

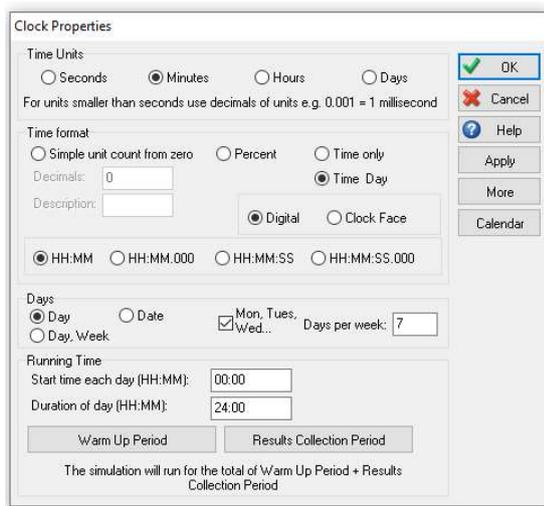
## Simul8 User Guide for Critical Care Unit

The aim of this document is to provide a high level overview of the main stages of building a Discrete Event Simulation model of a Critical Care Unit using Simul8. The template is structured in line with the requirements of our research, and that of the unit and the data with which we utilised.

This however can be manipulated to meet your requirements and the main stages in doing so, are outlined below. Due to confidentiality, we have removed the exact data values used in our model and set all to zero. Again, the stages of replacing these are outlined in this document.

### 1. General model specifications

To choose the running time for the simulation, select the **Data and Rules tab – Properties**. Here the days per week, start time and duration of the day can be set. It is recommended that a warm up period is set to achieve a steady state of the number of patients to be established within the system. Currently the warm up period is set to 30 days with the simulation running for 2 years.



It is also useful to check all travel times are set to zero by selecting **File – Preferences – Distances – Set to zero**. This will ensure the length of arrows in the simulation do not account for any time within the running of the simulation. In some scenarios, where time travelled between departments needs to be considered, this may need to be altered.

### 2. Patient Arrivals

Arrivals are calculated using inter-arrival times, the time between each arrival. The simplest way to calculate this from most data sources is from the arrival rate. This is calculated as followed:

$$\text{Inter-arrival rate} = 1 / \text{Arrival rate}$$

For example, an arrival rate of two patients per hour, would result in an inter-arrival rate of one patient per 30 minutes.

To change the arrival rate within each 'Start Point' node, **either double click or right click the icon and select Properties** on the individual node.

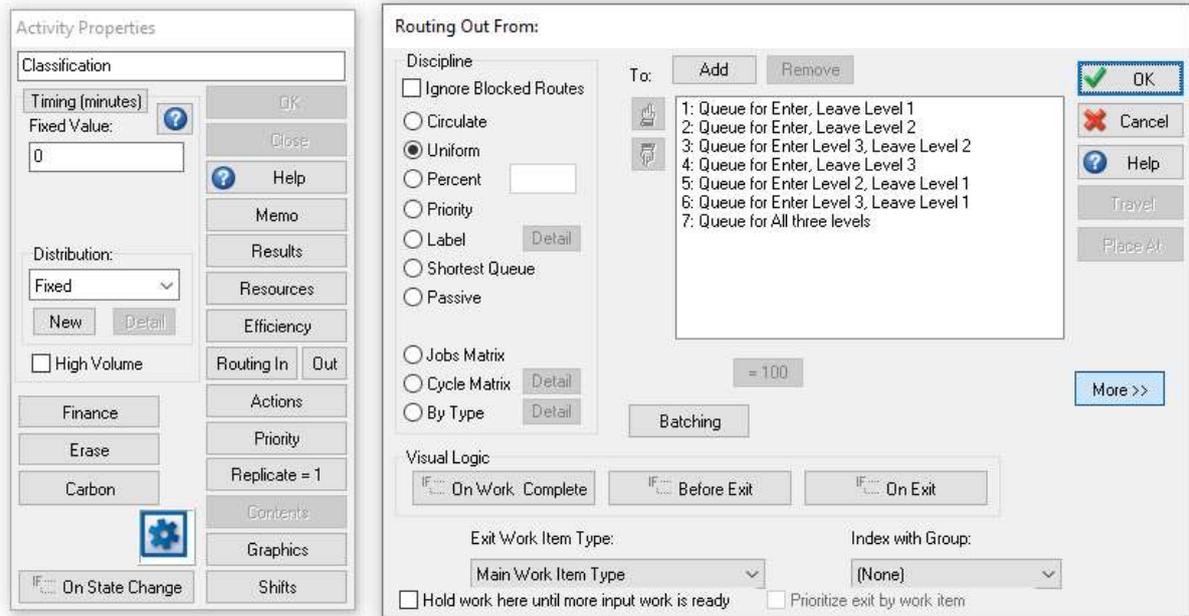
Here, admissions can also arrive via distributions – to decide on the distribution to best suit your data, online distribution fitters are readily available. A number of pre-set distributions exist in Sumul8 or you can add your own probability distribution under the **Data and Rules tab – Create Distribution**.

Complete this for each start point. In our model we have a different entry point for both planned and unplanned arrivals to allow a different arrival pattern for each of these scenarios.

### 3. Classification

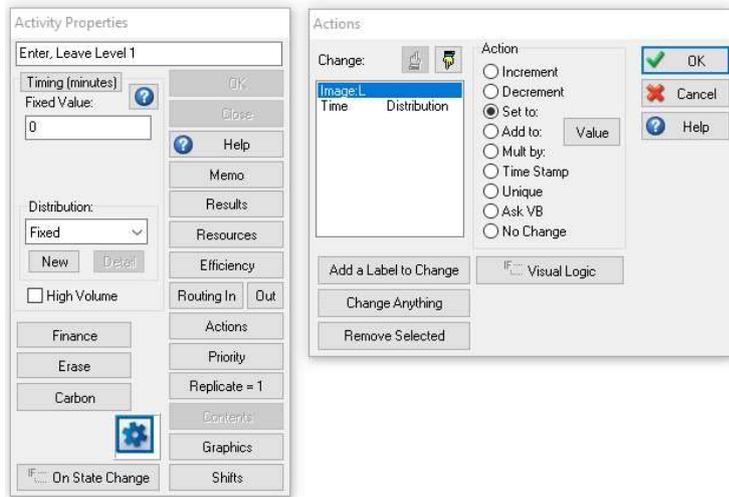
The classification node is a dummy node used for routing purposes with a fixed distribution of 0 (this should not be modified). The **Routing Out** discipline can be changed to a percentage to route patients depending on the levels of care they will receive. Based on our data we are allocating a percentage to each level of care.

If wanting to have a priority on the patients entering the system, i.e. unplanned (emergency) patients over planned (elective) patients, this can be performed within the **Routing In** button.



As well as the main classification node, there are a number of dummy nodes to allocate the length of stay to each patient based on their current level of care.

Patients who enter the unit either as a Level 1 or 2 patient, often have a shorter length of stay and their time distribution can be changed within **Properties – Actions**. The time distribution can then be set to a distribution that fits the length of stay for that patient type.



The Level 3 patients are more seriously ill and therefore have longer length of stays. The routing of the patients on whether they had a long or short length of stay is determined by a percentage, again chosen within the routing out option. The time distribution can again be set for each pathway according to their length of stay within the system.

Activity Properties

Short LOS patients: Leave Level 2

Timing (minutes)

Fixed Value: 0

Distribution: Fixed

New Detail

High Volume

Finance

Erase

Carbon

On State Change

OK

Close

Help

Memo

Results

Resources

Efficiency

Routing In Out

Actions

Priority

Replicate = 1

Contents

Graphics

Shifts

Actions

Change: Time Distribution

Action

Increment

Decrement

Set to: Value

Mult by: Value

Time Stamp

Unique

Ask VB

No Change

Add a Label to Change

Visual Logic

Change Anything

Remove Selected

OK

Cancel

Help

#### 4. Treatment

The number of treatment beds can be set within the **Replicate** option – this is currently set to 23 beds. The **Routing In** options have priorities set, so patients downgrading levels and being discharged have priority over those waiting in the queue for a bed. The routing out options for the system is already predetermined by the labels given in the Classification stage.

Patients in the treatment bed node, will remain there for the duration of their length of stay within the level of care in which they entered. Once completed, there is the option for a patient to be downgraded to a lower level of care, or be physically fit for discharge. This again, is allocated based on proportions.

Activity Properties

Treatment beds

Timing (minutes)

Distribution: Distribution

New Detail

High Volume

Finance

Erase

Carbon

On State Change

OK

Close

Help

Memo

Results

Resources

Efficiency

Routing In Out

Actions

Priority

Replicate = 23

Contents

Graphics

Shifts

Routing In To: Treatment beds

Selection Method Options Change Over

Add Remove Place At

1: Queue for Treatment: Level 2's

2: Queue for Treatment: Level 1's

3: Queue for Discharge bed

4: Queue for Treatment

Discipline

Priority

Collect

Passive

More >>

OK

Close

Help

Routing Out From:

Discipline

Ignore Blocked Routes

Circulate

Uniform

Percent

Priority

Label

Shortest Queue

Passive

Jobs Matrix

Cycle Matrix

By Type

To: Add Remove

1: Queue for Level 1 Classification

2: Queue for Level 2 Classification

3: Discharged or Died

4: Queue for Discharge

OK

Cancel

Help

Travel

Place At

More >>

Visual Logic

On Work Complete

Before Exit

On Exit

Exit Work Item Type: Main Work Item Type

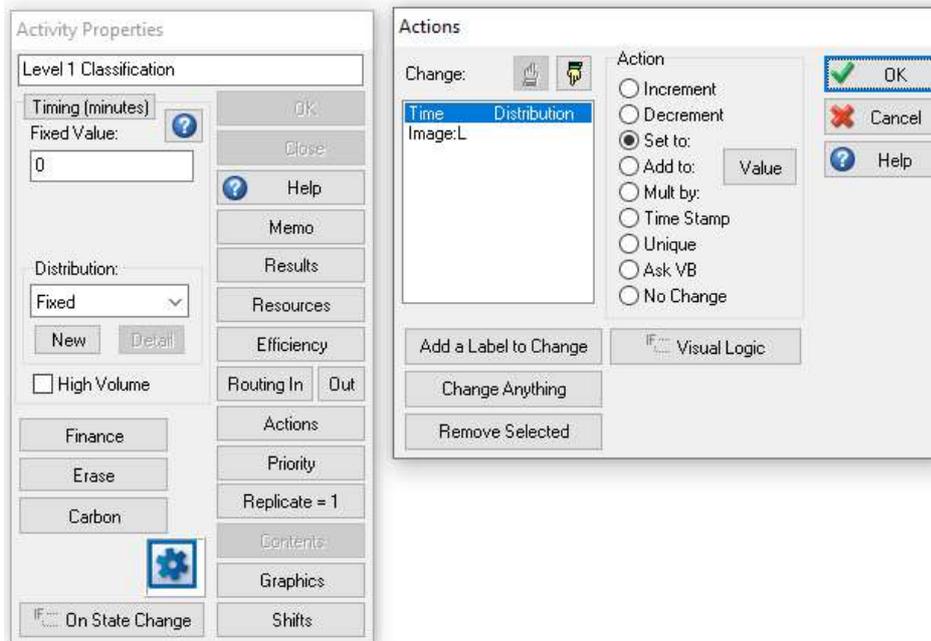
Index with Group: [None]

Hold work here until more input work is ready

Prioritize exit by work item

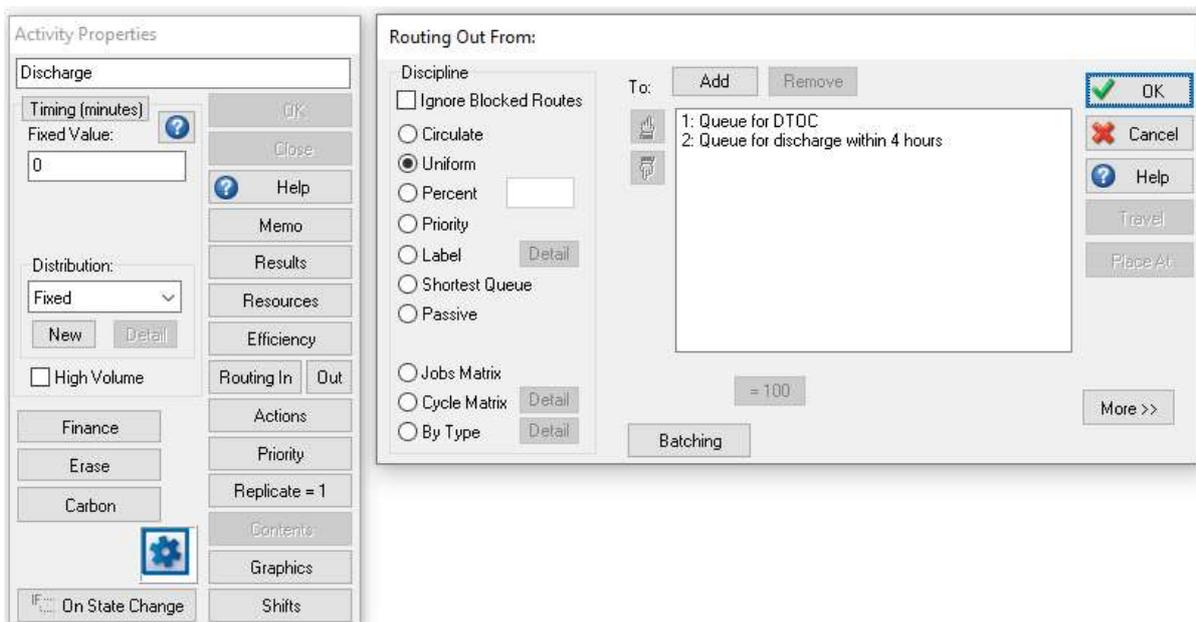
## 5. Downgrade

The downgrade option reclassifies patients to a different length of stay. Again, this acts as a dummy variable so has a fixed distribution of zero. The time distribution can be set to reclassify patients with either a Level 2 or Level 1 length of stay, who still require treatment. Similar to previously, this is achieved through **Actions** within **Properties**, and the time distribution can be set to a different distribution.

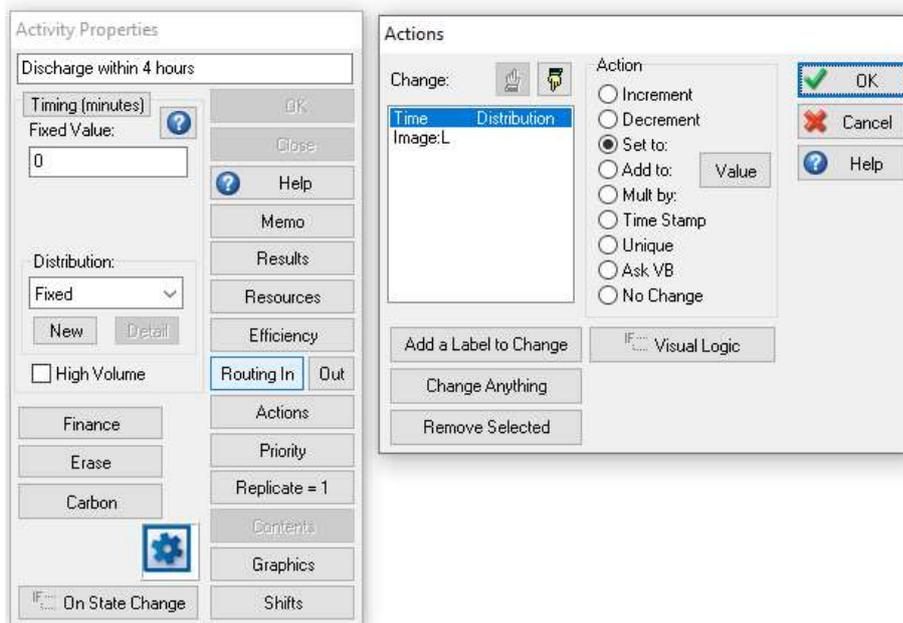


## 6. Discharge

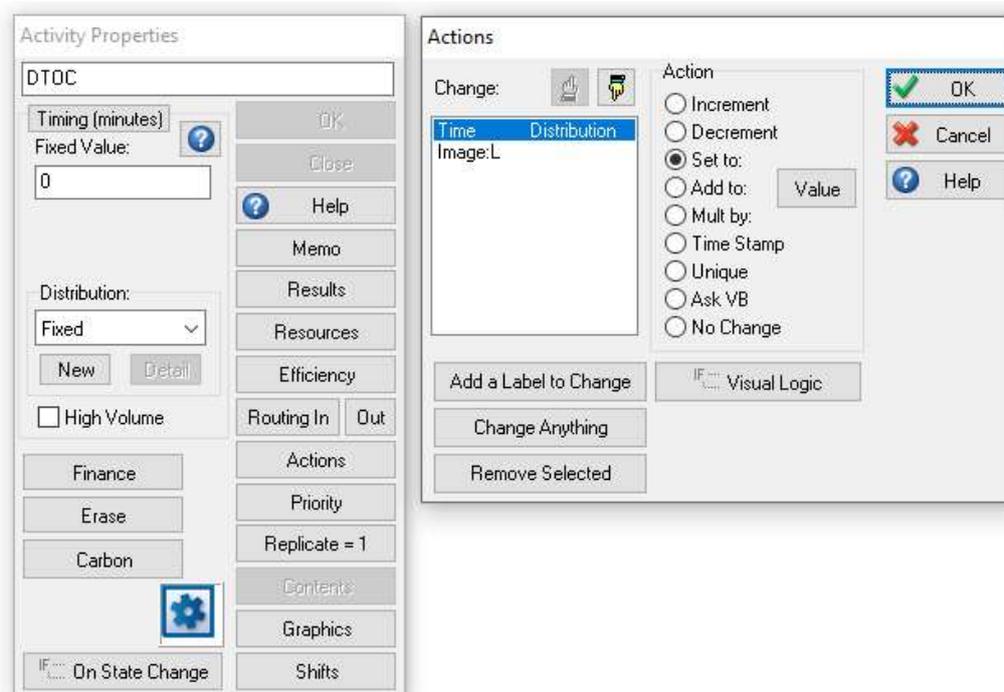
Due to the labelling system built into the model, when a patient has completed its treatment length of stay and is physically ready to be discharged, the patient moves through the discharge node (a dummy variable with a fixed time of zero). The proportion of patients who classify as DTOC or discharged within four hours can then be set through the **Routing out** option.



The patients who are discharged within four hours can then have a time distribution set specifically so they do not stay longer than four hours, and therefore not classified as DTOC. This is achieved through the **Actions** within the node's properties.



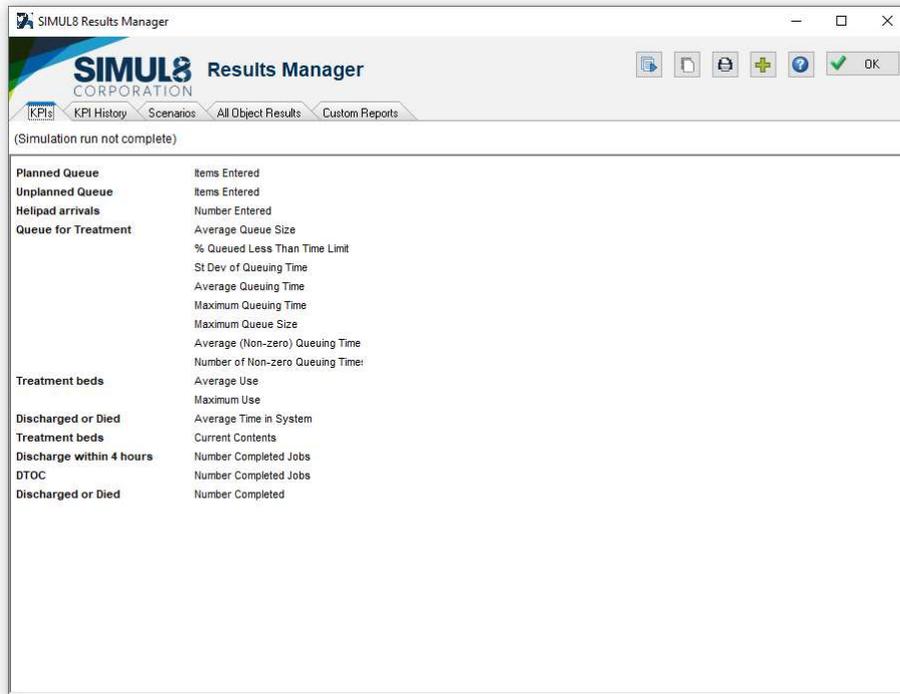
For patients who classify as DTOC, and therefore have a length of stay of longer than four hours the time distribution can be set within the within **Actions**.



Patients will then re-enter the Treatment node and remain until their discharge and/or DTOC time has been completed in which the patient will then leave the system.

## 7. Results

Upon completion, results can be viewed in the **Results Tab**. This is managed under the options in the **Home - Results Manager** further to this trails can be managed under the **Run Trail** option. These results can be easily exported and managed using the option in the top right corner.



For further support see: <https://www.simul8.com/support/help/doku.php?id=start>