Modelovanie a simulácia
Dynamická simulácia

AnyLogic

3. cvičenie

Ciele cvičenia

- Použitie objektov modelu v AnyLogic-u pre modelovanie:
  - Prideľovania vlastností (atribútov) zákazníkov a ich využívanie pre sledovanie výstupných údajov
  - Empirického rozdelenia pravdepodobnosti
  - Zdrojov (obsluhujúcich entít)
  - Pridelenie zdrojov na obsluhu
  - Priority pri čakaní vo fronte

Zadanie

- Modelovaný systém – doplnenie a úprava modelu z cvičenia 2
  - Príchod návštevníkov do múzea – 1 až 4 návštevníci pri jednom vstupe
  - Atribúty návštevníkov (vlastnosti) – čas začiatku čakania, ŤZP, typ expozície
  - Nákup vstupeniek – vrátanie predbiehania vo fronte
  - Obsluha – dve zamestnankyne
- Návštevník príde do múzea, kúpi si vstupenku (ak musí, tak počká v rade pred pokladňou; ŤZP majú pri čakaní prednosť), odchádza na prehliadku múzea

Zadanie

- Vstupné údaje
  - Počet návštevníkov na jeden vstup – 1 – 25%, 2 – 30%, 3 – 35%, 4 – 10%
  - 5% návštevníkov – ŤZP
- Výstupné údaje – do modelu pridať alebo prispôsobiť
  - Priemerné časy čakania – všetci, ŤZP, zdraví
  - Maximálna a priemerná dĺžka frontu
  - Histogram pre časy čakania návštevníkov

Nové prvky simulačného modelu

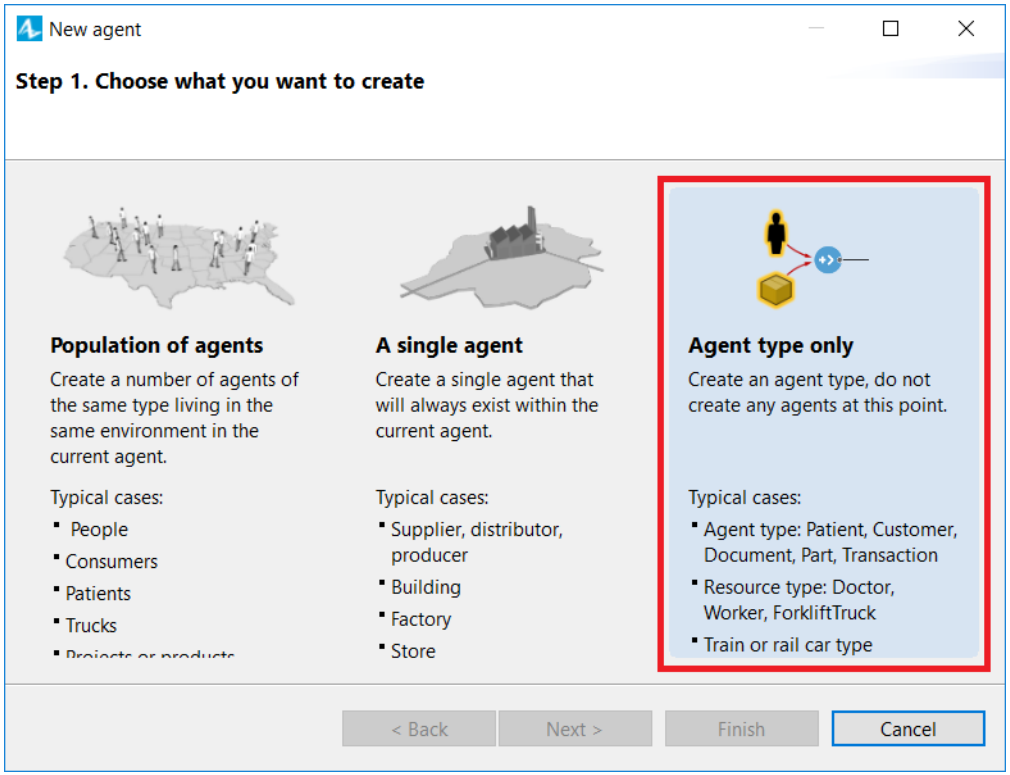
- Empirické rozdelenie pravdepodobnosti – *customDistributionArrivals*
- Atribút s informáciou o zdraví návštevníka – *parDisability*
- Zdroje (obsluhujúce entity) – *resPoolPersonnel*
- Modelovanie obsluhy iným objektom – *serviceSell*
- Štatistika pre dĺžku frontu pred pokladňou – *statQueueLength*
- Štatistiky pre časy čakania – *statWaitingTimeDisability*, *statWaitingTimeOthers*
- Údaje pre histogram časov čakania – *hdWaitingTime*

Nová trieda - návštevník

- Objekt **Agent** – knižnica **Agent**

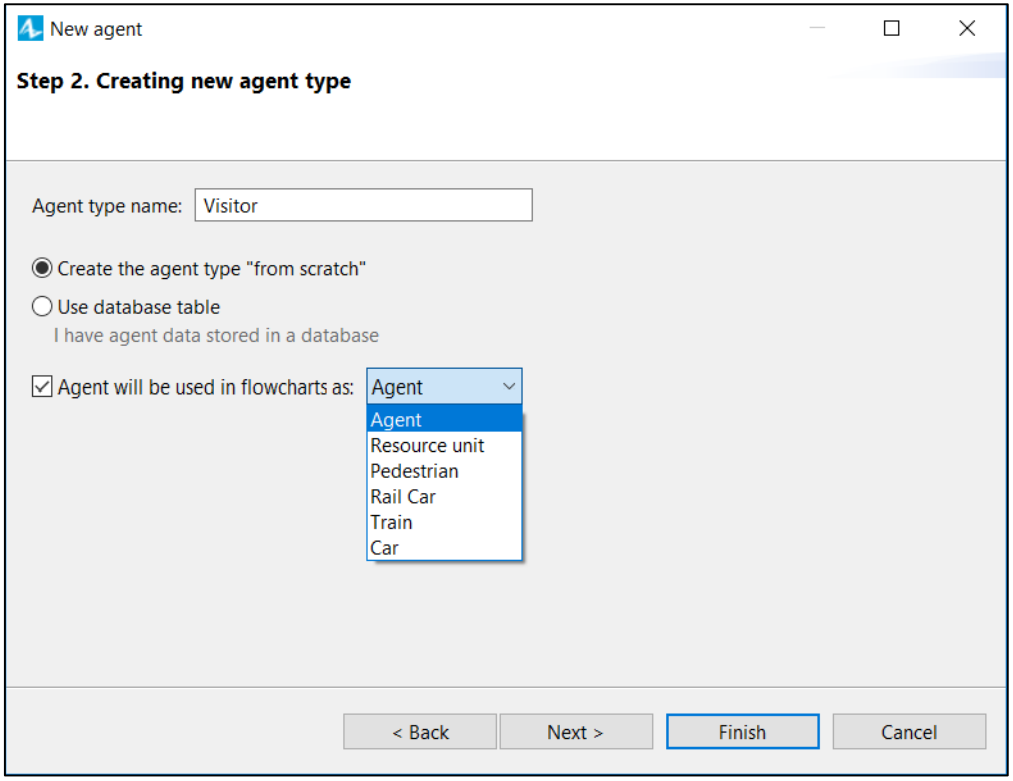
  - Chytiť a premiestniť na ľubovoľné miesto na pracovnej ploche v rámci triedy **Main**

1.



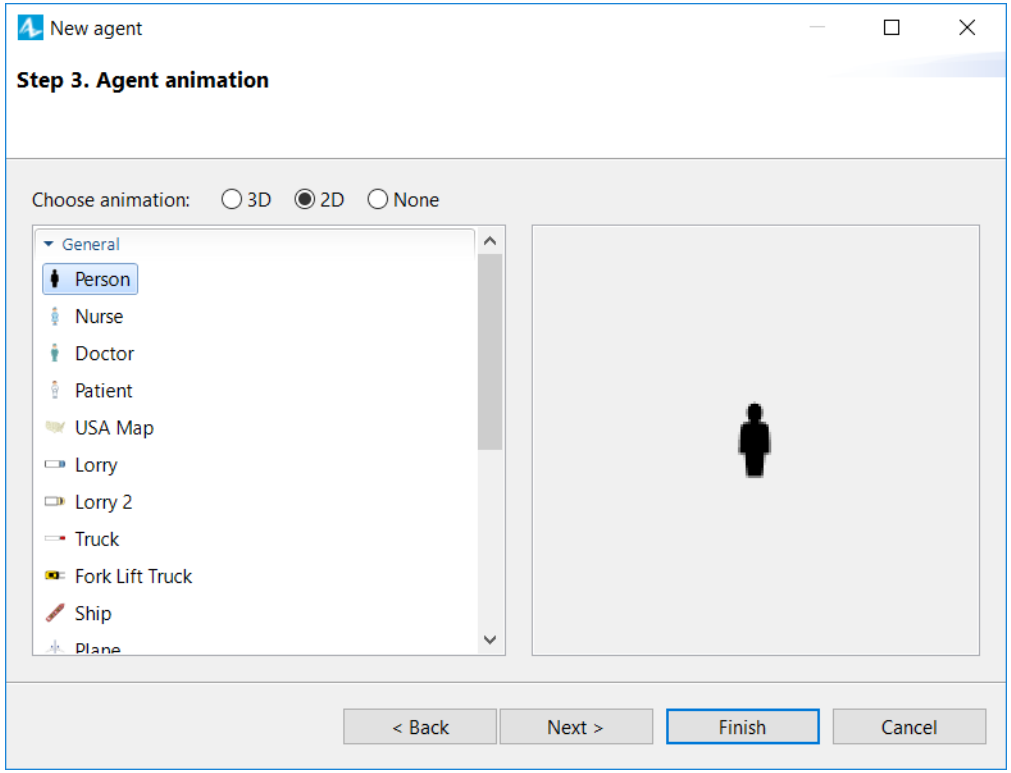
Nová trieda - návštevník

- Objekt **Agent** – knižnica **Agent**

2. 

Nová trieda - návštevník

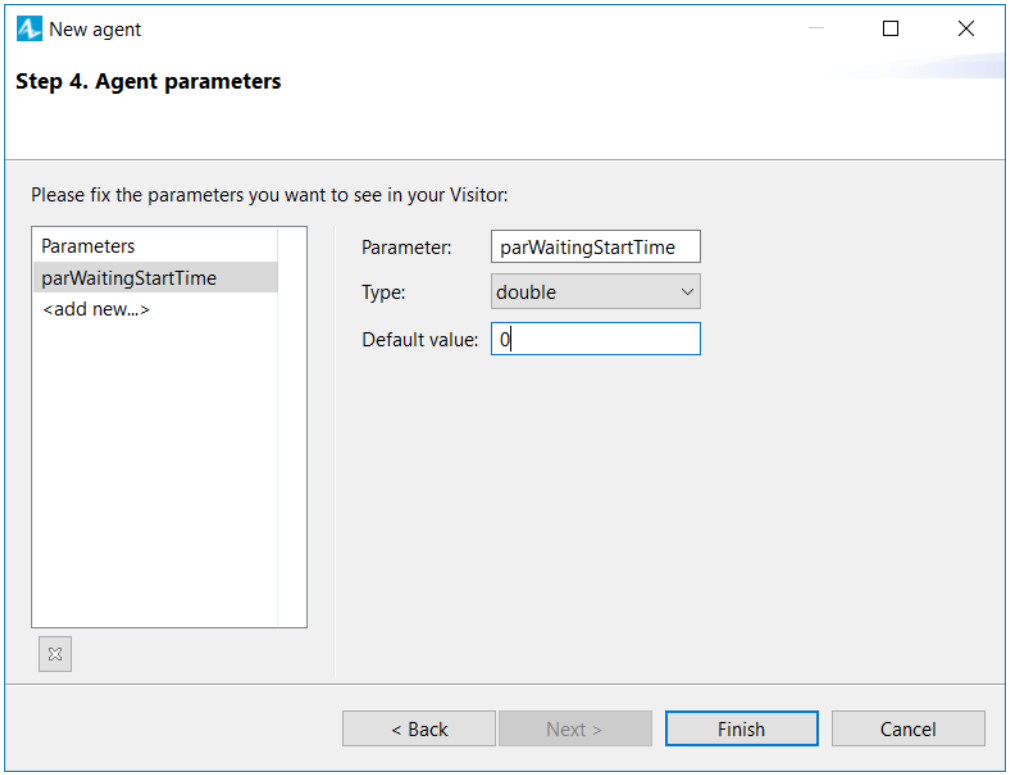
- Objekt **Agent** – knižnica **Agent**

3. 

Nový atribút – začiatok čakania

- Objekt **Agent** – knižnica **Agent**

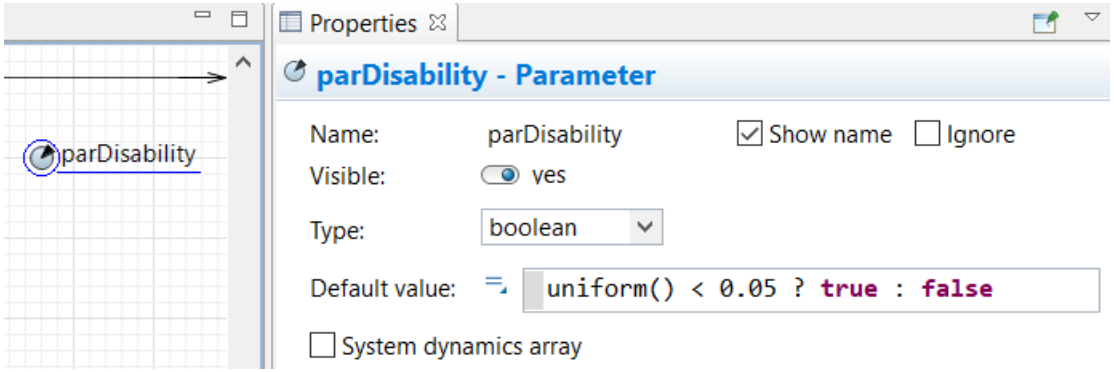
4.



Ďalší atribút – zdravotný stav

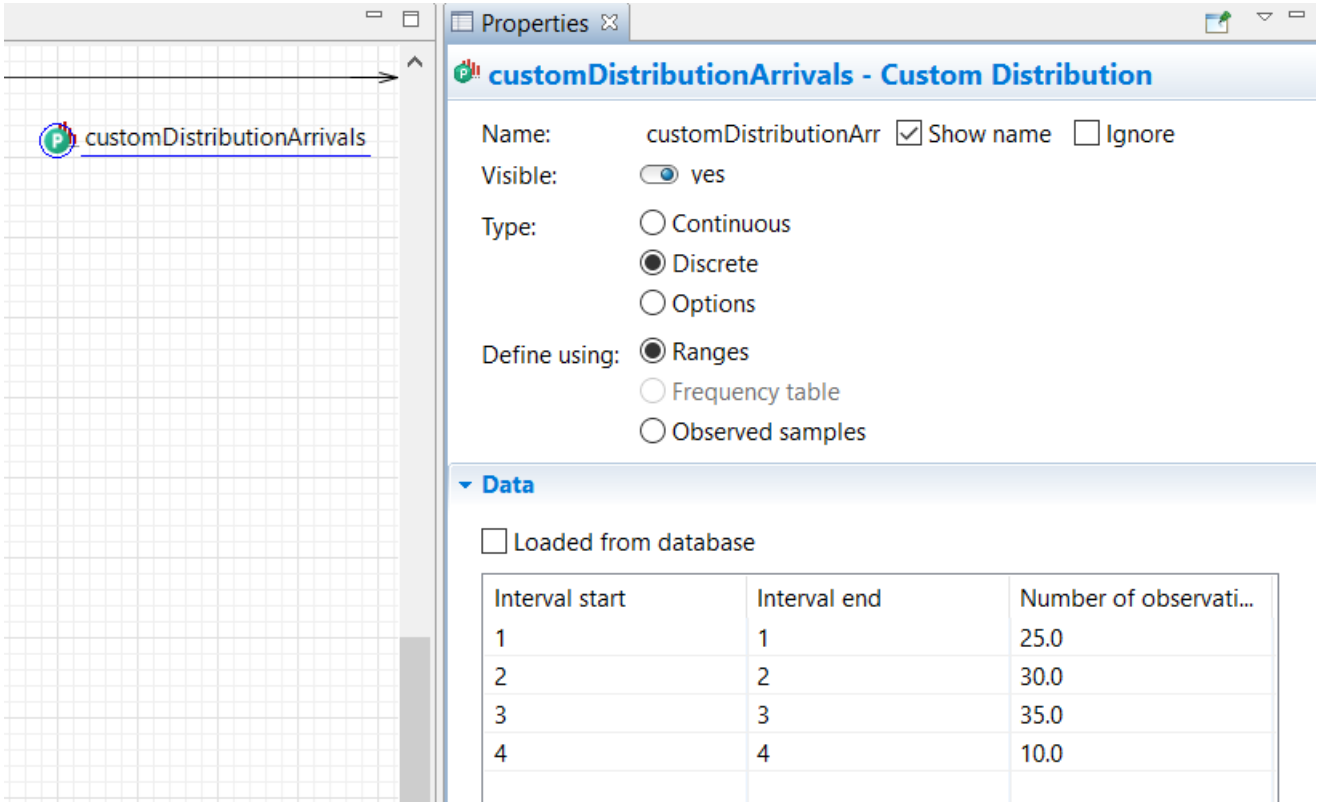
- Objekt **Parameter** – knižnica **Agent** 

  - Chytiť a premiestniť na ľubovoľné miesto na pracovnej ploche v rámci triedy **Visitor**



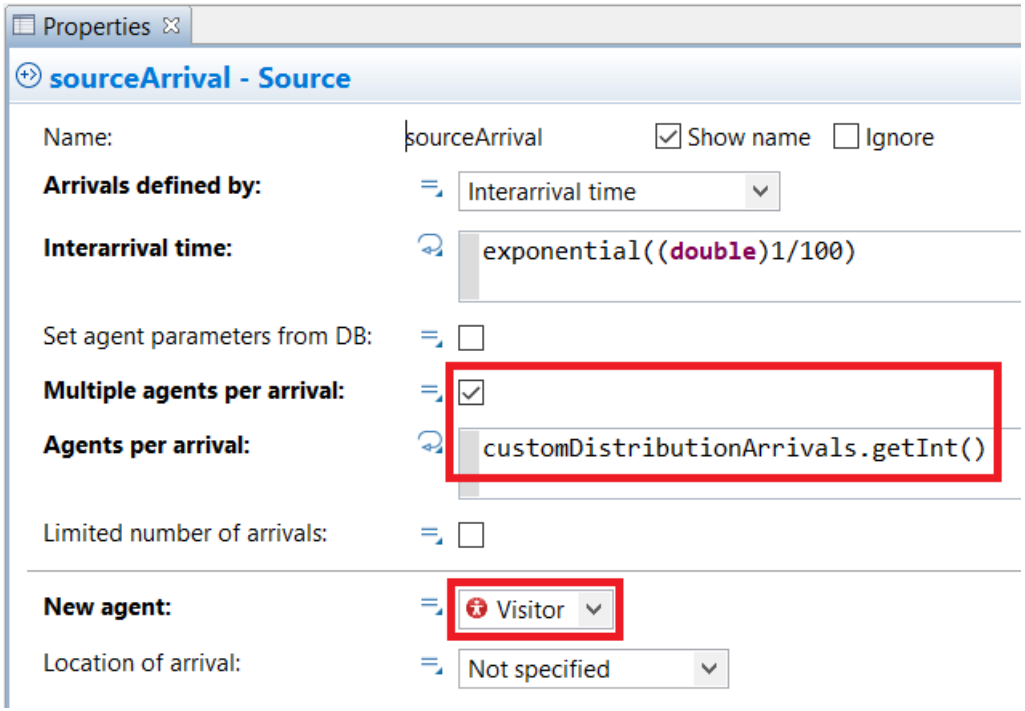
Modelovanie rôzneho počtu zákazníkov pri príchode

- Objekt **Custom Distribution** – knižnica **Agent**



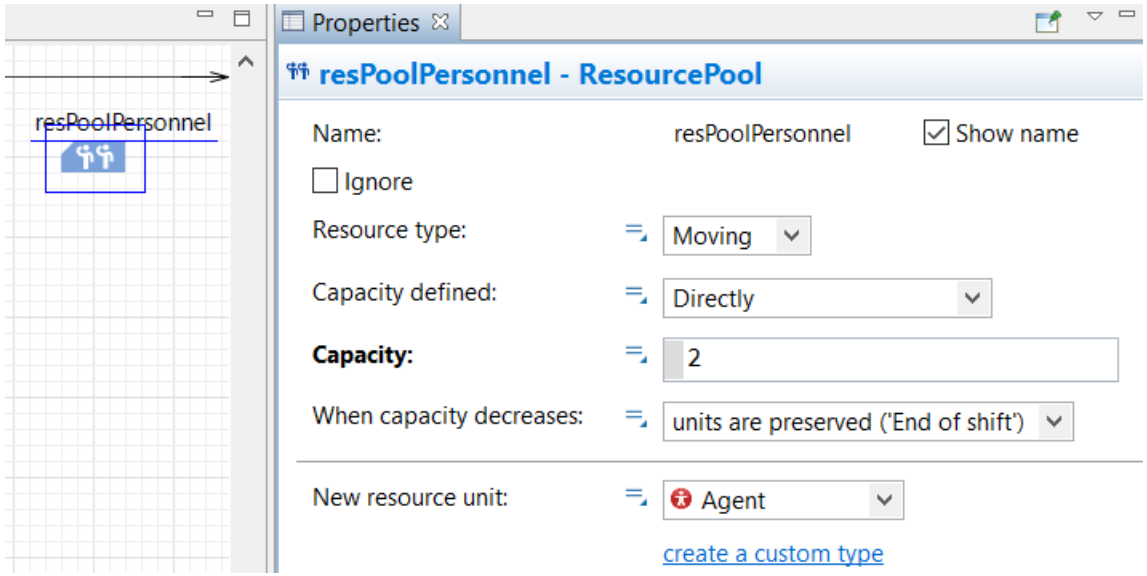
Modelovanie rôzneho počtu zákazníkov pri príchode

- Úprava objektu **sourceArrival**



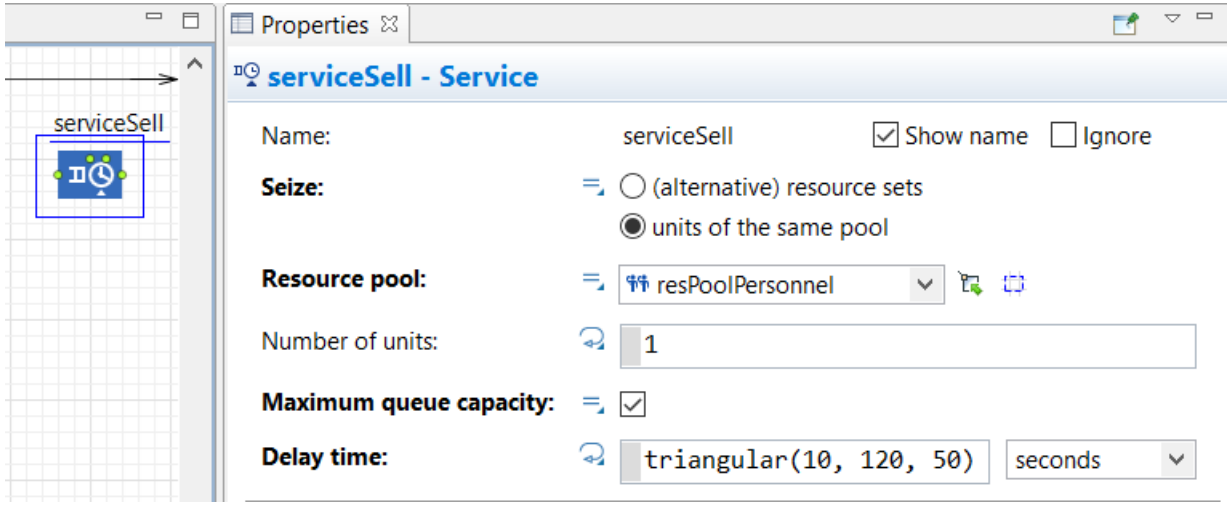
Modelovanie zdrojov

- Objekt **Resource Pool** – knižnica **Process Modeling Library**



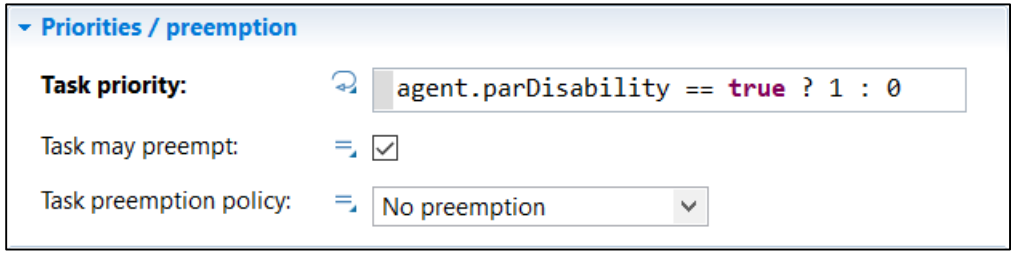
Modelovanie pridelenia zdrojov pre obsluhu

- Objekt **Service** – knižnica **Process Modeling Library**
- Nahradenie objektov **Queue** a **Delay** (vplyv na objekty štatistiky!!!)



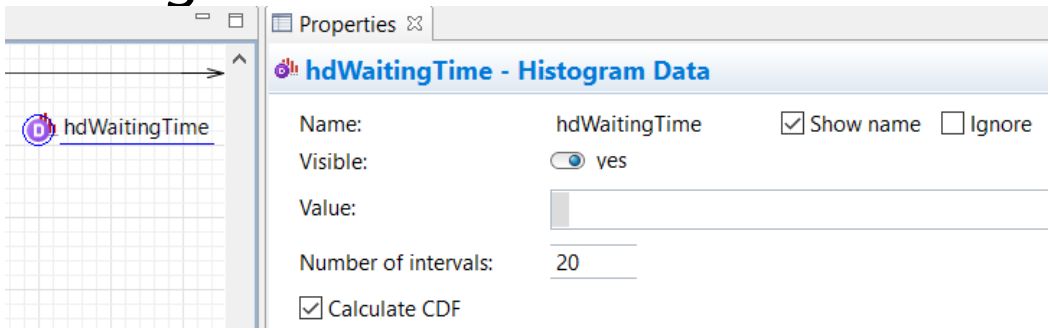
Použitie priority pri čakaní vo fronte

- V objekte **Service**, časť **Priorities / preemption**
- Odkaz na atribút *parDisability* – kontrola jeho hodnoty

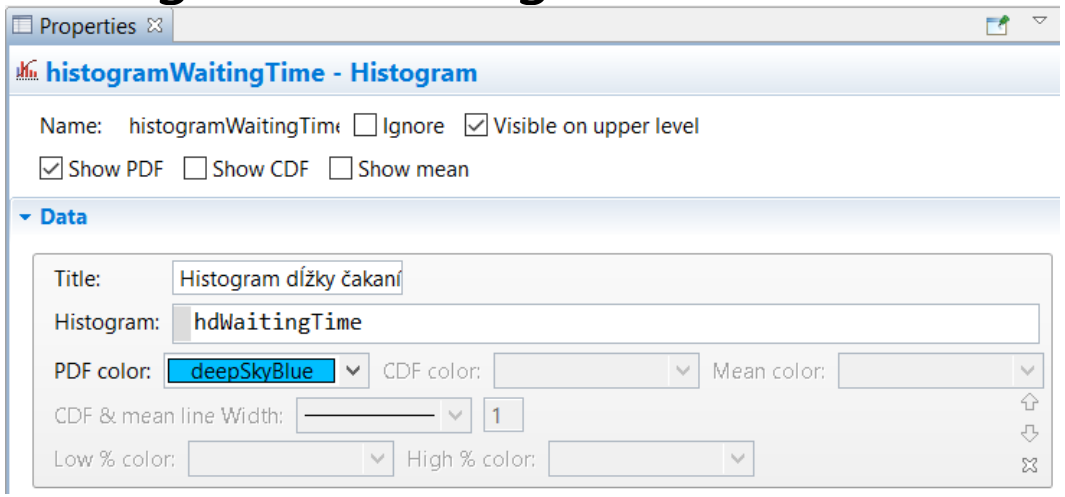


Histogram – čas čakania

- Objekt *Histogram Data*

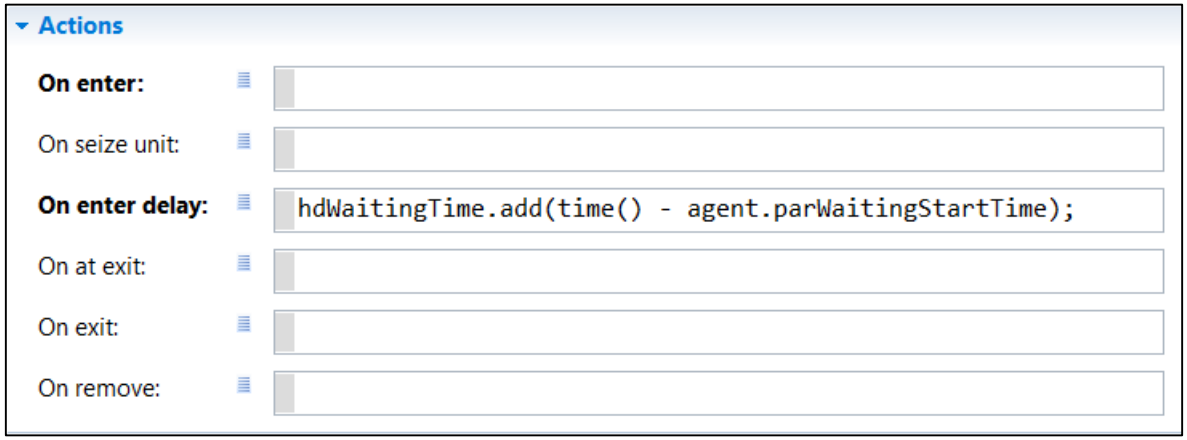


- Objekt *histogramWaitingTime*



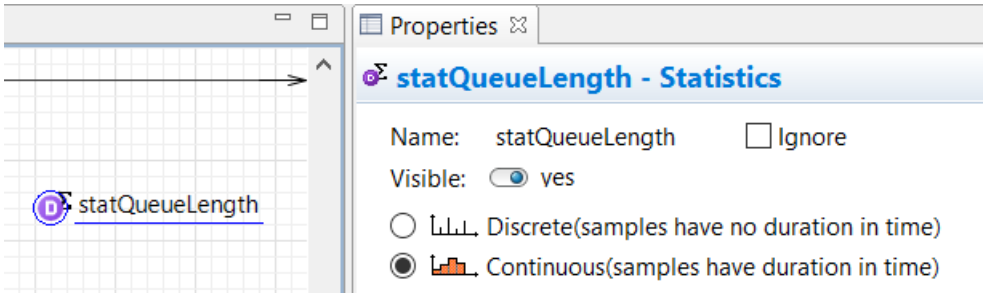
Histogram – čas čakania

- Objekt *serviceSell*

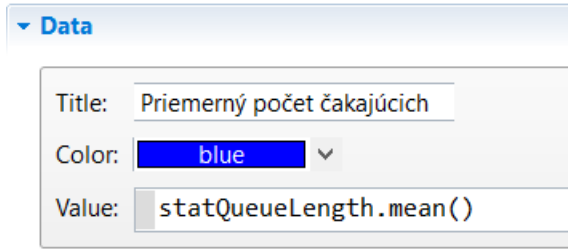


Oprava barChartAverageQueue

- Úprava maxima pre zobrazovanie – z 1 na 3
- Objekt *queueWaiting* z pred. verzie modelu je preč
- Pridanie nového objektu **Statistics**

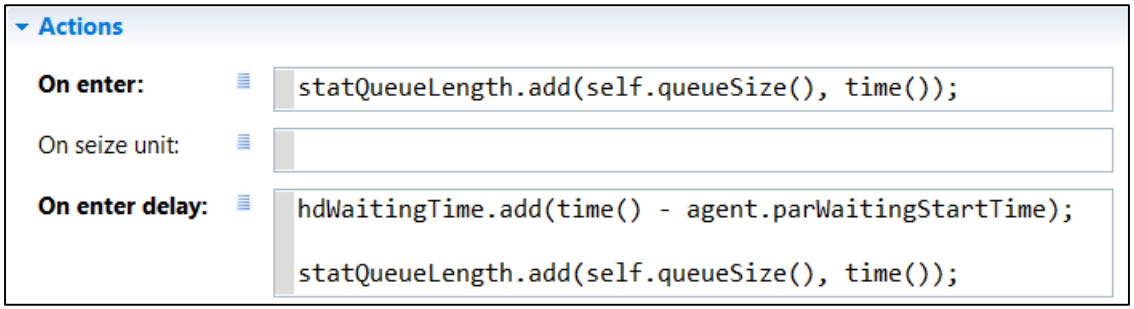


- Odkaz na výstupy z objektu – *statDlzkaFrontu.mean()*



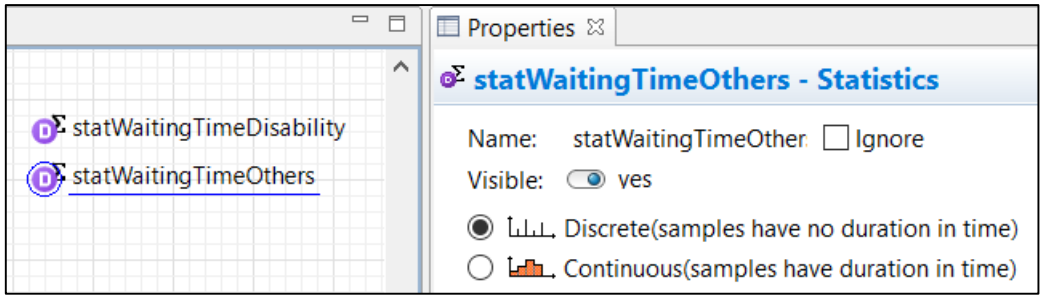
Oprava barChartAverageQueue

- Objekt *serviceSell*

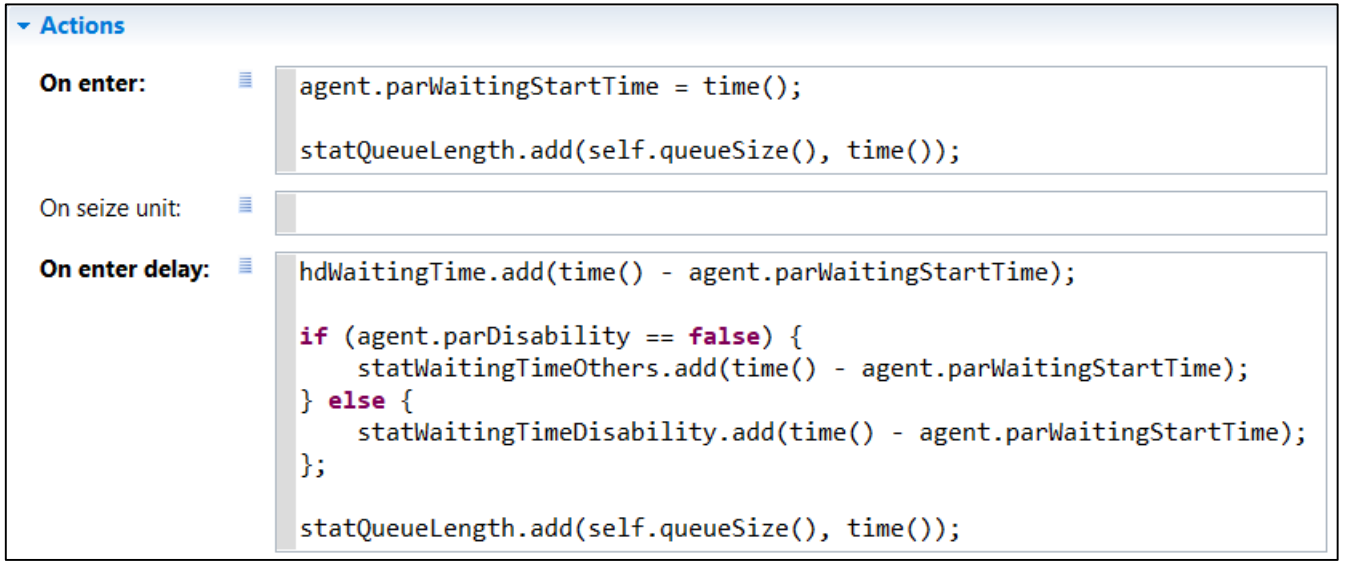


Štatistiky pre časy čakania

- Nové objekty **Statistics** (rovnaké nastavenie)

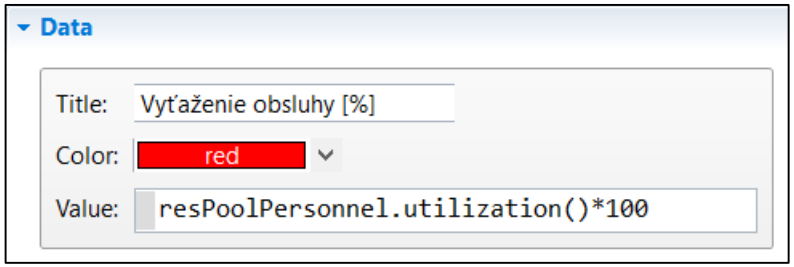


- Kód v objekte *serviceSell* (**Service**)



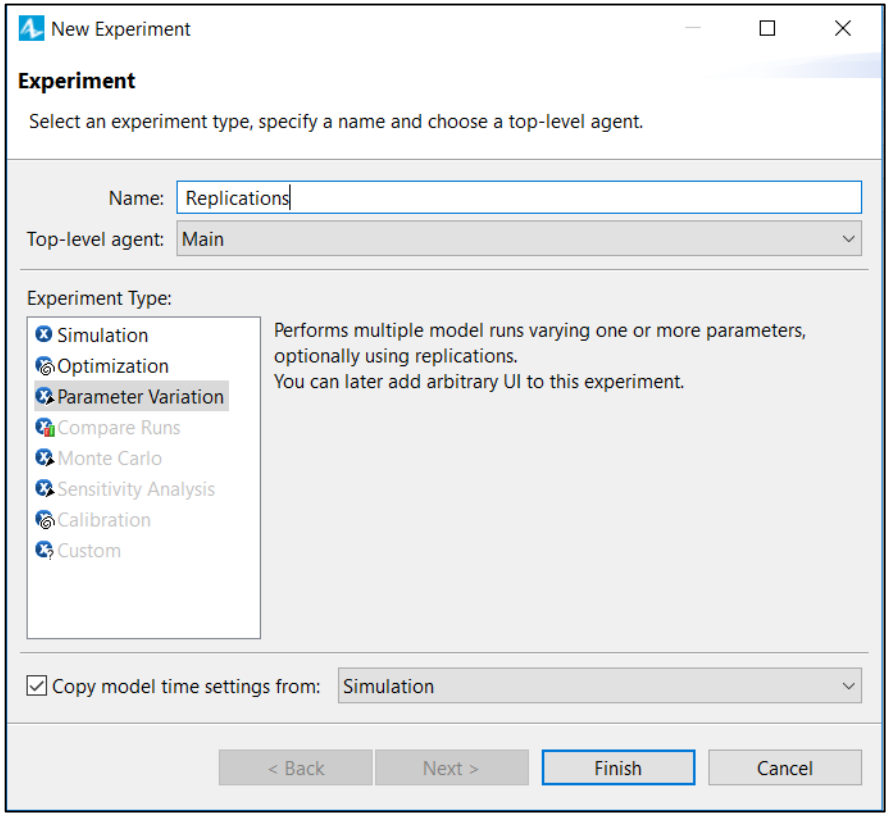
Oprava barChartSellUtilization

- Objekt *serviceSell* (pôvodne ako objekt **Delay**) z predchádzajúcej verzie modelu je preč
- Odkaz na výstupy z objektu **Resourse Pool** –



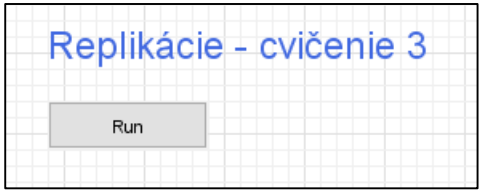
Definovanie replikácií

- **New – Experiment**

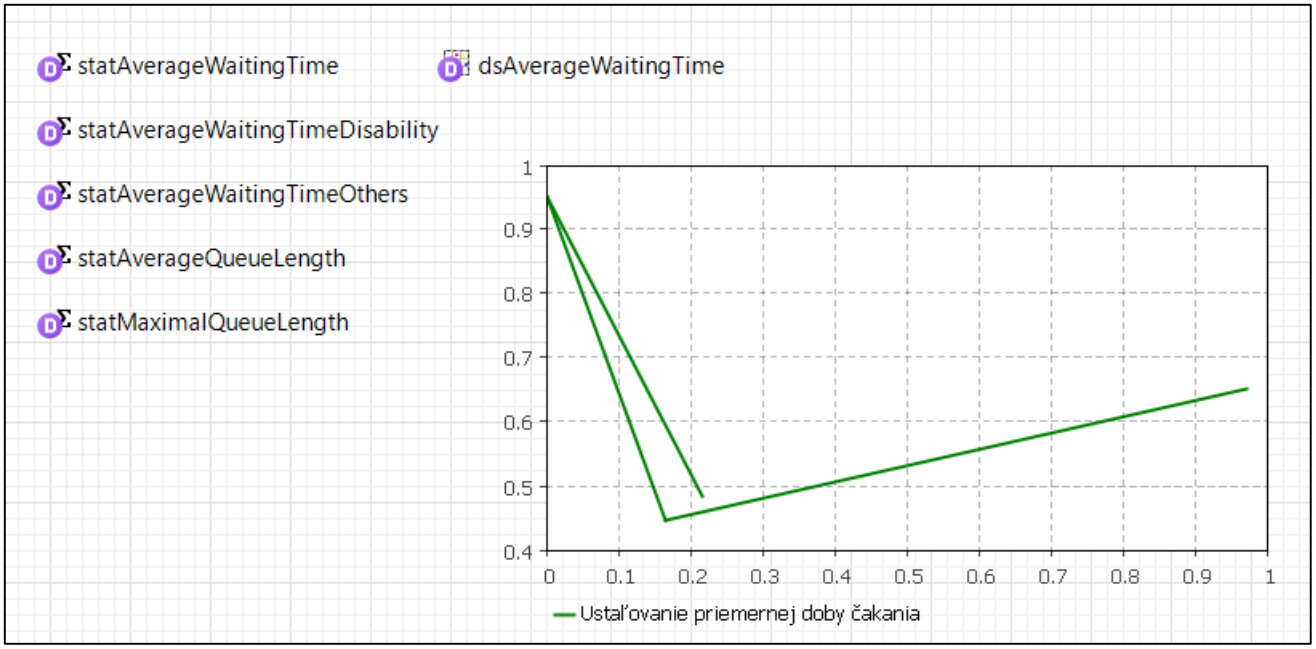


Definovanie replikácií

- Properties – *Create default UI*

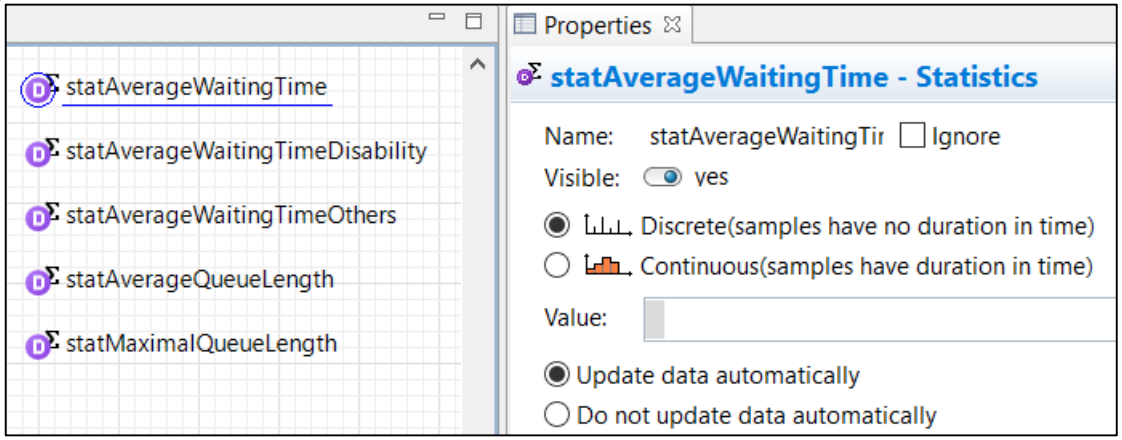


- Objekty **Statistics**, **Data Set** a **Plot**

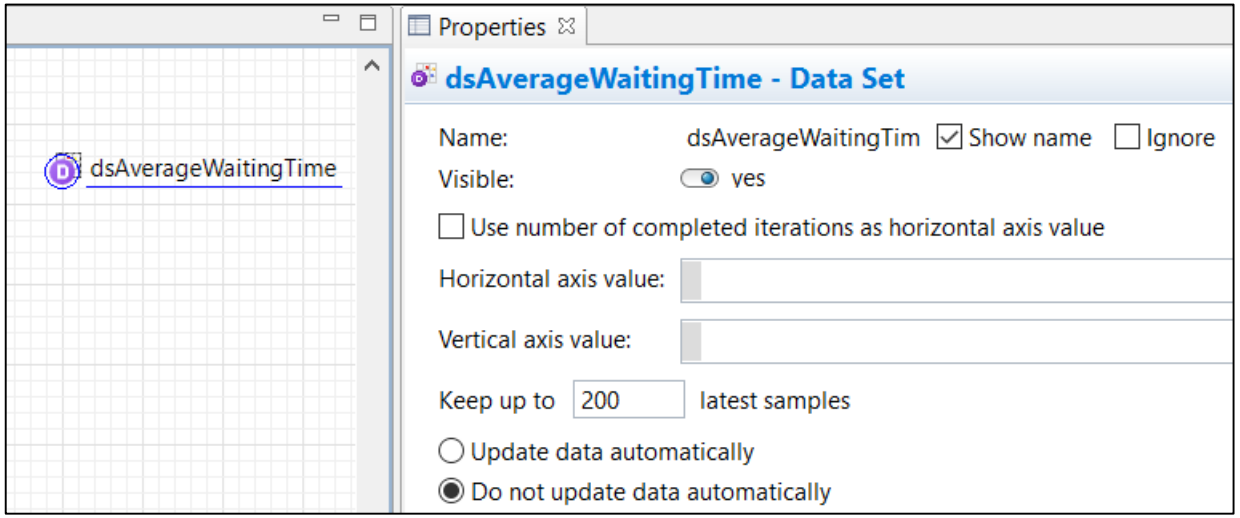


Definovanie replikácií

- Objekty **Statistics**

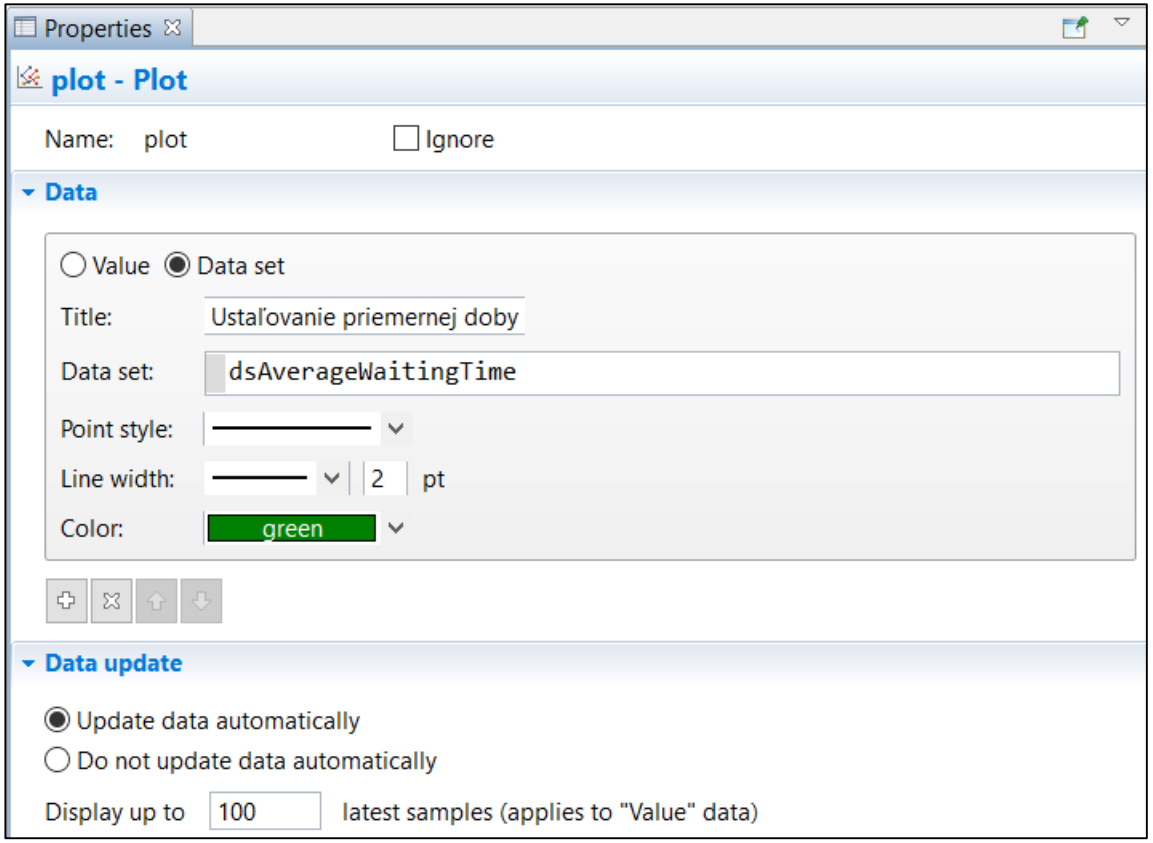


- Objekt **Data Set**

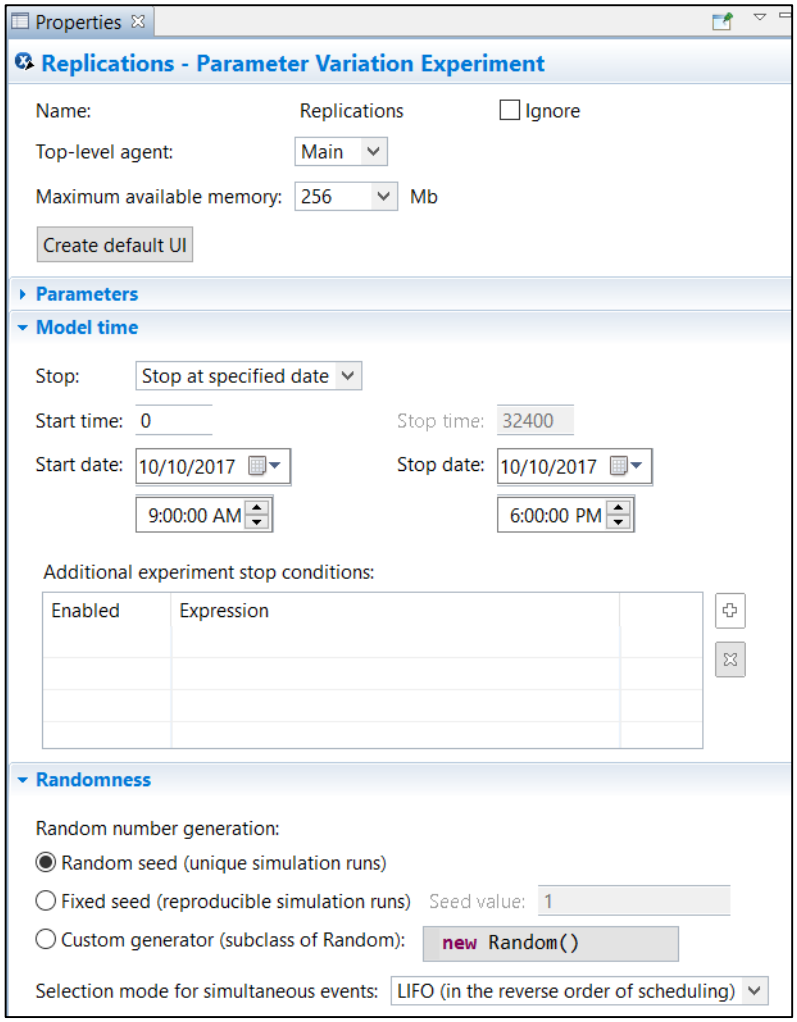


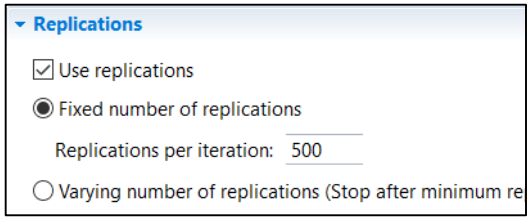
Definovanie replikácií

- Objekt **Plot**

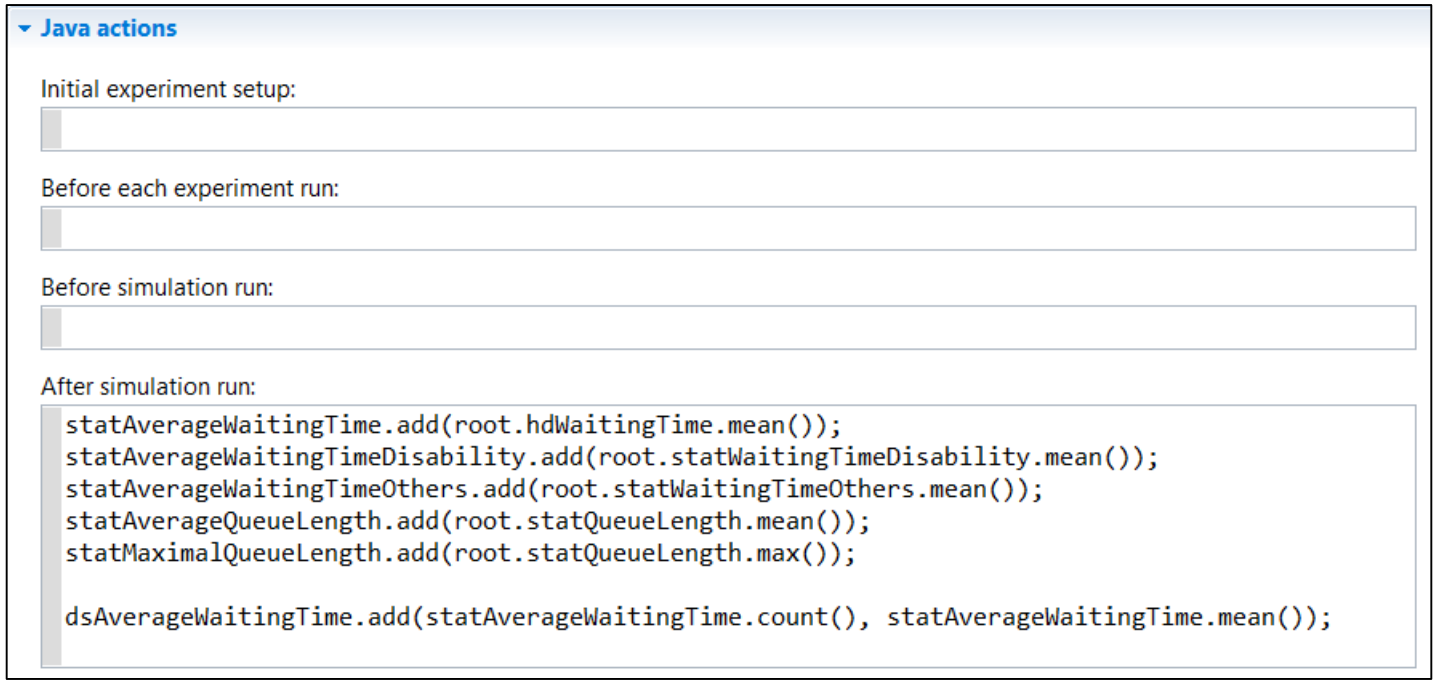


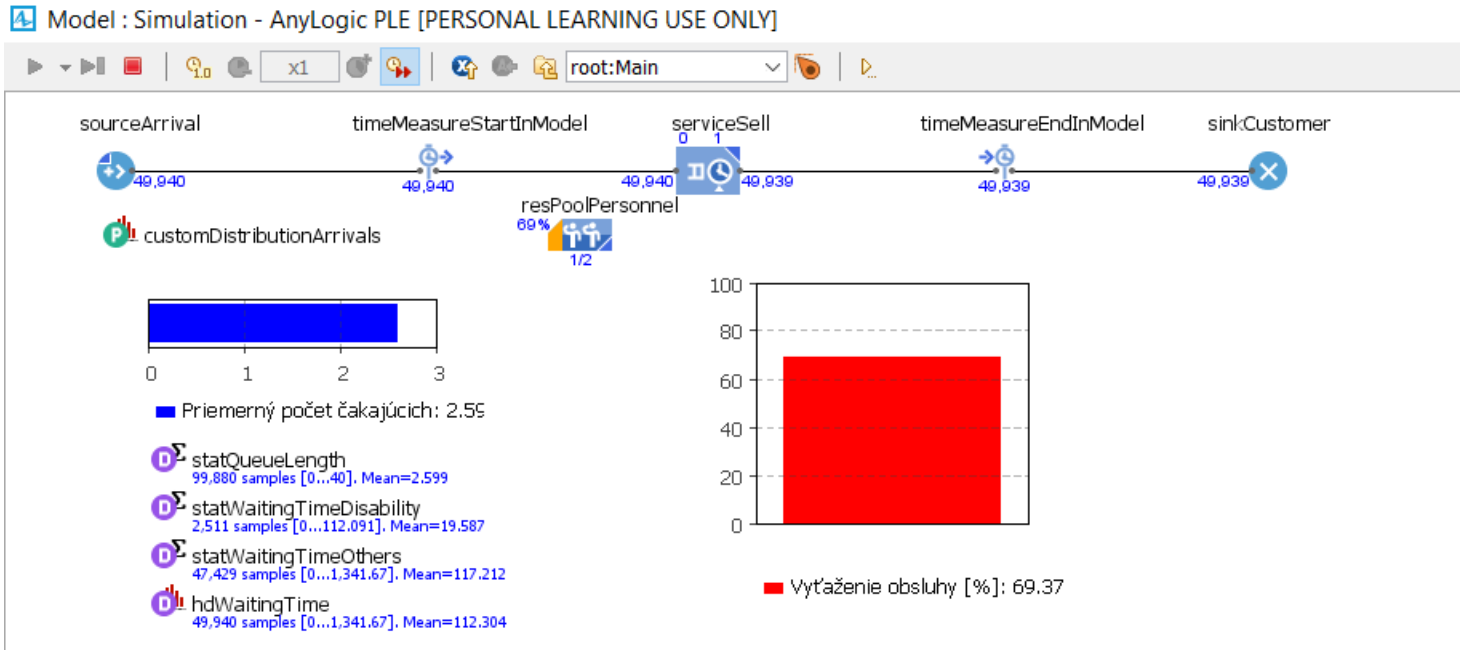
Definovanie replikácií





Definovanie replikácií




Model : Simulation - AnyLogic PLE [PERSONAL LEARNING USE ONLY]
x1
root:Main
sourceArrival
timeMeasureStartInModel
serviceSell
timeMeasureEndInModel
sinkCustomer
49,940
49,940
49,940
49,939
49,939
49,939
0
1
resPoolPersonnel
69%
1/2
customDistributionArrivals
0
1
2
3
Priemerný počet čakajúcich: 2.59
statQueueLength
99,880 samples [0...40], Mean=2.599
statWaitingTimeDisability
2,511 samples [0...112.091], Mean=19.587
statWaitingTimeOthers
47,429 samples [0...1,341.67], Mean=117.212
hdWaitingTime
49,940 samples [0...1,341.67], Mean=112.304
100
80
60
40
20
0
Vyťaženie obsluhy [%]: 69.37

Model cv 3 : ParametersVariation - AnyLogic PLE [PERSONAL LEARNING USE ONLY]

Replikácie - cvičenie 3

Run

statAverageWaitingTime
500 samples [54.066...222.177], Mean=106.059

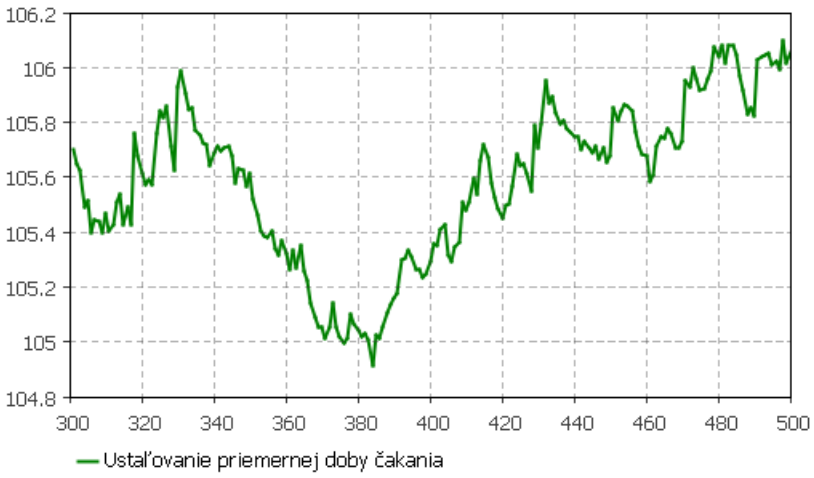
statAverageWaitingTimeDisability
500 samples [11.076...27.473], Mean=19.371

statAverageWaitingTimeOthers
500 samples [56.059...231.302], Mean=110.616

statAverageQueueLength
500 samples [1.088...5.413], Mean=2.481

statMaximalQueueLength
500 samples [10...39], Mean=18.968

dsAverageWaitingTime
200 samples ...[500, 106.059]



Koniec