Introduction to Process Mapping and Discrete-Event Simulation (Simul8)

“Why do I need Process Mapping? I already understand the process!”

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Agenda

1. The Need to Understand and Improve Processes
2. Process Mapping
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4. Data Collection
5. Discrete-Event Simulations
6. Simul8
7. Developing a Simul8 Model
8. Basic Exercise and Relevant Example
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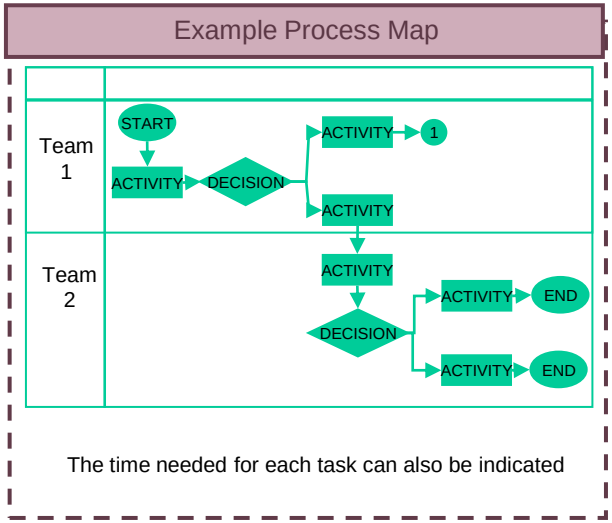
The Need to Understand and Improve Processes

The Need to Understand and Improve Processes

- To sustain continuous improvement in operational practices, organisations must first understand their processes through multiple stakeholder perspectives.
- Improving processes begins with the customer and the boundaries identified. It is the analysis and redesign of processes to eliminate problems and inefficiencies over time.
- Understanding which requirements are most critical to the customer determines which processes should be improved. Identifying issues that the customer may not be aware of is the responsibility of the analyst.
- Understanding processes helps to:
  - Measure process performance;
  - Determine the stability, capability, and flexibility of processes;
  - Identify the factors that limit quality, slow service time and increase costs;
  - Develop results-oriented solutions that will improve performance.

Process Mapping

Process Mapping

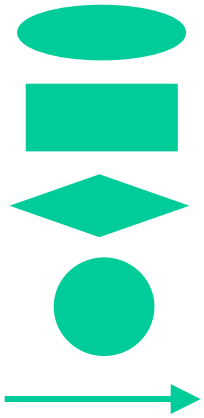


- Process mapping is an exercise to identify all the steps and decisions in a process in diagrammatic form which:
  - Describes the flow of materials, information and documents;
  - Displays the various tasks contained within the process;
  - Shows inputs and outputs;
  - Indicates the decisions that must be made along the chain;
  - Demonstrates the essential inter-relationships and interdependence between the process steps; and reminds us that the strength of a chain depends upon its weakest link.

- They provide a basic 'birds eye' view of all the actions undertaken.

- They are used to improve a process from multiple (customer agreed) perspectives. Appropriate multiple perspectives should be rigorously argued for, otherwise all that can be achieved in not an improvement from a holistic view.

Process Map Symbols



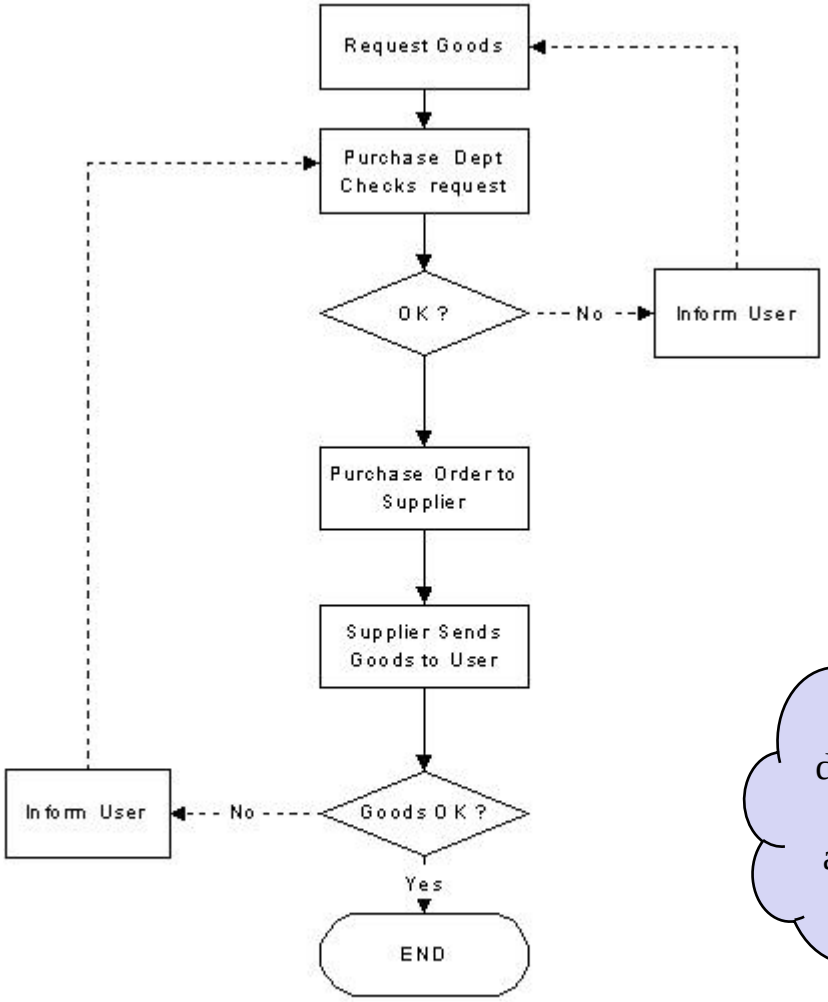
Elongated circles, which signify the start or end of a process

Rectangles, which show instructions or actions

Diamonds, which show decisions that must be made

Numbered circles, which represent a connection t o a process chart on another page – useful when a full process will not fit on one sheet

Arrows, which show the direction of flow



Simple Process Flow chart

Actions, decisions and sequence of activities are recorded

Building a Basic Process Map

1. Understand the existing process. You need to establish what actually happens at the moment, rather than what people think should happen.
2. If there are variations, options or alternatives being used then all these need to be mapped. Do not assume that processes are applied consistently.
3. Identify the sequence of events.
4. Identify decision points within the sequence.
5. Identify who is involved at each stage.
6. Identify information sources used in the process.
7. Identify any IT systems used or referred to during the process.
8. Identify sub-processes – these may need to be mapped separately to keep the overall map clear.
9. Identify any outputs from the process.

Why Use Process Mapping?

Things to look for
Duplication
Delays
Uncertainty about what should be done
Inconsistency in ways of doing things
Confusion over roles and responsibilities
Inconsistent/conflicting accounts of what happens
Wishful thinking – is the process realistic?
Difference between what is meant to happen and what actually happens
Unnecessary layers/ pointless tasks
Unnecessary approval steps

- Process Maps provide a framework for analysing and challenging existing processes. They allow us to fully understand each activity involved in a particular task, process or system and how they interrelate.

- They enable us to clearly and simply model existing processes, examine them thoroughly and develop improvements by:
  - Identifying and eliminating unnecessary tasks;
  - Clarifying roles within the process;
  - Reducing delays, bottlenecks and duplications;
  - Understanding the critical pathways;
  - Reducing the number of staff required.

- Process Maps provide a product/record to maintain and form the base for future work. Other methods to analyse and improve processes include: Six Sigma, Lean etc.

- Specific process mapping frameworks exist to support their development in a consistent manner (e.g. MODAF and IDEF0)

Data Collection

Data Collection

- Collecting the appropriate data is absolutely vital. Common forms of data collection include:
  - Interviews with SMEs – to understand the sequence of events;
  - Questionnaires – to capture quantitative information (timings etc) associated with each activity;
  - Observation – Observe the process being undertaken.

- Speak to the people who are doing the work, rather then just those that manage it.
  - Probe to gain a clear understanding;
  - Ask follow up questions;
  - Ask “why?” to uncover unspoken assumptions;
  - Follow up information that seems inconsistent.
  - Is there anything that doesn't make sense, is there a better way? (They may be blindly following a process)

- Gather evidence, both to help your understanding and to verify the reality of the process as it has been reported to you. Once you have mapped the processes, ‘walk’ through them and test with users.

Discrete-Event Simulations

Discrete-Event Simulations

- A simulation is the use of a computer program to model a real world system, in order to validate decisions affecting the system.
  - ‘Discrete-Event Simulations’ refer to modelling events over time. Time advances until the next event can occur. Therefore, events occur at discrete points in time that impact on the overall performance of the system.
  - They allow the processes to be quantified and modelled.

- Simulations contain:
  - activities where things happen to entities during some time (which may be governed by a probability distribution);
  - queues where entities wait for an undetermined time;
  - entities that wait in queues or get acted on in activities.

- They help you to better understand the expected performance of your processes before their implementation, by providing you with useful analysis metrics.

Aim of a DSE Simulation

- To understand emerging phenomena and to understand the system normalities/abnormalities. This includes:
  - Material flows - are there bottlenecks?
  - Queue locations and sizes - do they get blocked or starved?
  - Resources - are they sufficient, do they starve important operations?
  - Failures- what are they and what causes them?

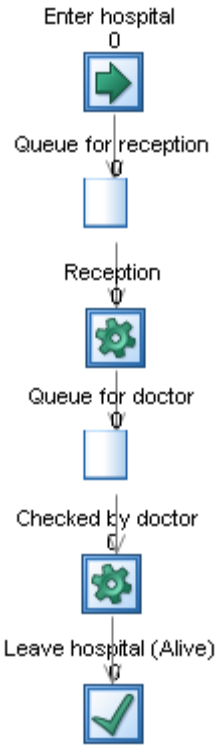
- Check if the process has the required capacity and see what different types of downtime do to performance (sensitivity analysis).

- Improve the design:
  - Consider these improvements in light of the perspectives you have surfaced, even if they are not within your remit for action.

Simul8

Simul8

- Simul8 is a widely used graphical Discrete-Event Simulation software.
- SIMUL8 is a flow simulation program that lets you view your process in action, by showing how its control flow moves around the organization.
- It can reveal key bottlenecks, over-utilized resources, or under-resourced elements of your system, and lets you fine-tune your simulation.



Simul8 Features

Click the Start Point icon on the toolbar and drop the object somewhere on the screen.

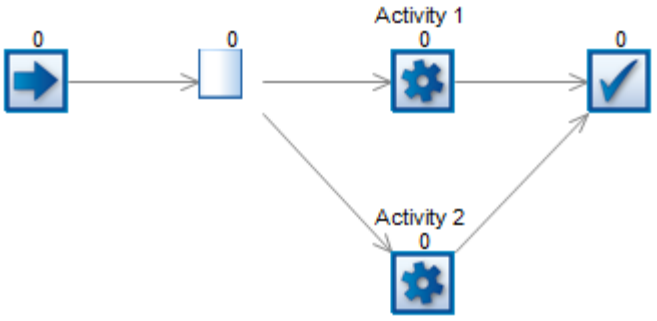
Next click the Queue icon and do the same.

Then place a Activity on the screen using the Activity toolbar icon button.

And finally create somewhere where work leaves the system with the End Point object.

Work Item

Process Direction



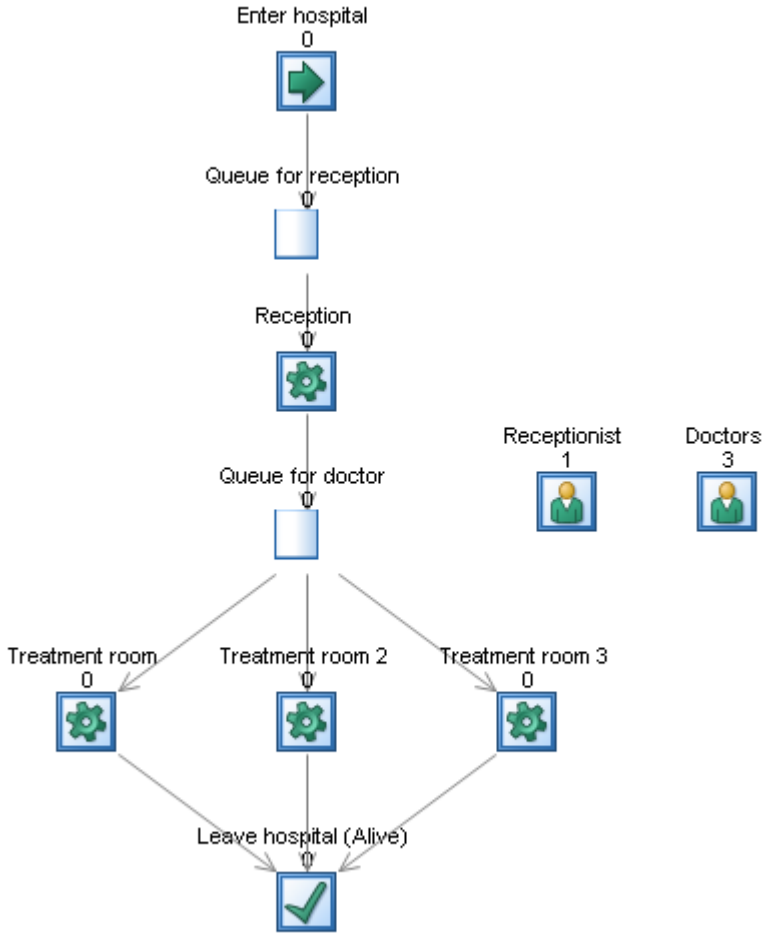
Click the RUN button to run the simulation.

Developing a Simul8 Model

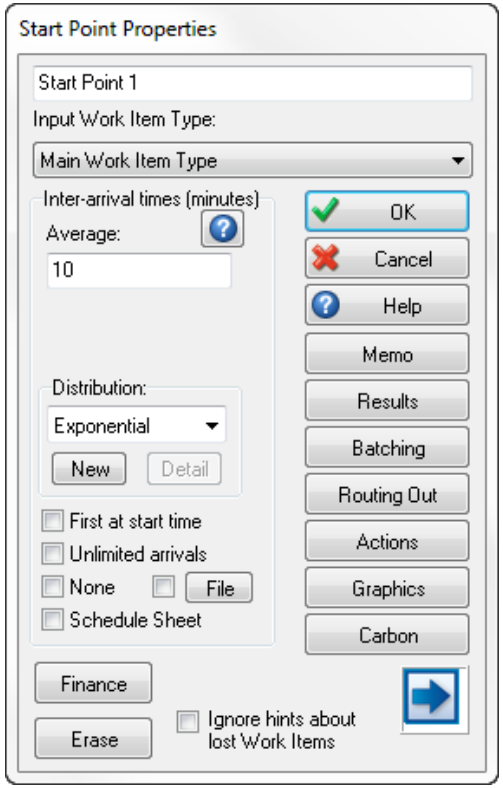
Developing a Simul8 Model

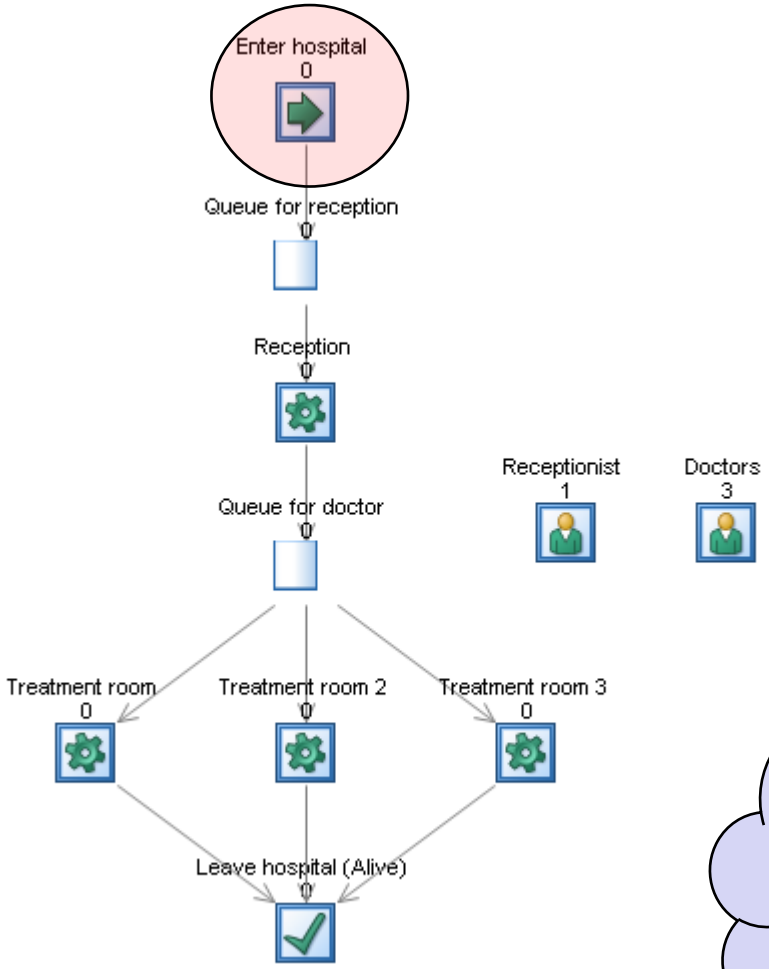
1. Be clear about what the Work Item represents!
2. Agree each term used in the process is understood and recognised by the multiple perspectives involved.
3. Map the process under observation (can use information from Process Map).
4. Understand the entry distribution/the rate in which items enter the system – entering on average, exponentially...
5. Understand and implement the timings involved within the process - how long it takes to carry out each activity.
6. Identify resource requirements and the assignment of resources to each activity.
7. Identify any other limitations/constraints within the system – limits in queues etc.
8. When running simulation, carry out sensitivity analysis throughout – Also check the Min, Max and Mean.

Each activity is recorded and the critical path/process is identified

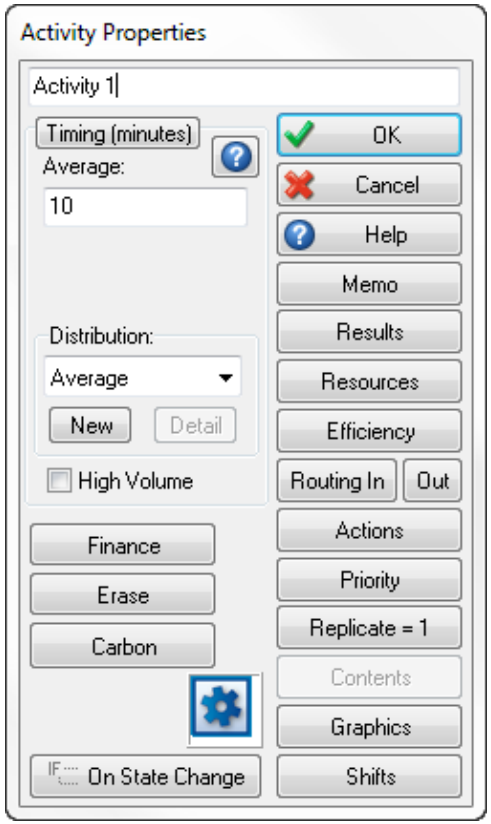


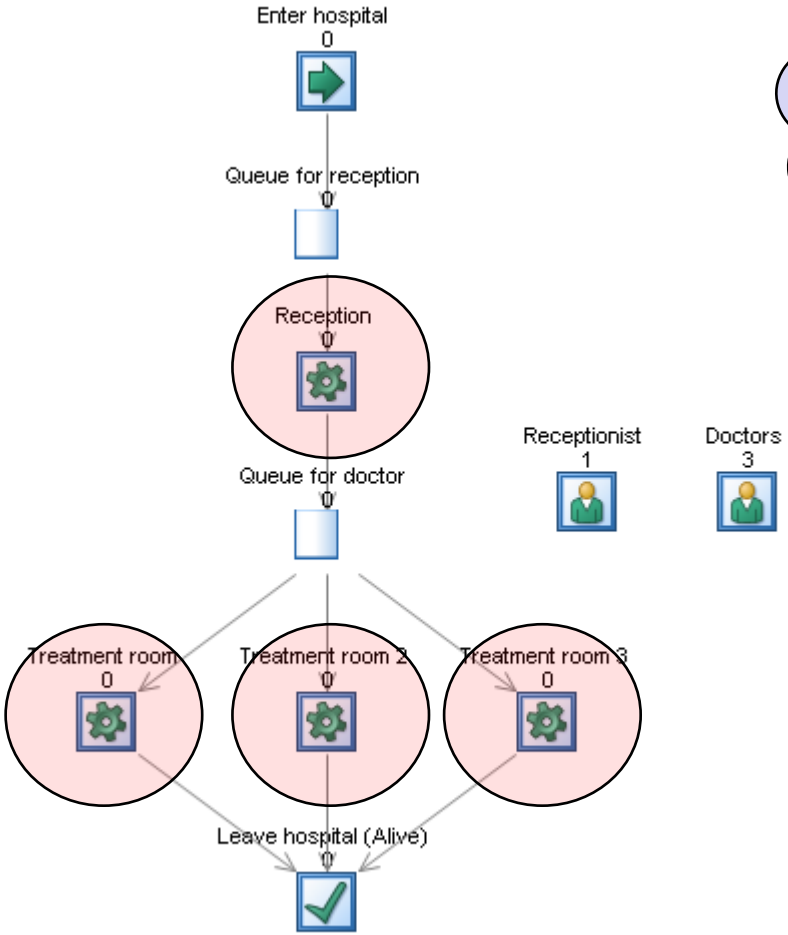
Activities are defined by Simul8 functions e.g. A queue if people are waiting



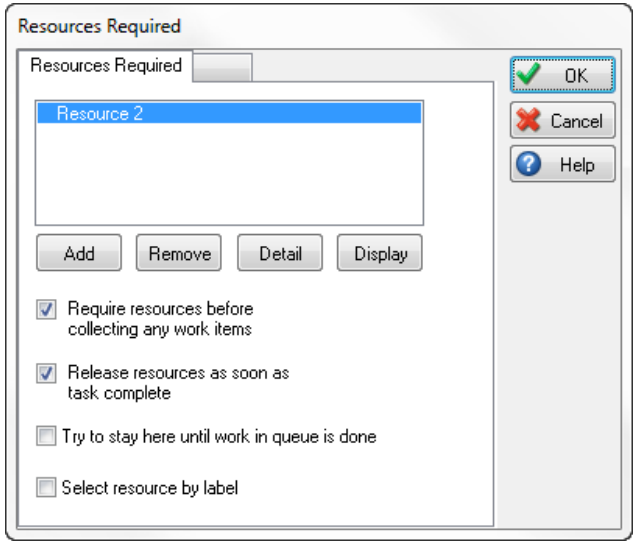


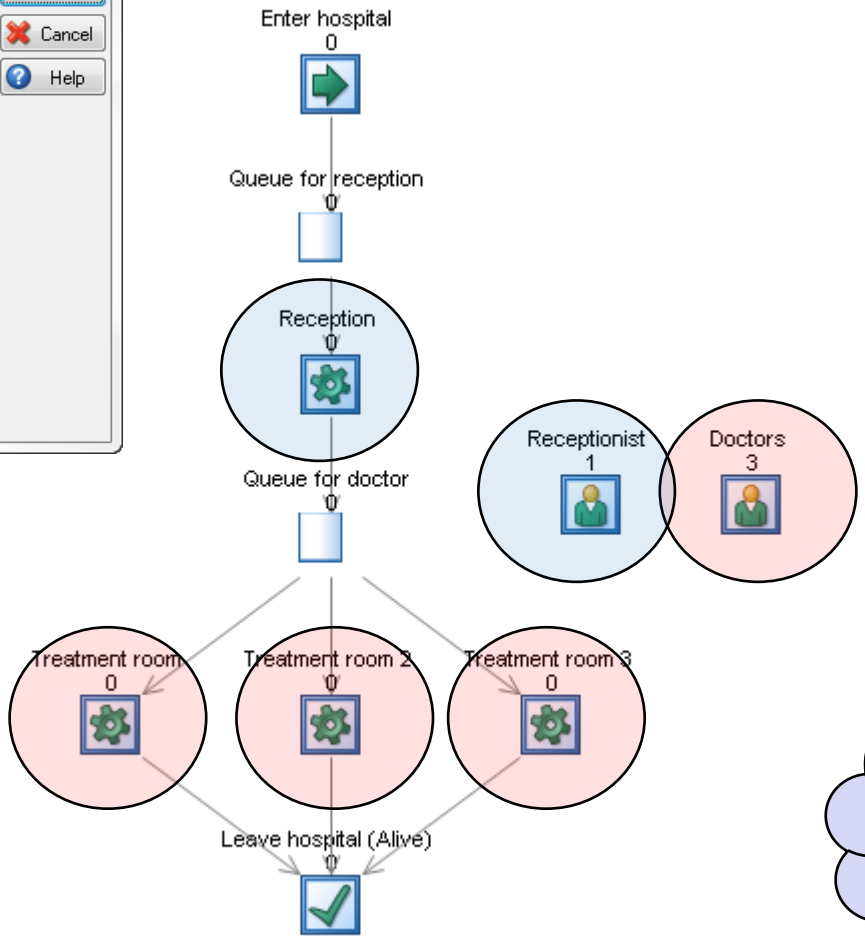
The rate of entry/the distribution is defined e.g. 1 person every 10 mins



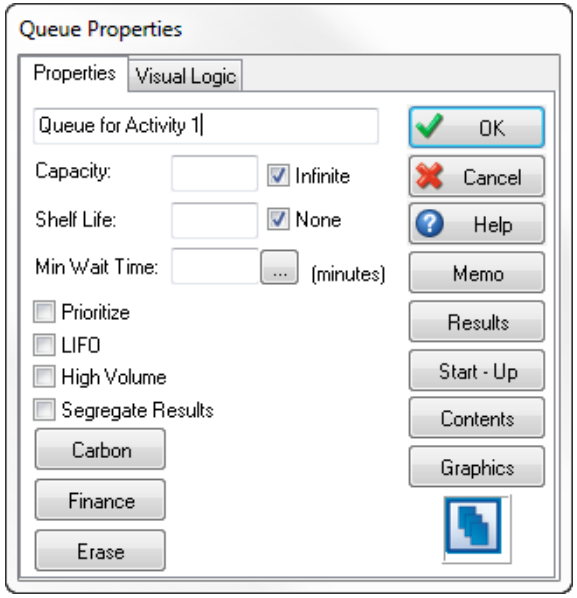


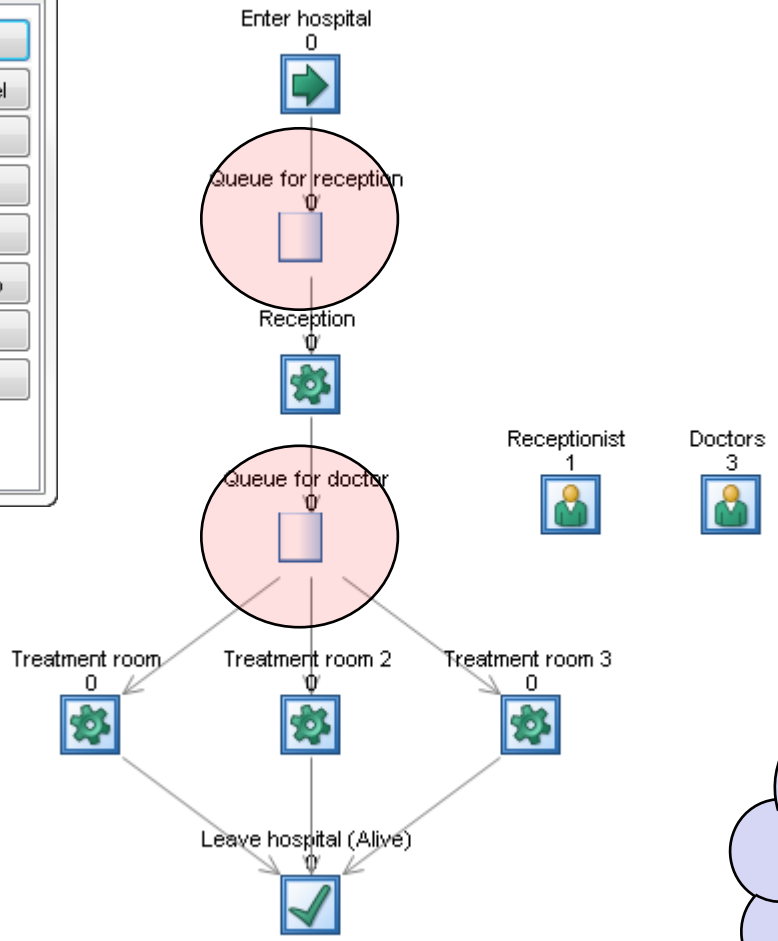
Timings and criteria for each activity/work centre are defined





Resources are assigned to each activity





Queues must be implemented to show the delay before each action

Constraints are defined e.g. Waiting room has a capacity of 5 people

Basic Exercise and Relevant Example

Additional Simul8 Functions

More Advanced Features

- Batching – More than one item moving through the model at once.
- Labels - Can be attached to any Work Item going through the simulation to control activity within the simulation.
- Prioritising – Are certain activities more important as in real life?
- SIMUL8 SQL - A powerful way of reading and writing data to and from a data source.
- Trials - A series of runs of the simulation, performed with the same settings for all parameters other than “random numbers” to check the reliability of results.
- Visual Logic - SIMUL8's Simulation Language. It lets you build detailed logic into your simulation to describe exactly how you want it to behave.

Many more features also exist...

Further Information

- If you would require further information on other features and applications within Simul8, please use:
  - The Simul8 Help Function;
  - The Simul8 Community of Practice;
  - Simul8 Corporation - Can contact if any problems or if you would like training individual training.

- There is a site wide license for Simul8.

- Consult technical experts when building models.

Concluding Remarks

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- Understanding a process qualitatively prior to any simulation adds great value. Process Maps offer:
  - A tangible product for the customer;
  - A detailed understanding of the process prior to any quantification;
  - A potential answer to their initial question (there may be no need to quantify the process beyond the qualitative model).

- Simul8 can be used to quantitatively model any process where there is a flow of work. It provides:
  - An understanding of potential throughput, problem areas and critical path;
  - Quantitative output for the customer.

- Think about customer expectations prior to applying Simul8. Is your modelling enough for what you have been asked to do? (as you cannot model real life).

Thank You!

Questions?