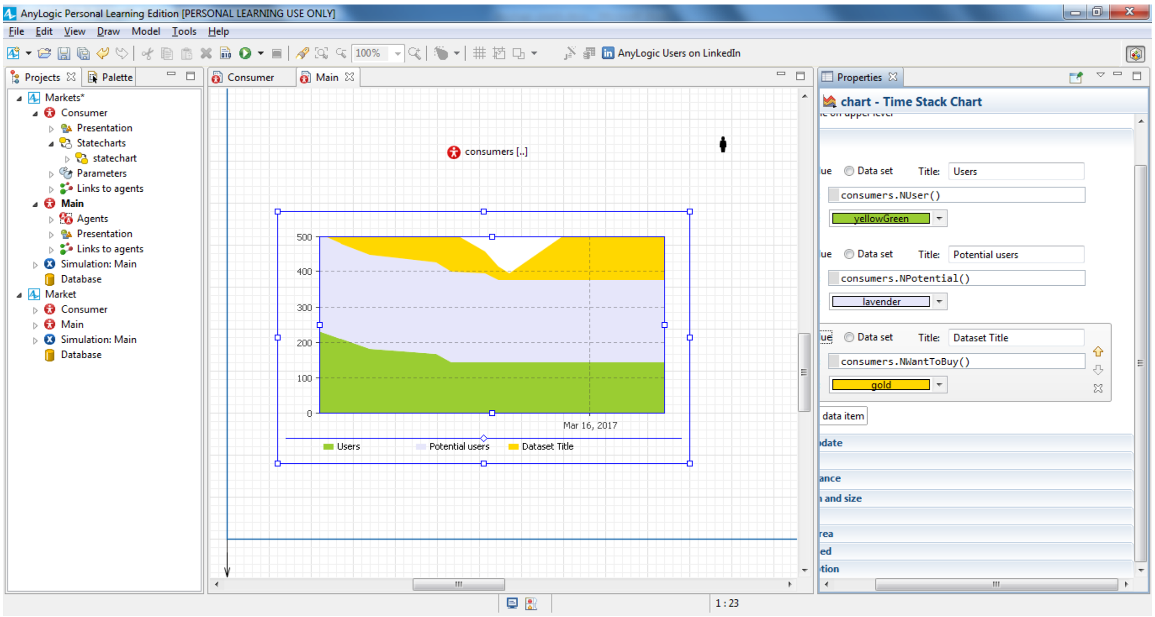


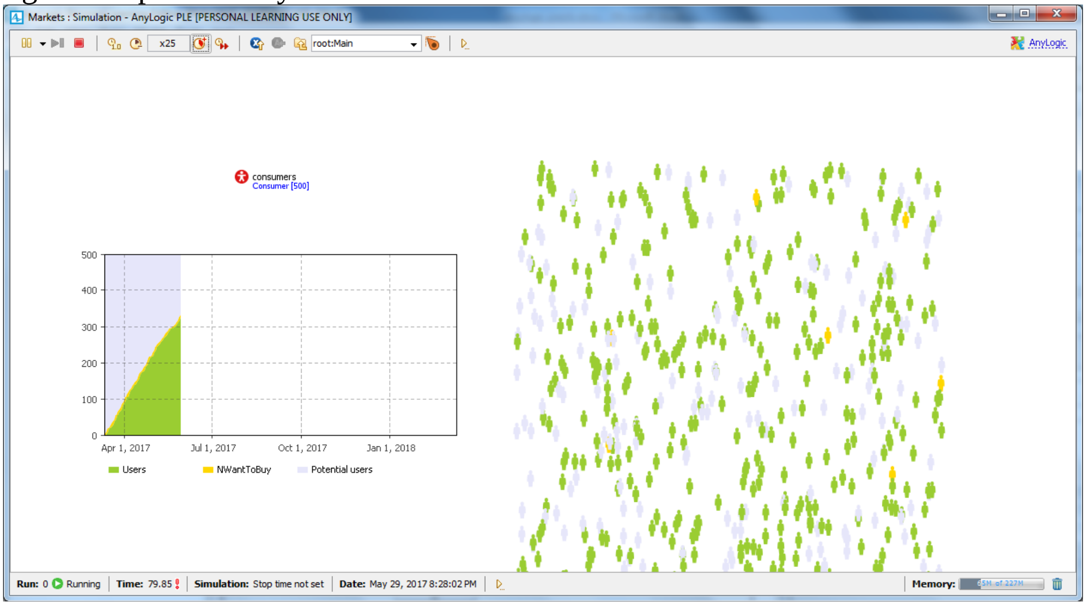
chart - Time Stack Chart

○ Data set Title: Users
consumers.NUser()
yellowGreen

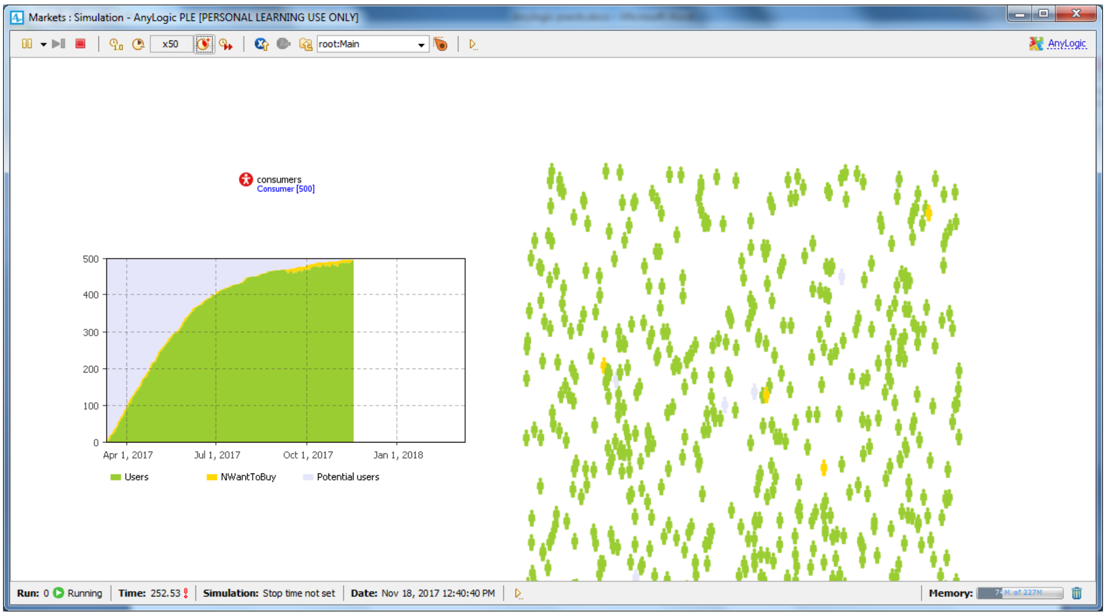
○ Data set Title: Potential users
consumers.NPotential()
lavender

○ Data set Title: Dataset Title
consumers.NWantToBuy()
gold

Run the model, and you’ll notice AnyLogic displays the number of consumers who are waiting for the product in yellow.



Run: 0 Running | Time: 79.85 | Simulation: Stop time not set | Date: May 29, 2017 8:28:02 PM



Markets : Simulation - AnyLogic PLE [PERSONAL LEARNING USE ONLY]

Run: 0 Running | Time: 252.53 | Simulation: Stop time not set | Date: Nov 18, 2017 12:40:40 PM