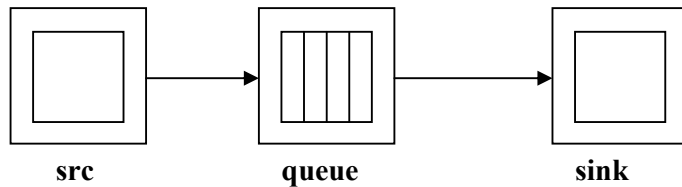


OPNET Modeler M/M/1 Queue
(Compiled from OPNET Modeler M/M/1 Tutorial)
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Read the OPNET tutorial on OPNET Modeler of M/M/1 queue system from the help file carefully.

Getting started:

Create project and scenario

- Lclick File
- Project: new
- Scenario: new
- Project name: **your_initial_mm1net**
- Scenario: **mm1**. → Start Up Wizard window opens
- Select Quit for Startup Wizard → Project Editor window opens

Node Editor:

Create Node model:

- Lclick File
- Lclick New
- Lclick Node model
- Lclick OK → To Open Node Editor window

Investigate and familiar with the name of each icon on the Node Editor.

Create Processor Module:

- Lclick and drag the Create Processor icon to the Node Editor workspace.
- Rclick to end.
- Lclick on the Processor module to open Process Model window (**Finite State Machine level**)
- Investigate the state diagram.
- Close the window.

Set processor module's attributes:

- Rclick on the Processor module
- Select Edit Attributes → To Open Attributes dialog window
- Name: src
- Process model: **simple_source**

- Lclick Value column of Packet Interarrival Time → To open Packet Interarrival Time Specification dialog window.
- Distribution name: Exponential
- Mean Outcome: 1.0
- Lclick OK → To Close Packet Interarrival Time Specification dialog window.
- Lclick on Value column of Packet Size → Open Packet Size Specification dialog window.
- Distribution name: Exponential
- Mean Outcome: 9000
- Lclick OK → To Close Packet Size Specification dialog window.
- Lclick OK → To Close Attributes dialog window.

Create Queue Module:

- Lclick and drag the Queue icon to the Node Editor workspace.
- Rclick to end.

Set queue module's attributes:

- Rclick on Queue module
- Select Edit Attributes → To Open Attributes dialog window
- Name: **queue**
- Process model: Select acb_fifo
- Service_rate: 9600.
- Lclick OK → To Close Attributes dialog window

Create Processor Module (Add a sink module to destroy a temporary entity):

- Lclick and drag the Create Processor module to the Node Editor workspace.
- Rclick to end.

Processor module's attributes:

- Rclick on Processor module
- Edit Attributes → Open Attributes dialog window
- Name: sink
- Lclick OK → To Close Attributes dialog window.

Create packet stream (modules connection)

- Lclick on Create Packet Stream icon.
- Lclick on src module then lclick on queue → connect src module to queue module
- Lclick on queue module then lclick on sink module
- Rclick to end.

The model is now completed

Save the model:

- Lclick File
- Lclick Save → Name: **your_initial_mml**
- Lclick Ok → To Close Node Editor.
- Get a print of the model.

The model is now available to be used in a network.

Create network model:

For this example, the network will consist of a single node object based on the M/M/1 model created above. This is achieved by *first creating a new object palette*.

Create a new object palette

- Lclick Open Object palette
- LClick Configure Palette → To open Configure Palette window

Activate Model List

- Lclick Clear
- Lclick Node Models → To open list of available node models
- Find **your_initial_mm1** node model created earlier.
- Lclick on Status column to include the node model
- Lclick OK → To Close the list
- Lclick Save → name: **your_initial_mm1_palette**
- Lclick OK → To save
- Lclick OK → To close Configure Palette window

Create network model

- Lclick and drag **your_initial_mm1** node model from object palette to workplace.
- Rclick to end
- Rclick on the node → To open Object window
- Name: **m1**
- Lclick OK → To close Object window.
- Lclick File
- Lclick Save (*the name should be your_initial_mm1net*)
- Lclick OK → To save the network

Statistics Collection using Probe Editor

To provide statistics to be collected during simulation and for report generation after simulation.

- Lclick File
- Lclick New
- Select Probe Model
- Lclick OK → To open Probe Editor window

Set network model

- Click Objects on menu
- Select Set Network Model → To open network model window
- Select **your_initial_mm1net-mm1** network model from network model window.

Set probes

- Lclick Create Node Statistic Probe → a probe appears below Node Statistic Probe
- Rclick on the probe
- Select Choose Probed Object
- Lclick on the arrow next to **m1** node to show its components
- Lclick queue module in a node diagram

- Lclick OK → To close dialog window
- Rclick on probe
- Select Edit Attributes → To open Attributes window
- Name: queue delay
- Submodule: subqueue[0]
- Lclick in the Value column of statistic row → To open Available Statistics dialog window.
- Select queue.queueing delay
- Lclick OK to apply
- Lclick OK → To close Attributes window.
- Lclick Create Node Statistic Probe
- Rclick on new probe
- Select Edit Attributes → To open Attributes window
- Name: queue size
- Subnet: top
- Node: m1
- Module: queue
- Submodule: subqueue[0]
- Group: queue
- Statistic: queue size (packets)
- Lclick OK → To close Attribute dialog window
- Lclick File
- Lclick Save → name: **your_initial_mm1probe**

At this point, modeling process is finished.

The model has been created completely

Data to be collected for analysis have been specified.

The next step is *simulation*.

Simulation

- Lclick Simulation on menu of Project Editor → To open simulation menu
- Lclick Configure Simulation (Advanced) → To open Simulation Tools
- Rclick on the Scenario
- Select Edit Attributes
- Probe File: **your_initial_mm1probe**
- Seed: 431
- Duration: 7 hours
- Lclick OK
- Lclick Execute Simulation Sequence to begin simulation session.

Wait until the simulation finish.

Analysis Tools

View average queueing delay

- Lclick File
- Lclick Open
- Select Analysis Configuration
- Select **your_initial_mm1net-mm1**
- Lclick OK → To open Analysis Tool window
- Lclick Create A Graph Of A Statistic → To open View Results dialog window
- Lclick File Statistics
- Lclick **your_initial_mm1net-mm1**
- Lclick Object Statistics
- Lclick m1
- Lclick queue
- Lclick subqueue[0]
- Lclick queue
- Lclick queueing delay → To enable the statistic
- Lclick average
- Lclick Show → the graph of **average queueing delay** appears.

View time-averaged queue size

Do not close the graph window of queueing delay

- Lclick queueing delay → To disable the statistic
- Lclick queue size (packets) → To enable the statistic
- Select Time-average
- Lclick Show → the graph of time-averaged queue size appears

View queue size versus time-averaged queue size

- Close view results window
- Rclick on the graph of time-averaged queue size
- Select Add Statistic → To open new view result window
- Lclick File Statistics
- Lclick **your_initial_mm1net-mm1**
- Lclick Object Statistics
- Lclick m1
- Lclick queue

- Click subqueue[0]
- Click queue
- Click queue size(packets)
- Click Add → To add the graph of queue size (packets)
- Get hard copies of the model and all graphs