

Warteschlangensimulator [unsaved model file]

File Edit View Model Simulation Extras Help Quick access (Strg+E) Feedback

Load model Save model Model editor Simulation results Start animation Start simulation Parameter series Help

**Model**

**Element**

**Edge**

**Overview**

**Erlang C comparison model**

This simple model can be fully described by the Erlang C formula.

Number of clients at the process station (current value and average over the complete run time)

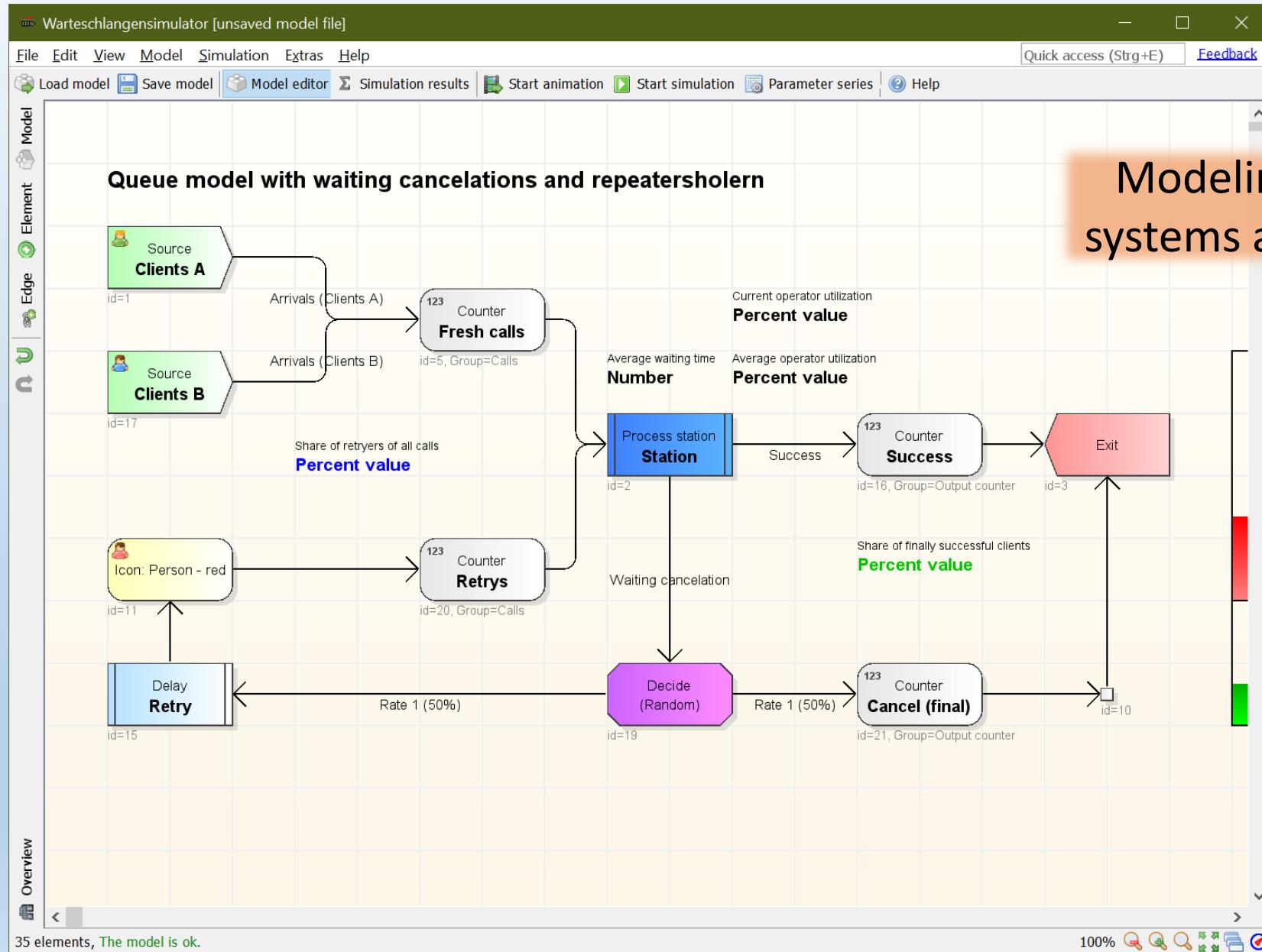
Fraction of time for the numbers of clients

(blue=0, green=1, red=2..10, orange=11...)

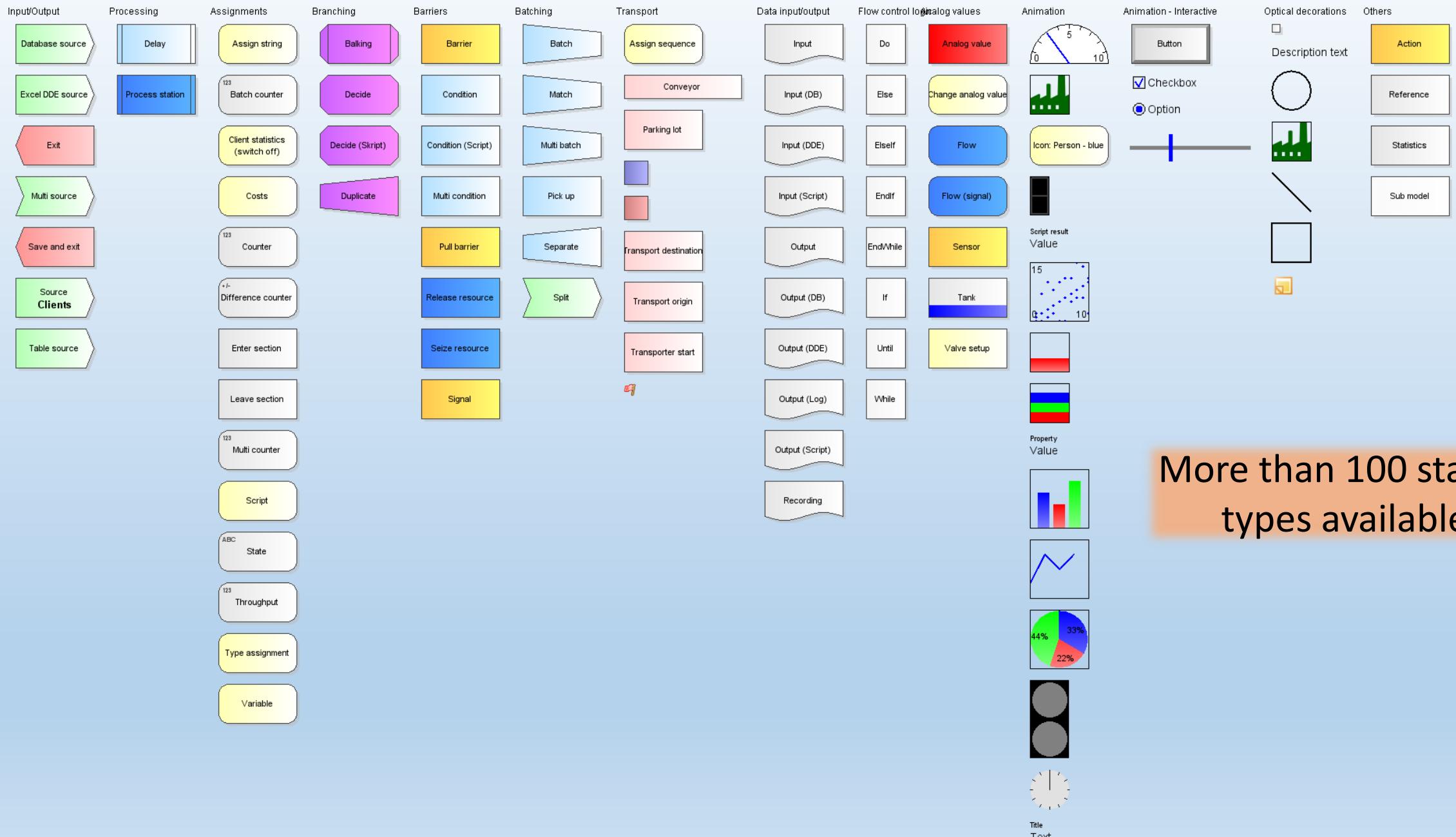
12 elements, The model is ok.

100%

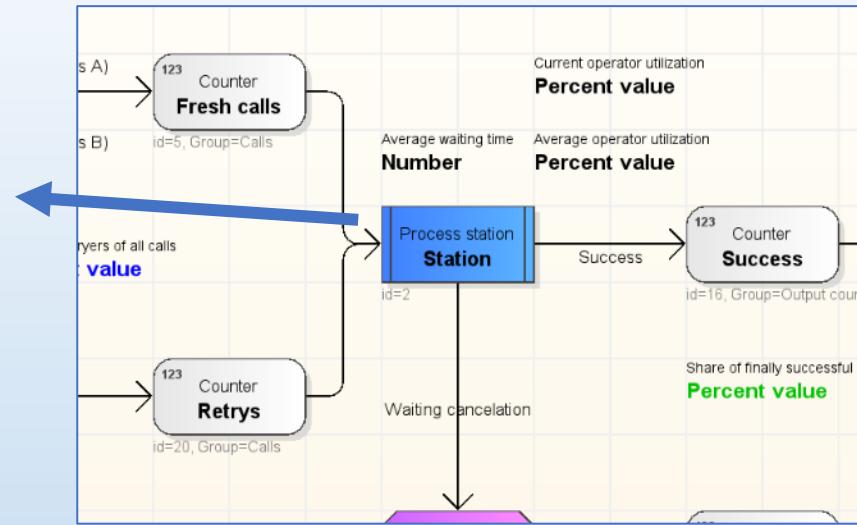
**Warteschlangensimulator**  
Fast and versatile event-driven  
stochastic simulator



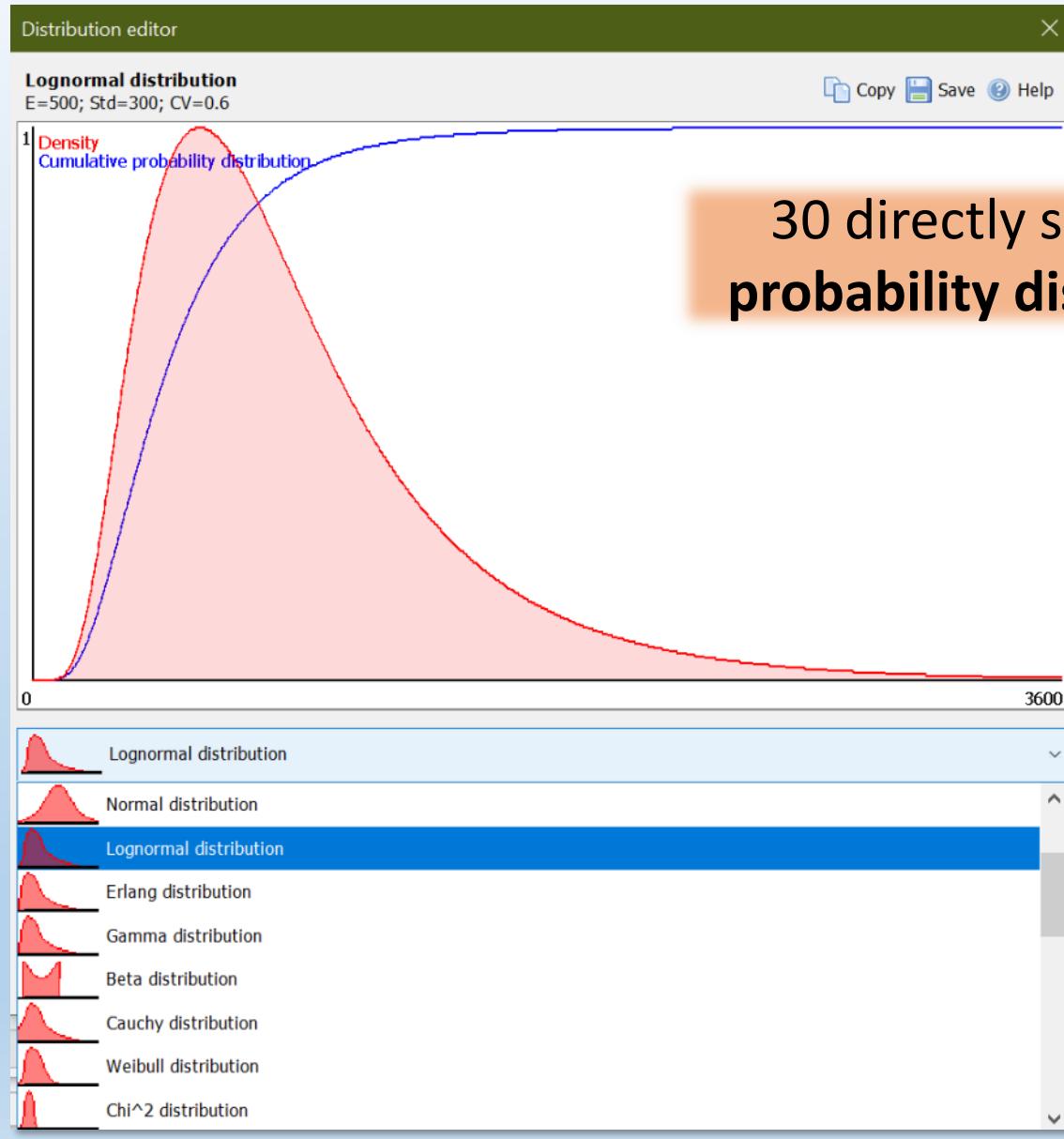
Modeling queueing systems as flow charts



More than 100 station types available

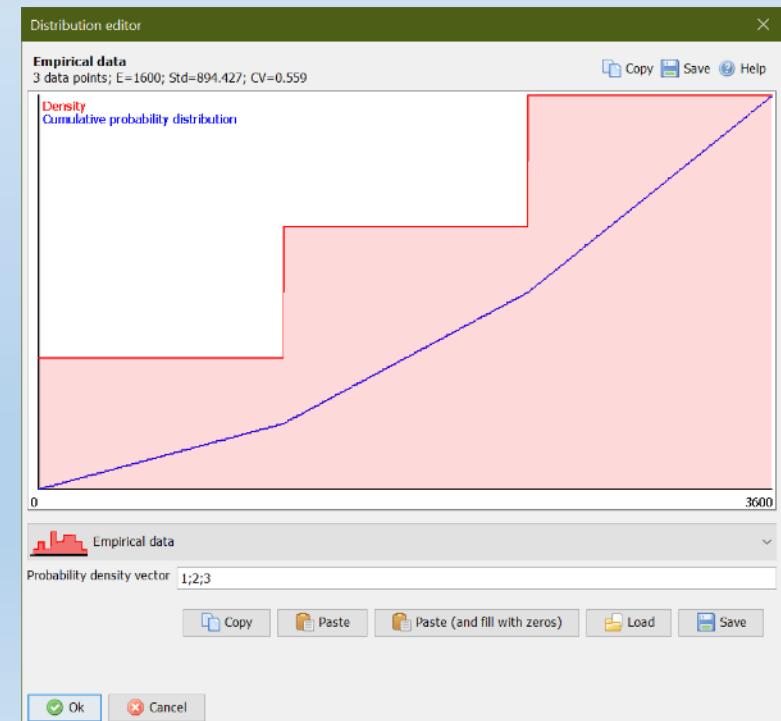


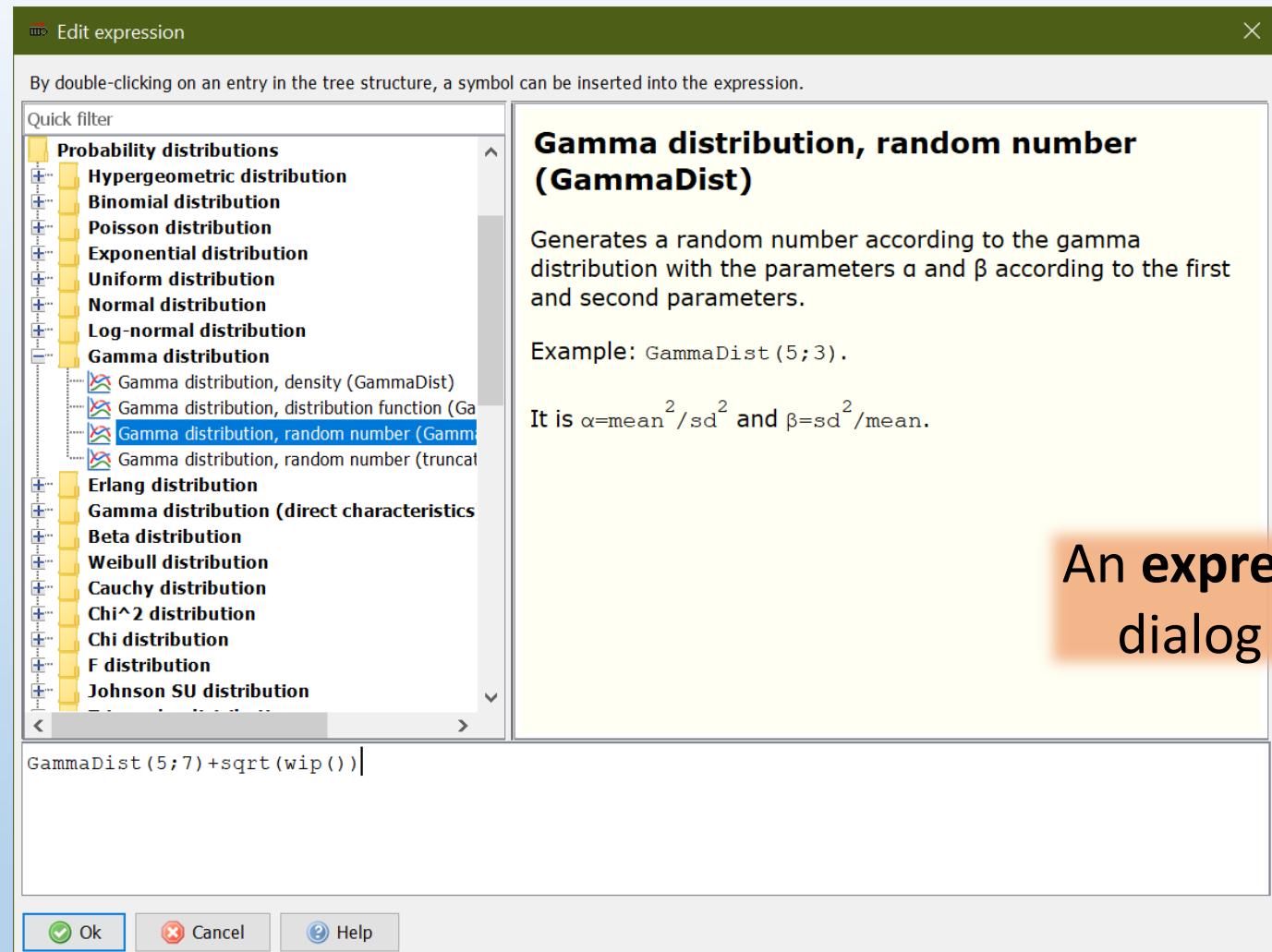
Many optional settings  
for each station



30 directly selectable  
probability distributions

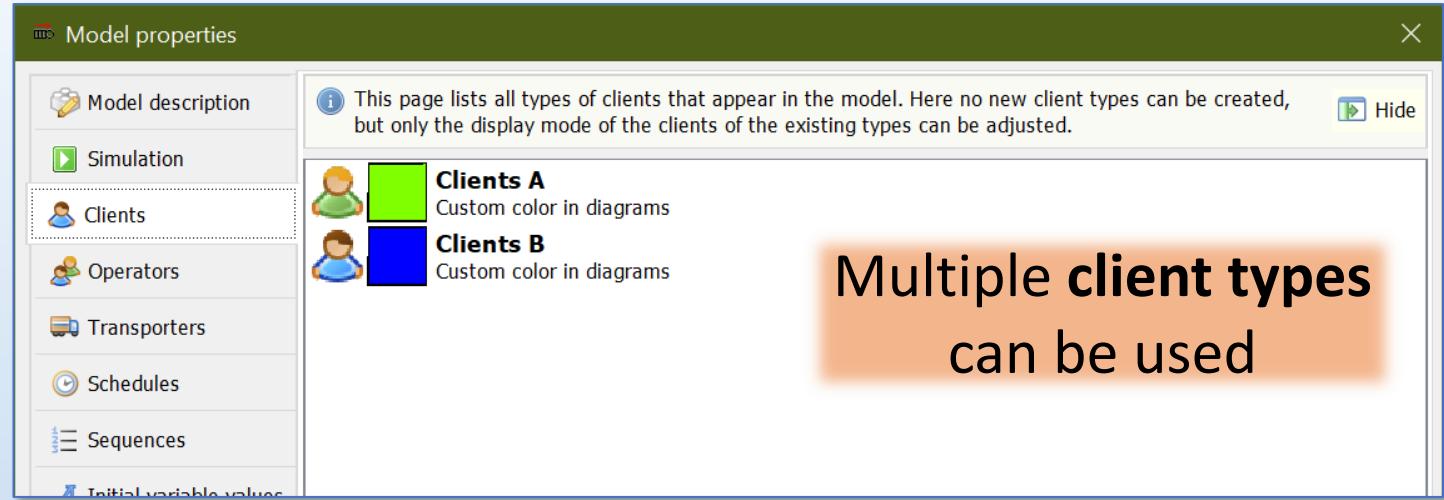
... including the option to use  
loaded empirical data





Calculation expressions  
can also be used

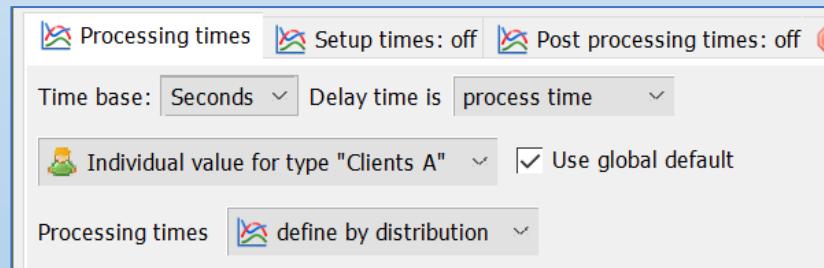
An expression builder  
dialog is available

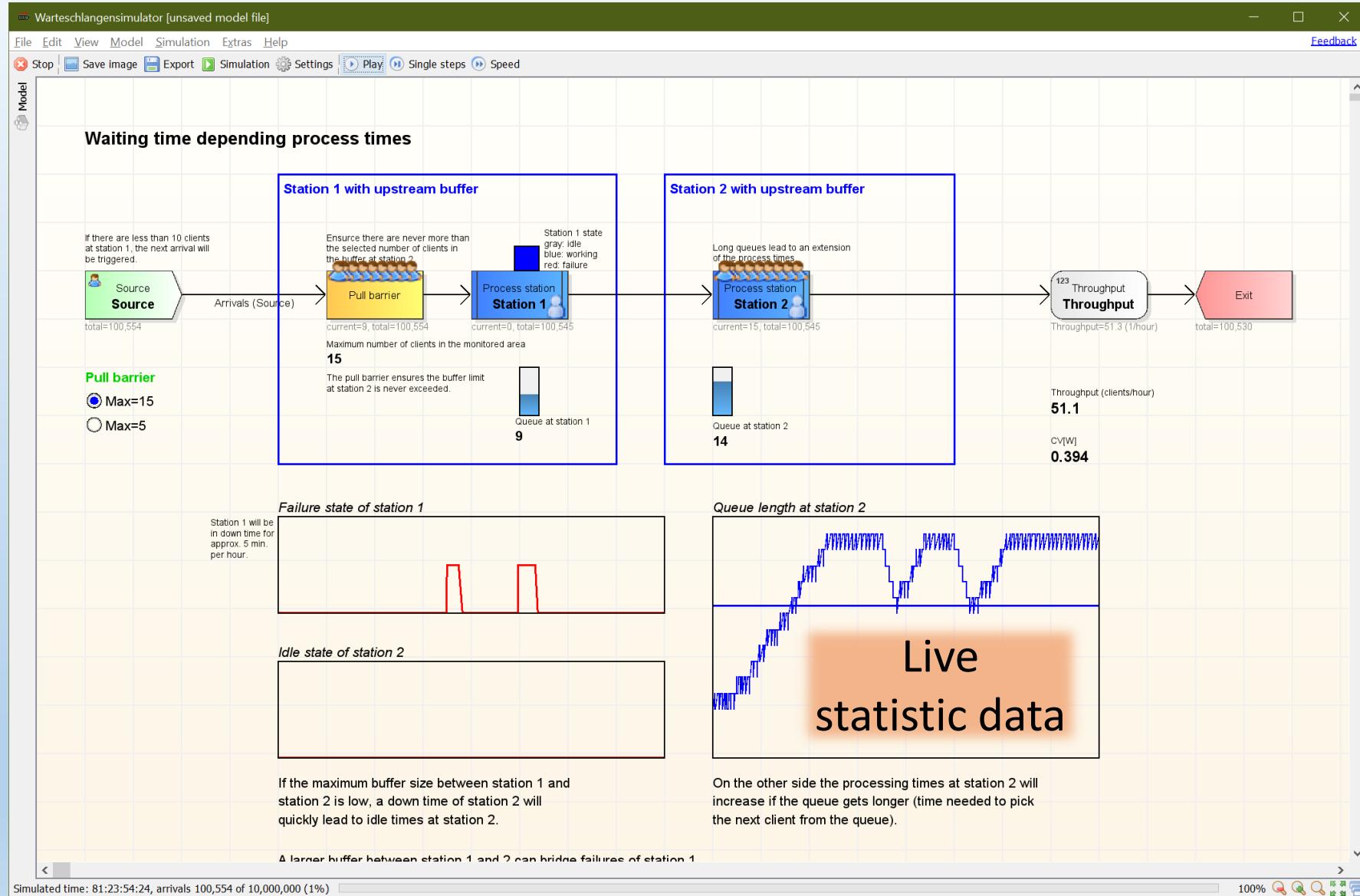


Multiple client types  
can be used



Each type can have an  
individual parameters

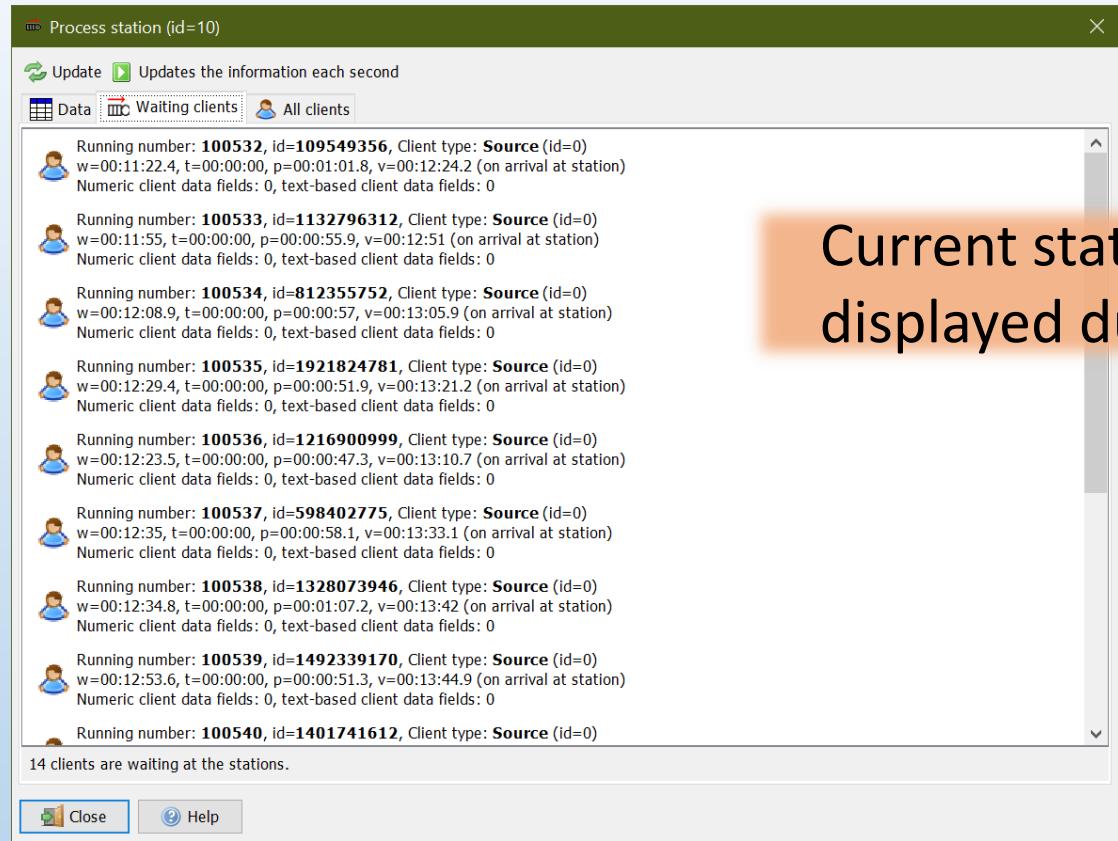




## Animation of models

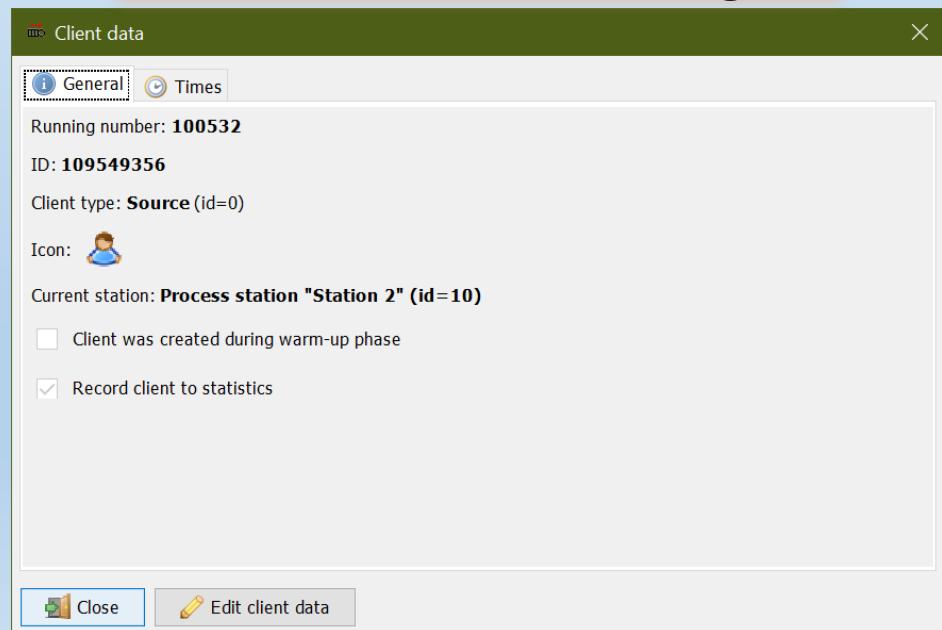
... which can be recorded as videos

Live  
statistic data



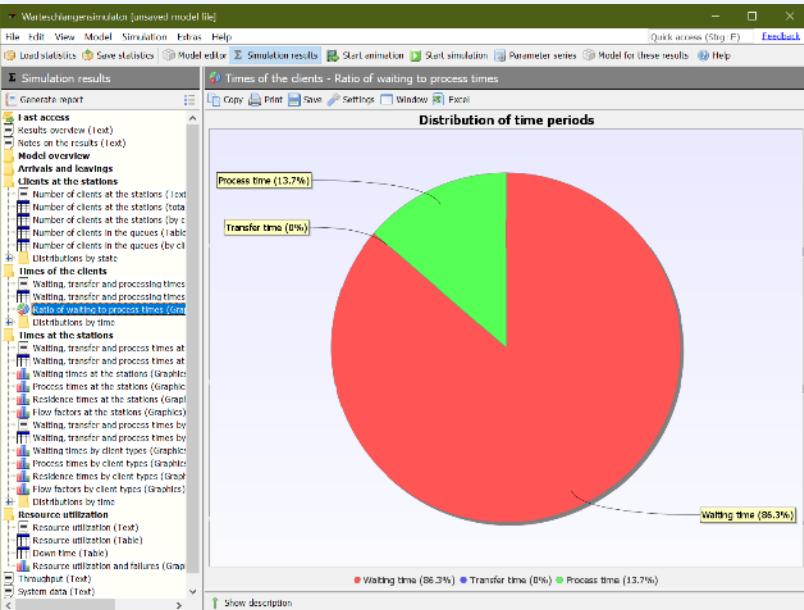
Current station data can be displayed during animation

... and also changed while animation is running

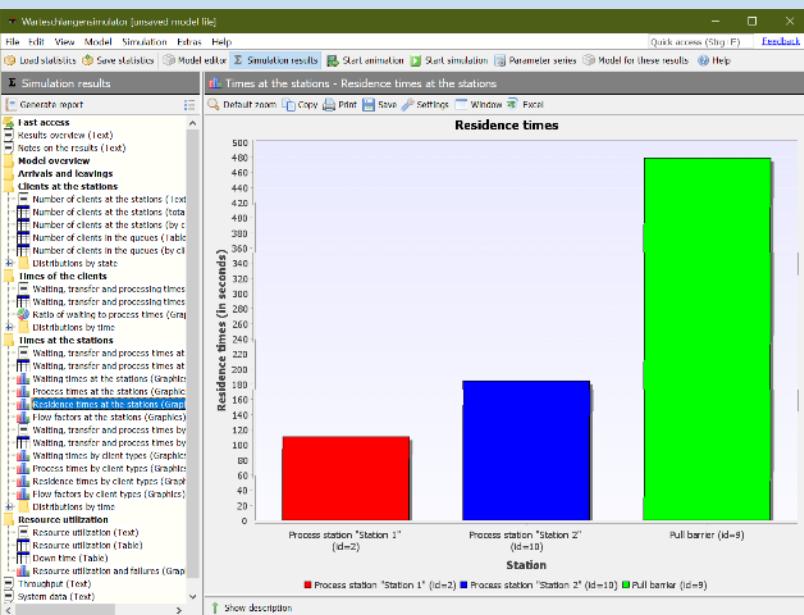


The screenshot shows the Warteschlangensimulator software interface. The main window title is "Warteschlangensimulator [unsaved model file]". The menu bar includes File, Edit, View, Model, Simulation, Extras, and Help. The toolbar contains icons for Load statistics, Save statistics, Model editor, Simulation results, Start animation, Start simulation, Parameter series, Model for these results, and Help. The left sidebar is titled "Simulation results" and lists various categories: Fast access, Results overview (Text), Notes on the results (Text), Model overview, Arrivals and leavings, Clients at the stations, Times of the clients, Times at the stations, Resource utilization, and Throughput/System data. The "Results overview" tab is selected. The main content area displays the "Results overview" section, which includes the "Simulation model" (Name: Waiting time depending process times, Simulated clients: 10,000,332) and several sections under "Average number of clients": Average number of clients (by station)  $E[N]$ , Average number of clients in the queues (by stations)  $E[NQ]$ , and Times by clients (Waiting times by client types  $E[W]$ , Process times by client types  $E[S]$ , Residence times by client types  $E[V]$ ). Each section provides average values and a "details" link.

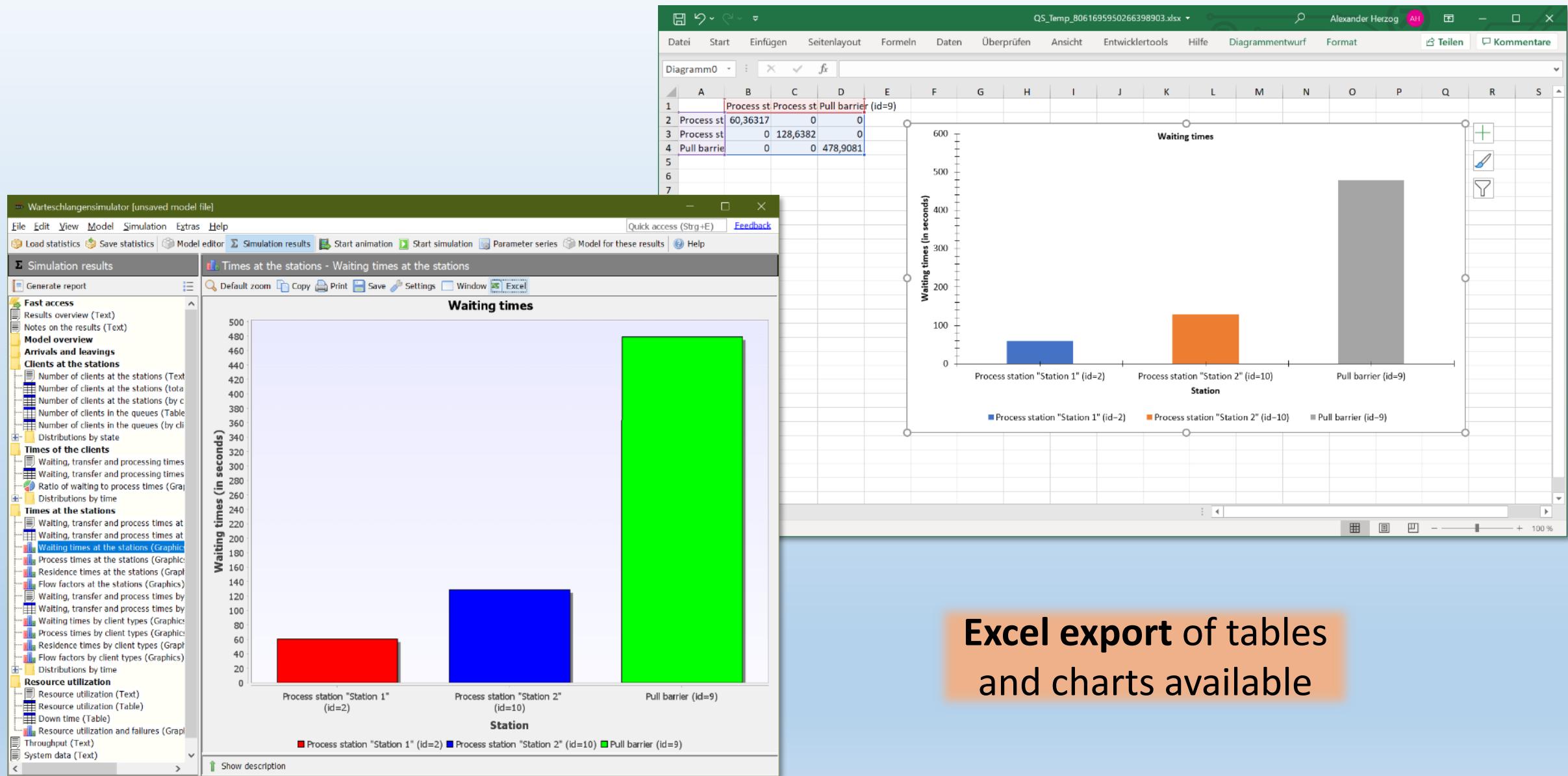
Full statistic recording  
without explicit configuration

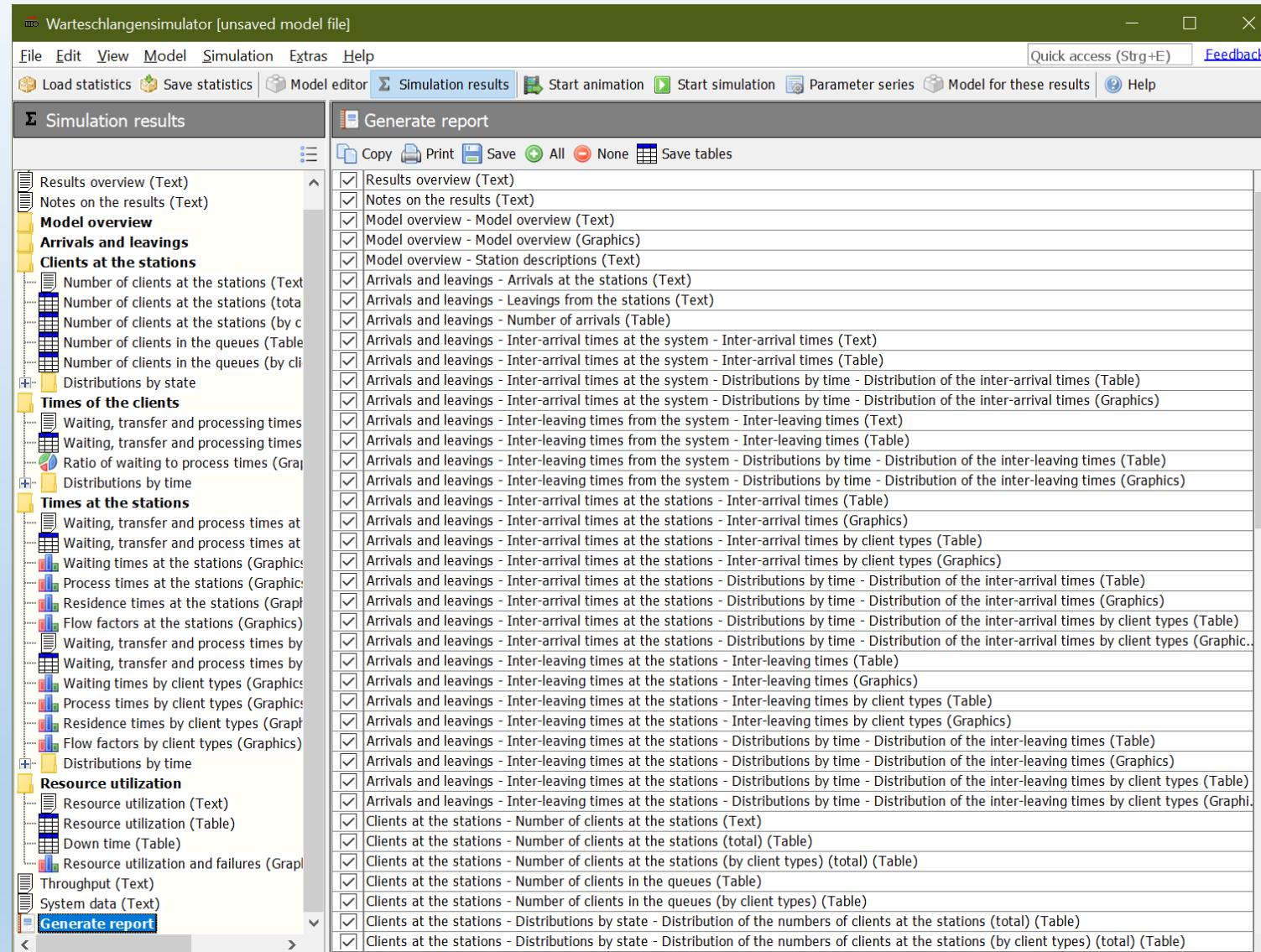


Station	Client Type	L1[N]	S1[N]	Var[N]	CV[N]	Min[N]	Med[N]	19% Quantile[N]	25% Quantile[N]	30% Quantile[N]
Process station "Station 1" (id=2)	Source	1.875	1.345	1.81	0.758	0	5	1	1	1
Process station "Station 2" (id=10)	Source	3.177	1.345	1.81	0.453	0	5	1	2	4
Pull barrier (id=9)	Source	8.127	1.345	1.81	0.165	3	10	6	7	9



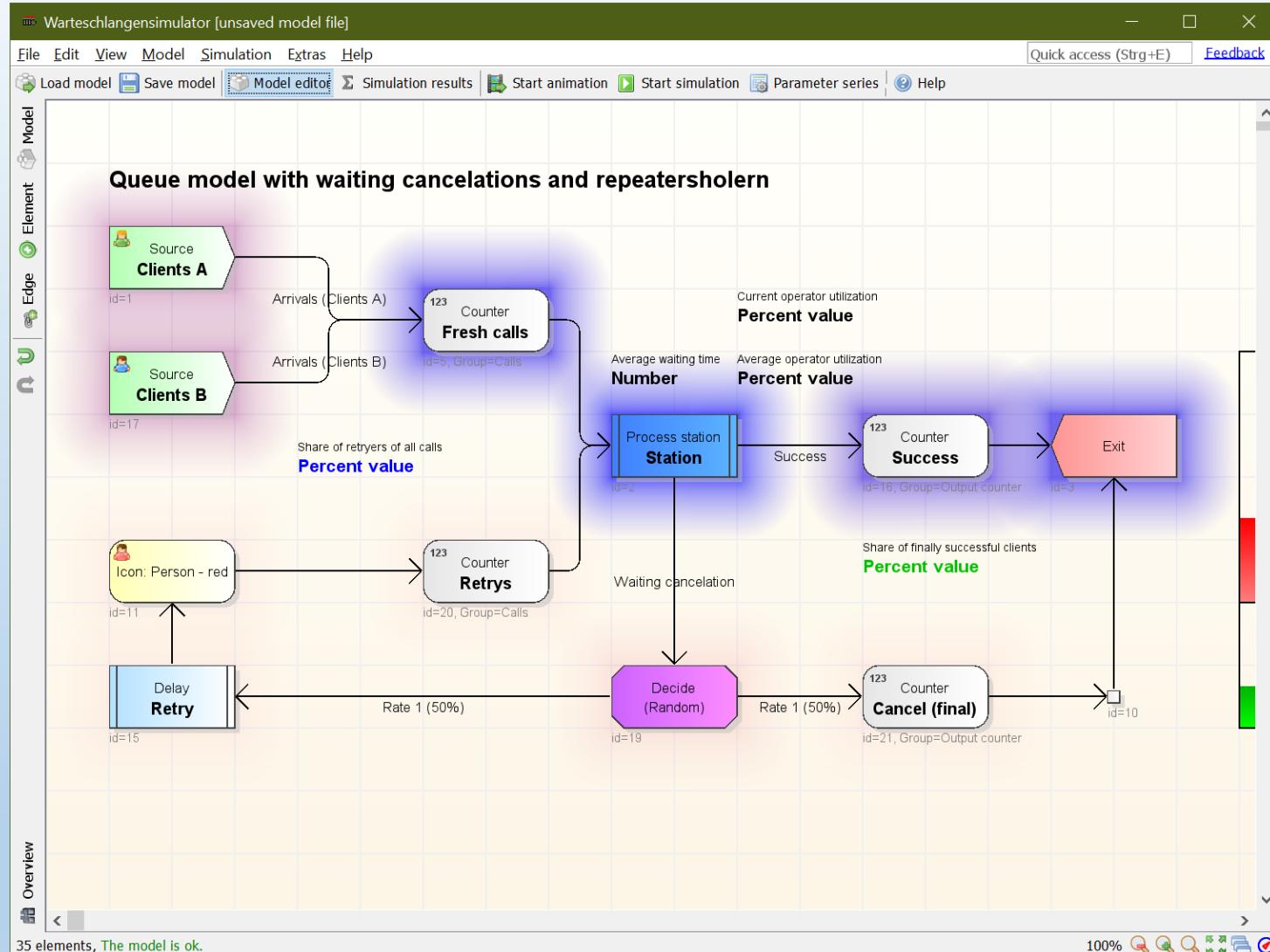
# Results available as texts, tables and charts



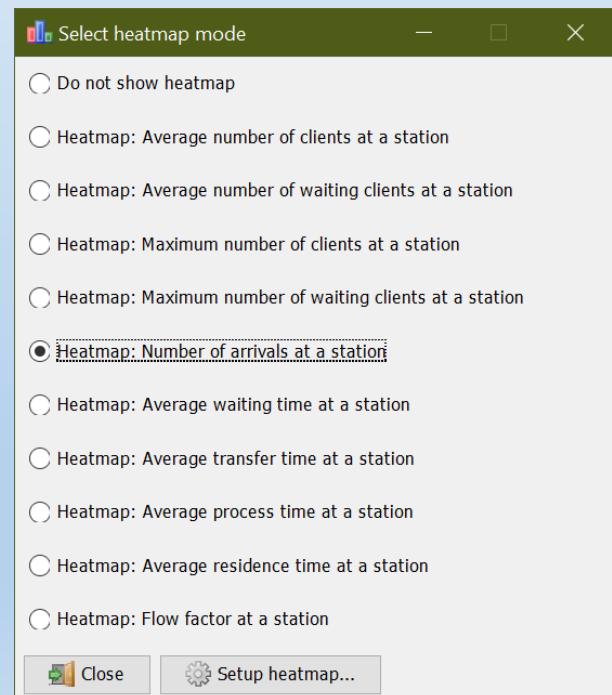


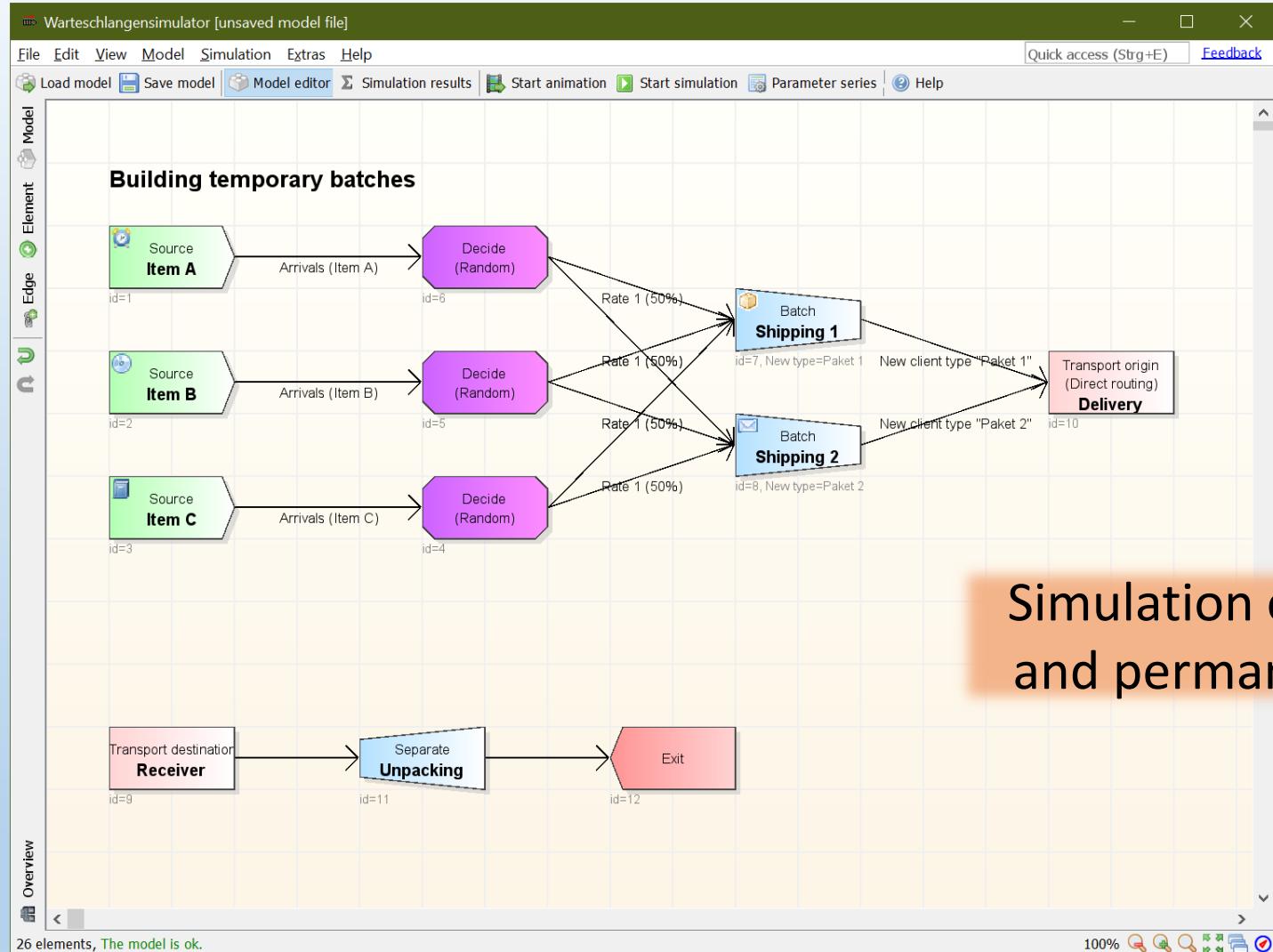
**Report generator**  
supporting docx, pdf,  
tex and html

html Reports can be saved  
as interactive web viewers

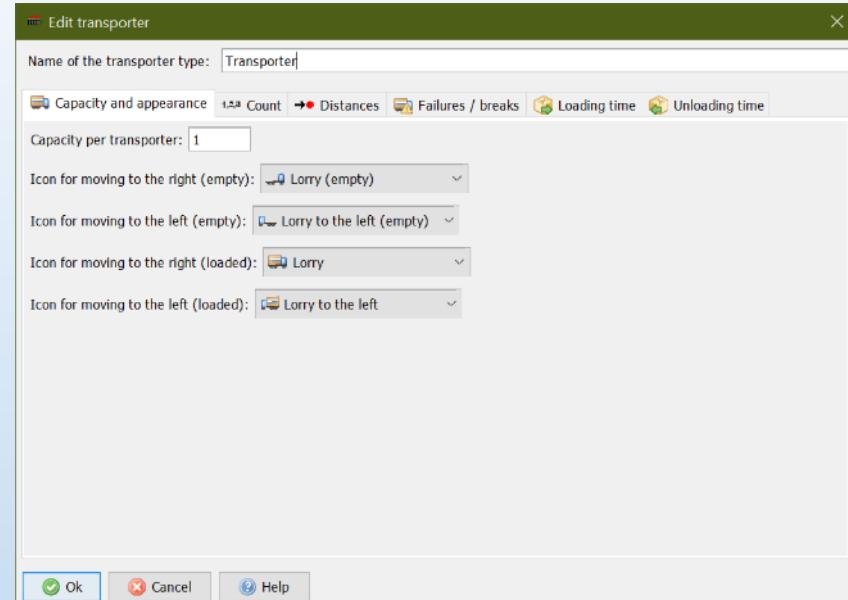
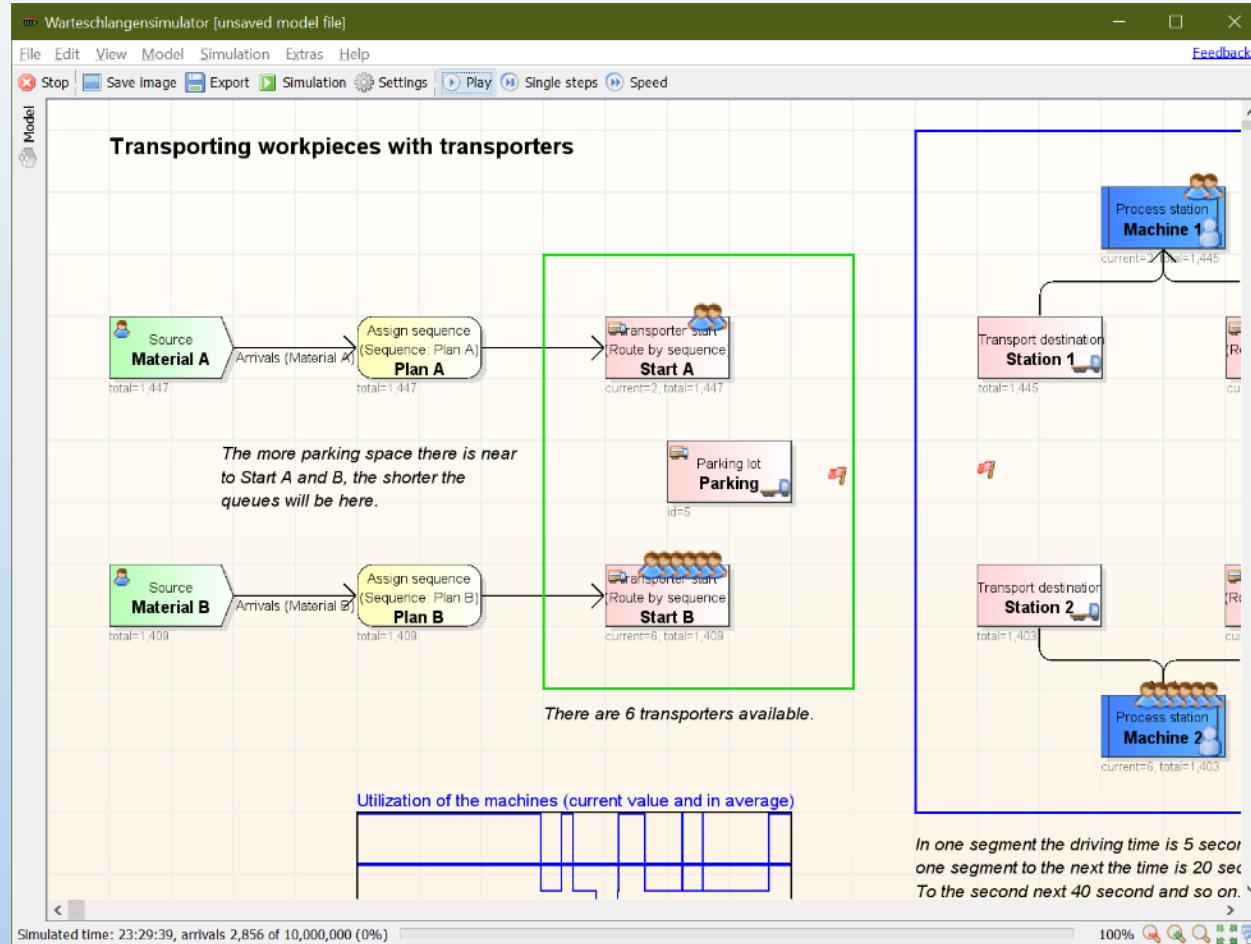


# Visualizing simulation results as heatmaps

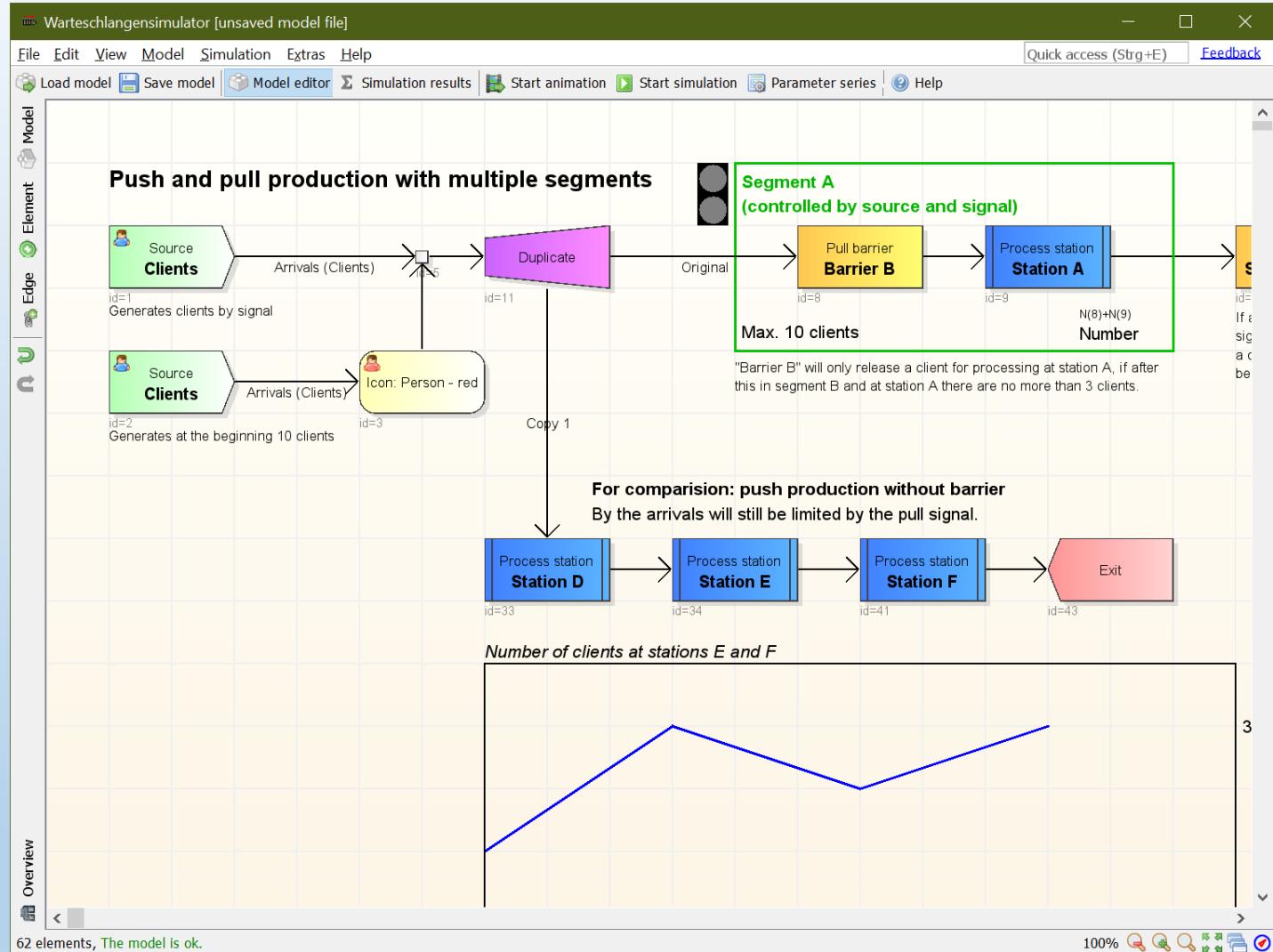




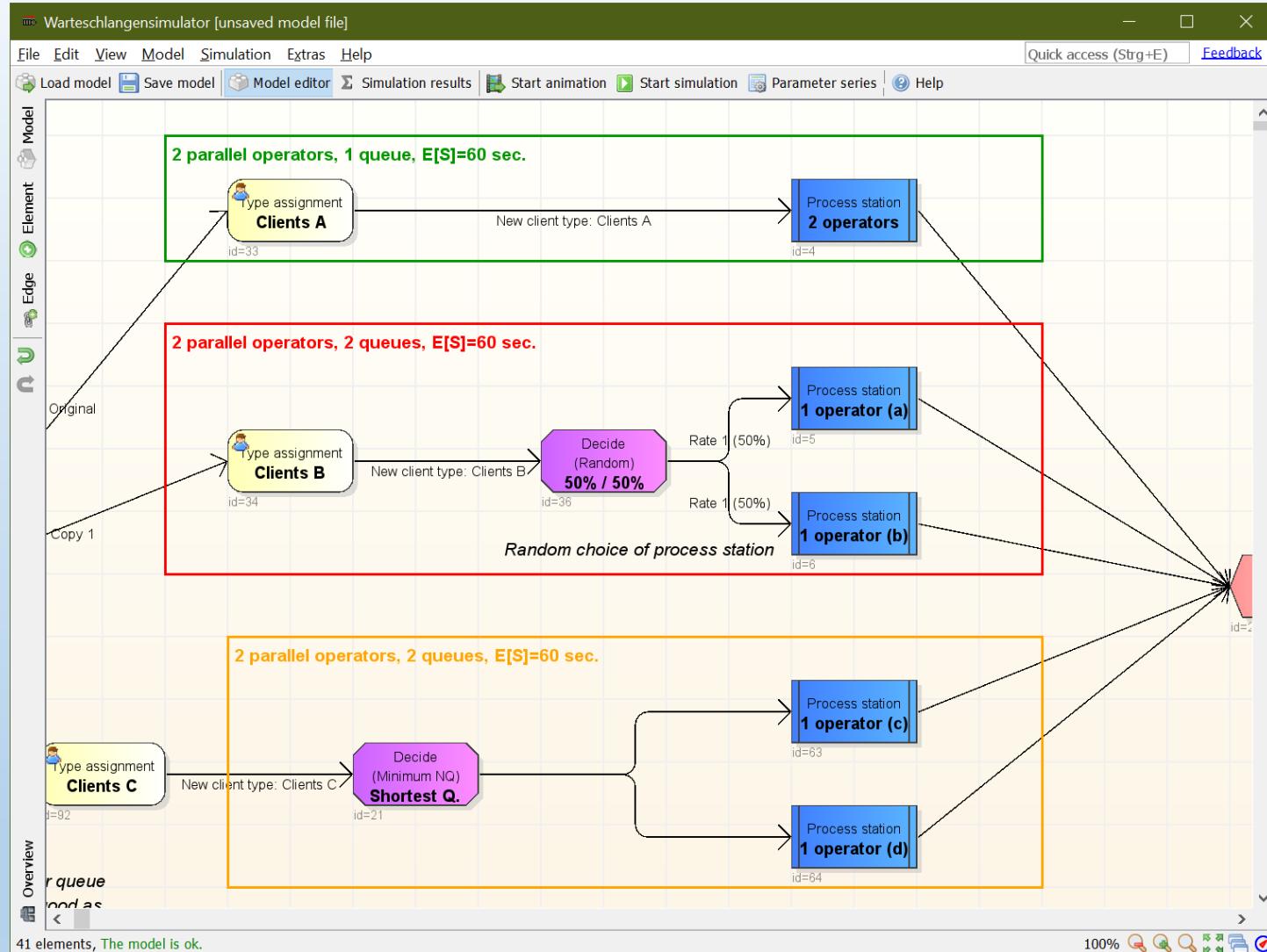
Simulation of temporary  
and permanent **batches**



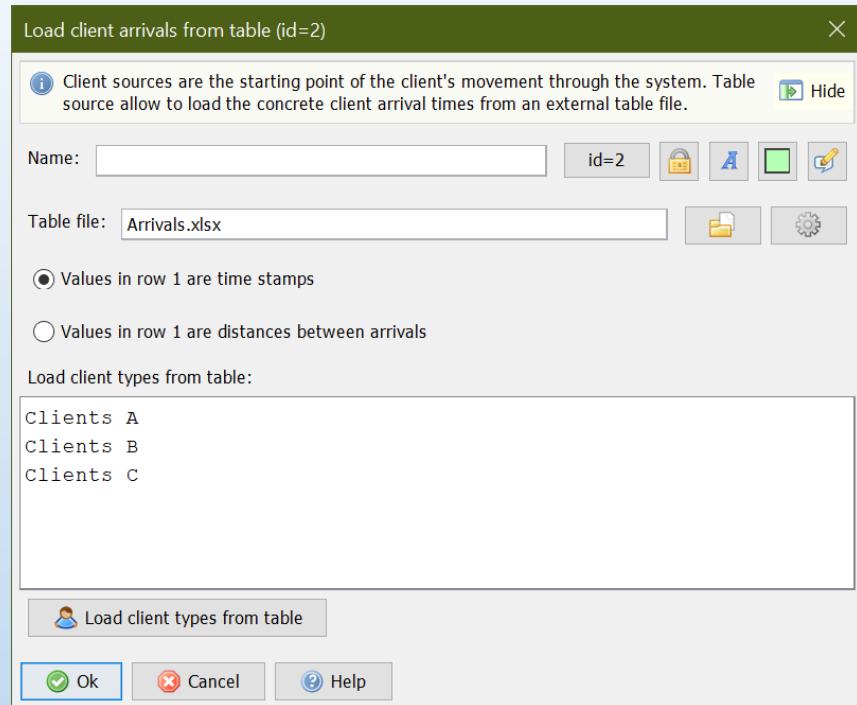
Simulation of transport processes using transporters



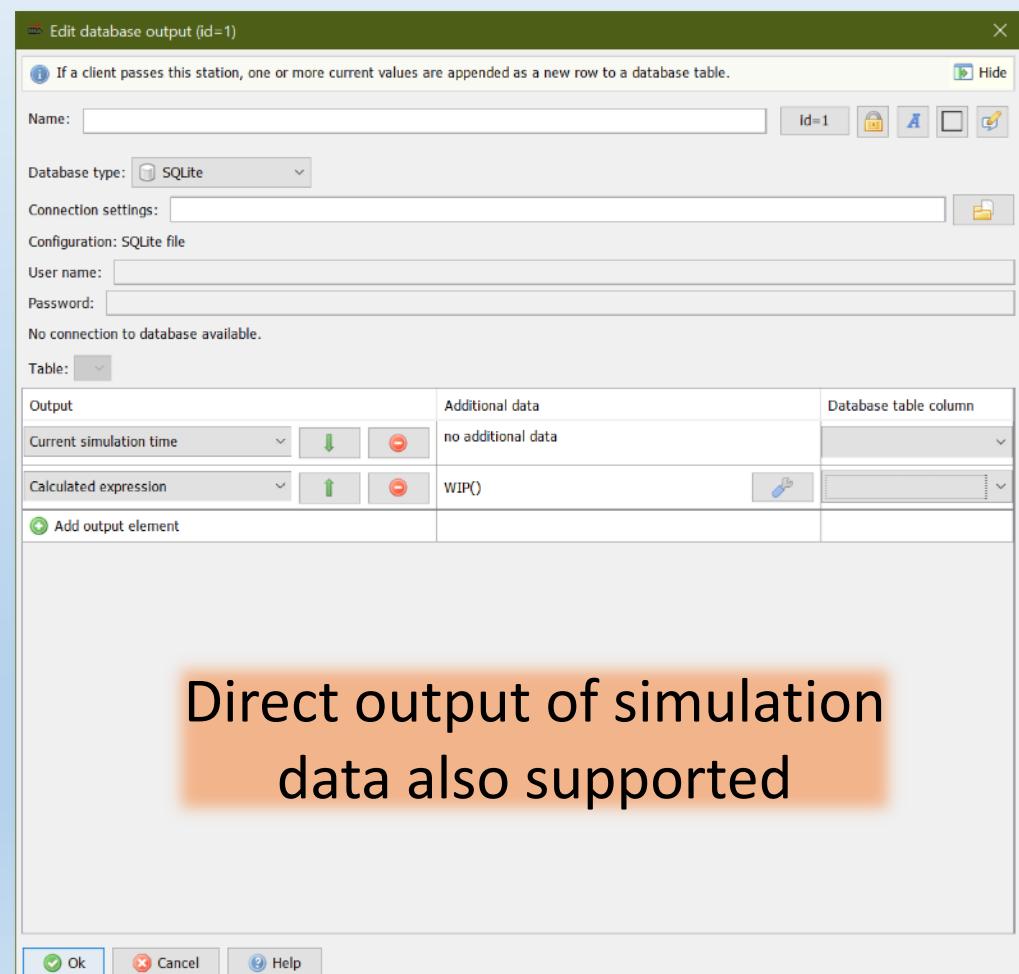
**Push/pull production – and any other kind of condition-based barriers, signals etc.**

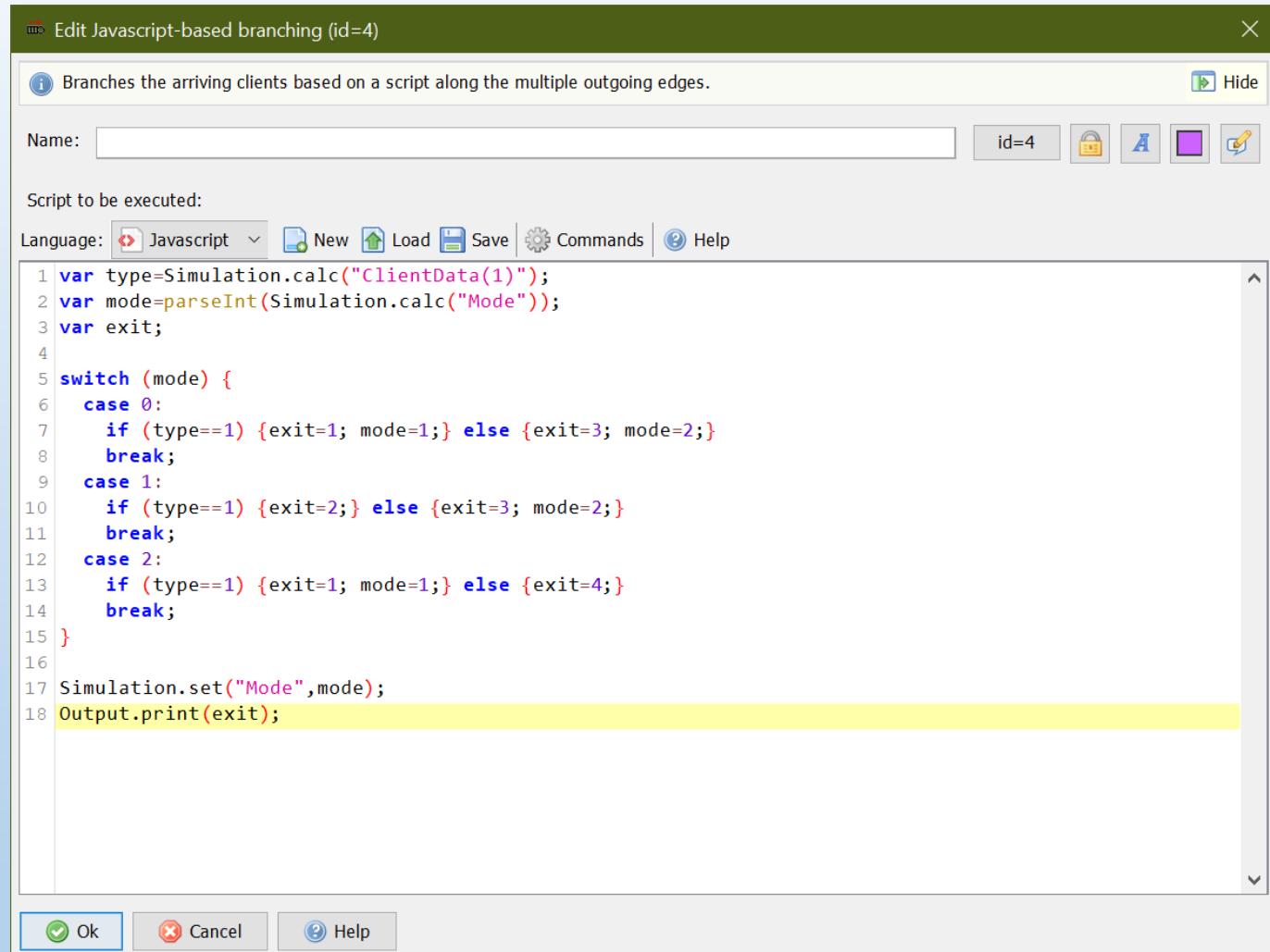


**Branching clients by conditions,  
by chance, script-based, etc.**



## Using external data for client arrivals and parameters in simulation process





Scripts can be used for  
modelling complex  
control strategies

Supported languages:  
Javascript and Java

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File Edit View Model Simulation Extras Help

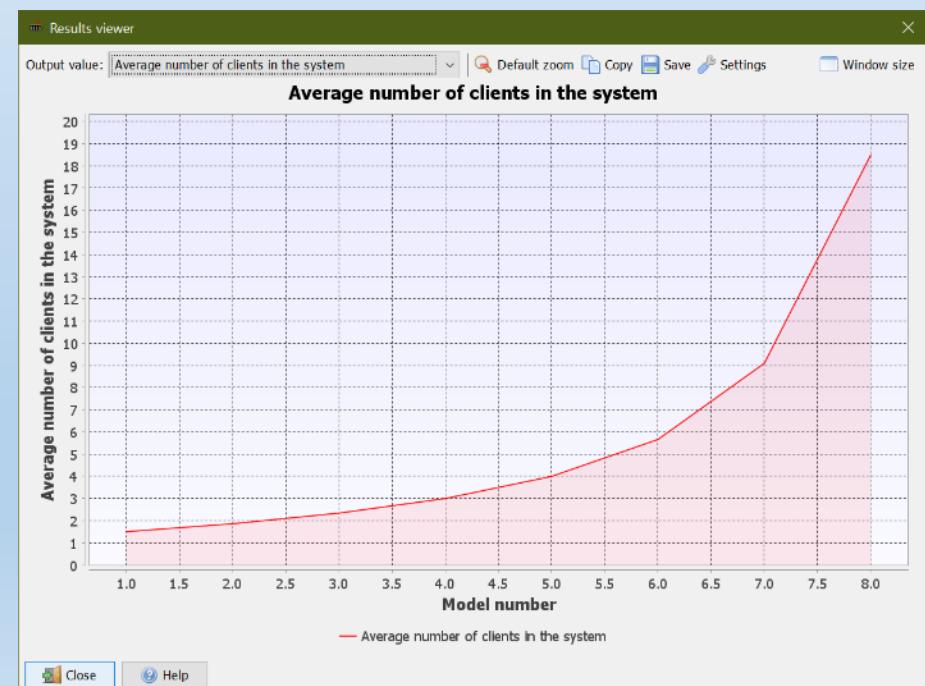
New Load Save Templates Base model Input parameters Output values Start simulation Process results Close Help

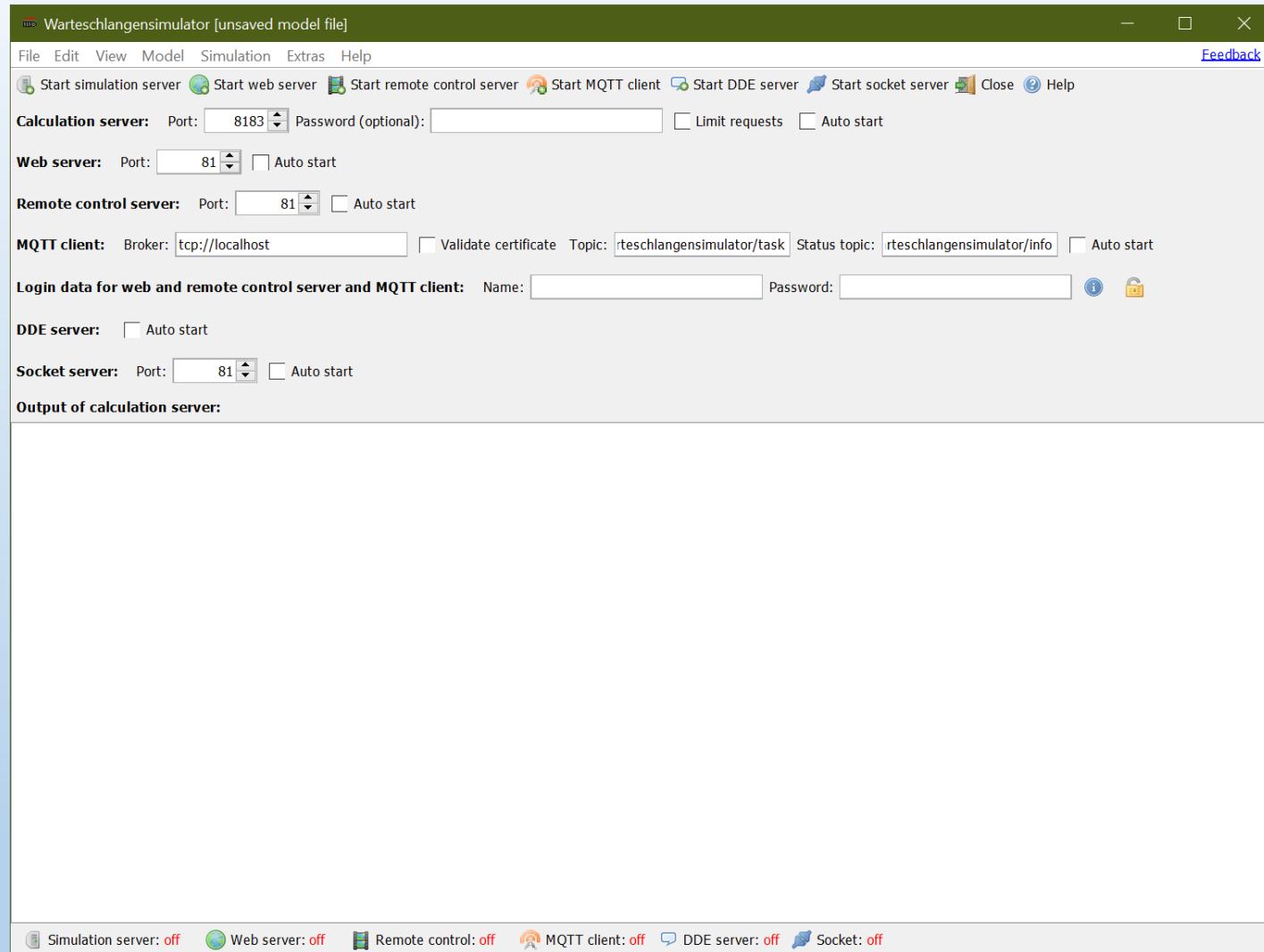
Model	Input parameter Average service time	Output value Average number of clients in the system	Output value Average number of waiting clients in the system	Output value Waiting time for all clients	Output value Process time for all clients	Output value Resource utilization - Operators group	Control
Parameter series 1	60	1.501	0.901	00:01:30	00:01:00	0.6	
Parameter series 2	65	1.859	1.208	00:02:00.7	00:01:05	0.651	
Parameter series 3	70	2.339	1.638	00:02:43.8	00:01:10	0.701	
Parameter series 4	75	2.997	2.247	00:03:44.7	00:01:15	0.75	
Parameter series 5	80	3.996	3.196	00:05:19.5	00:01:20	0.8	
Parameter series 6	85	5.661	4.811	00:08:01	00:01:25	0.85	
Parameter series 7	90	9.097	8.196	00:13:39.2	00:01:30	0.9	
Parameter series 8	95	18.488	17.54	00:29:16.5	00:01:35	0.948	

SIMULATION step 6: SIMULATION of model Parameter series 6  
 Simulation step 7: Simulation of model Parameter series 7  
 Simulation step 8: Simulation of model Parameter series 8  
 The simulation of the parameter series was finished after 8 steps.  
 Total simulation time: 5 seconds, simulation time per steps: 1 seconds.

## **Optimizer** also built-in

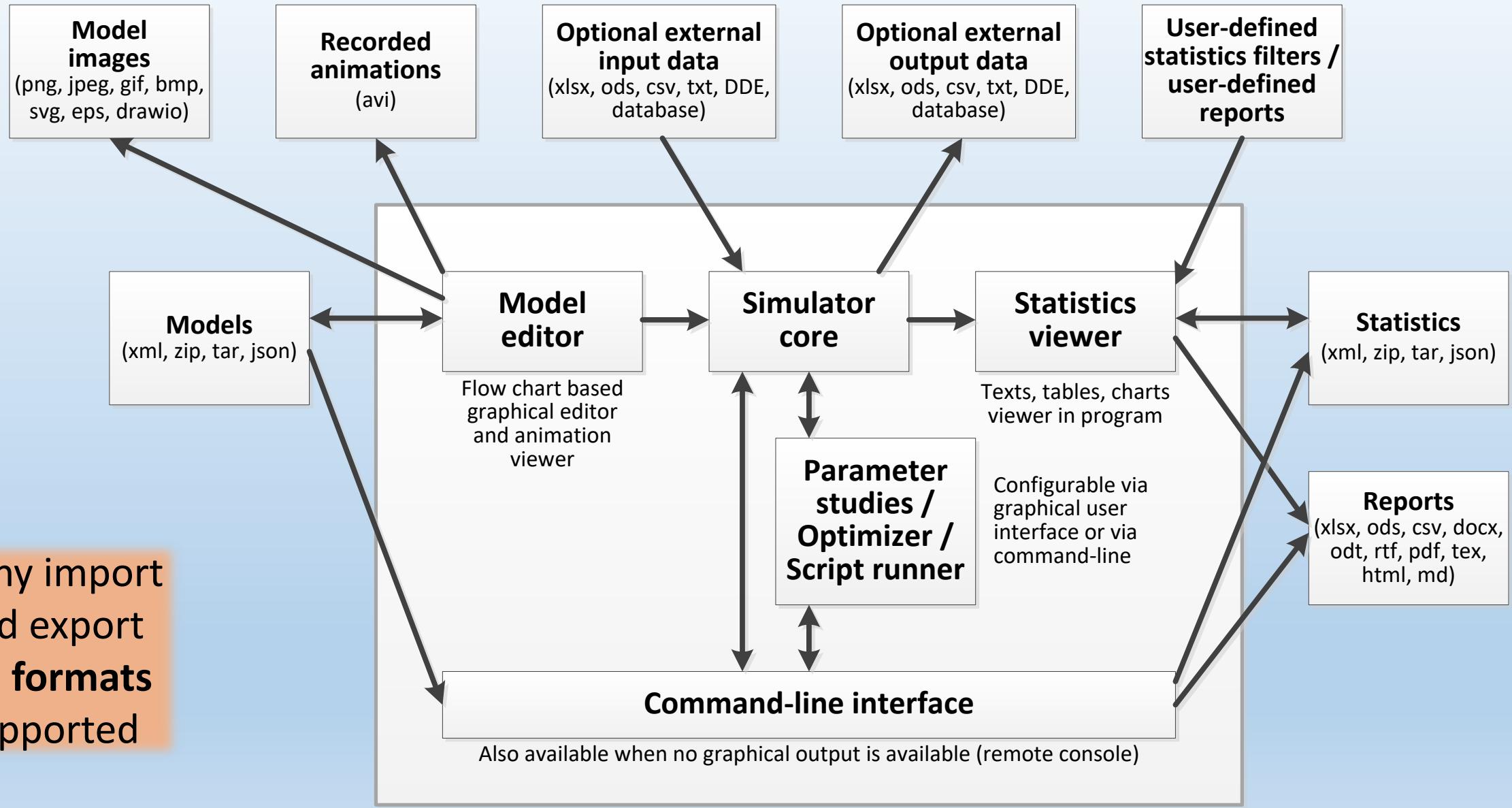
# Fast and easy creation of parameter studies

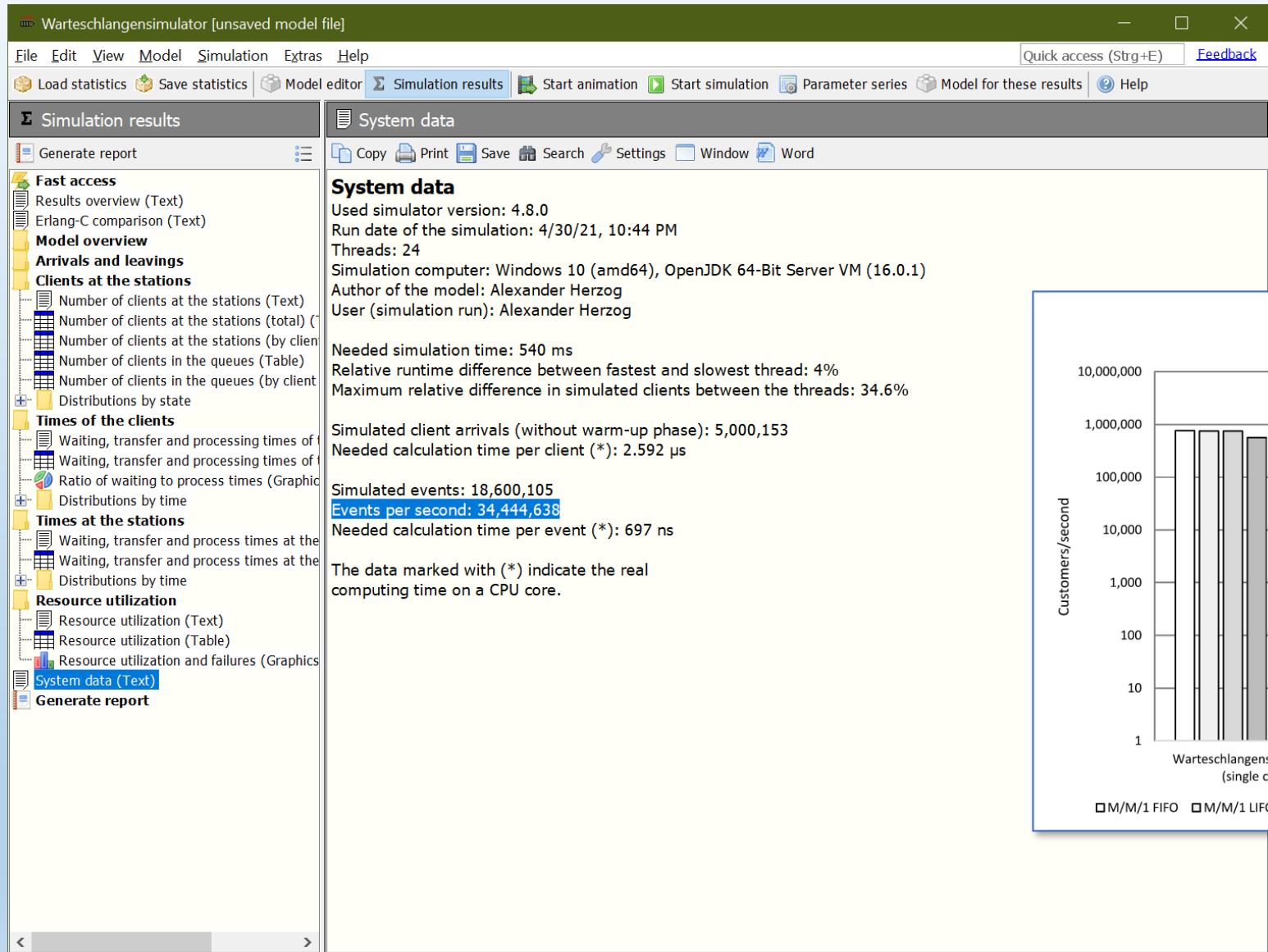




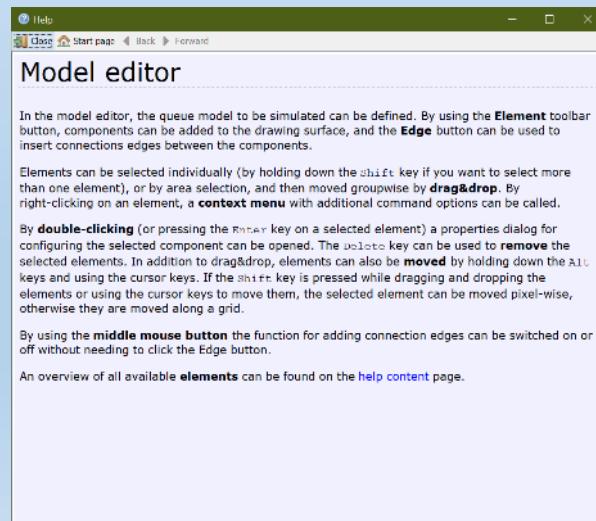
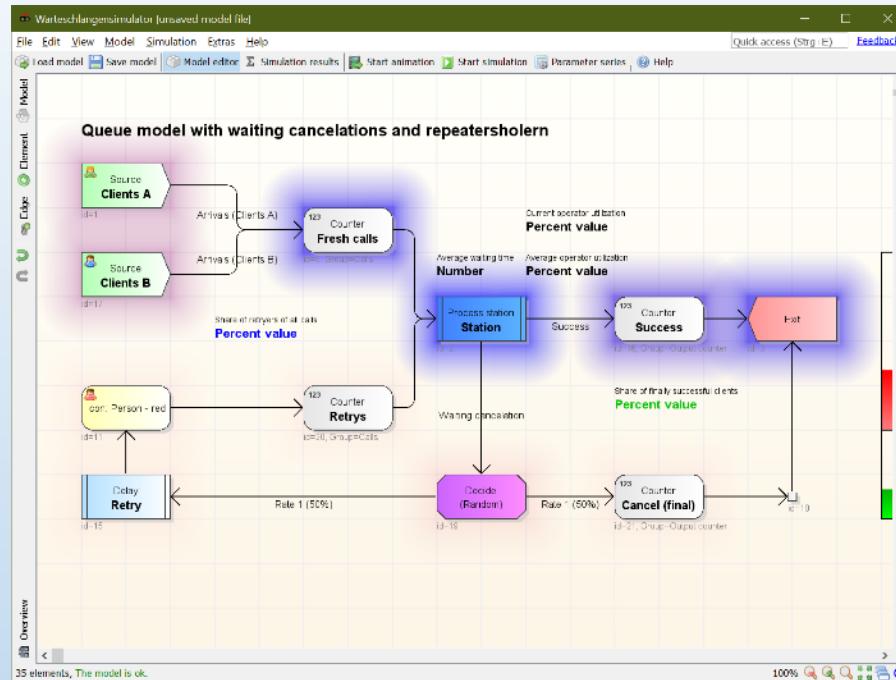
Command-line and  
server operation available

Simulator can be used on  
Linux-based HPC systems

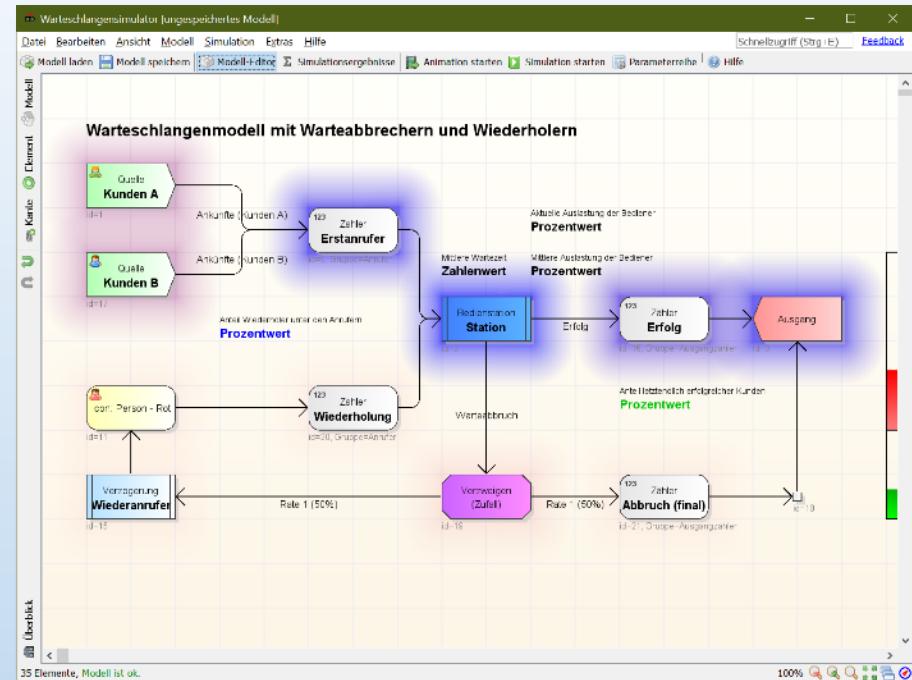




# Fast simulation supporting multi-core CPUs



User-interface and full documentation available in English and German



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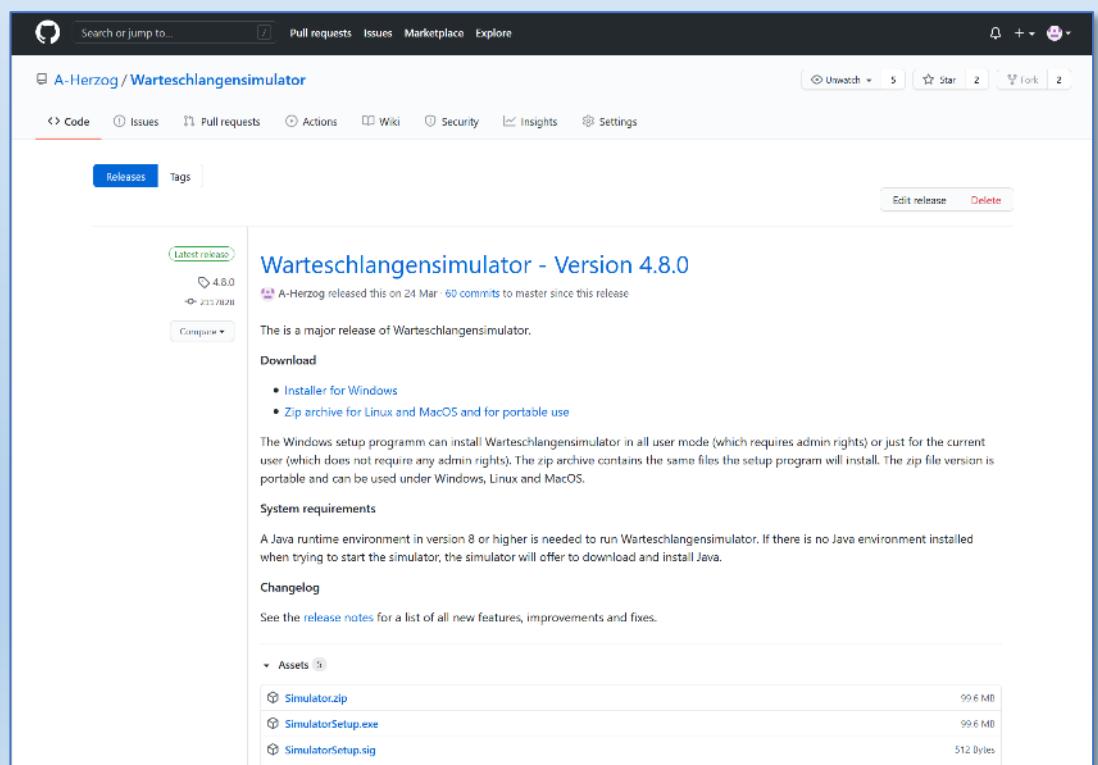
- License and copyright notice
- State changes

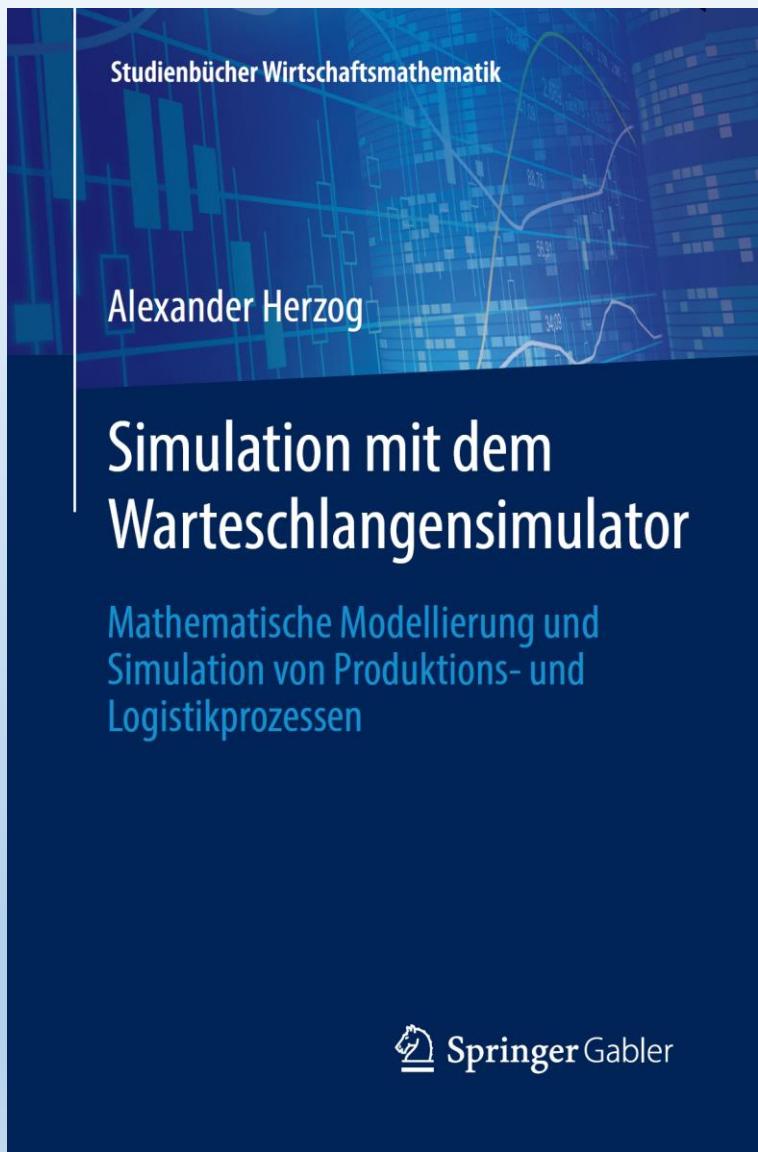
### Limitations

- Liability
- Trademark use
- Warranty

Available as **OpenSource**  
on GitHub

Windows installer and  
zip file archive (for Linux  
and MacOS) available





**Textbook**  
(in German language)  
available from September 2021

... but tutorials,  
references, online help  
etc. directly built-in in  
Warteschlangensimulator

